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Proceedings of the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation

Willard L. Stockwell

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Proceedings of the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation

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PREFACE

The contents of this document represent the consensus of participants in the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation. Each specific recommendation does not necessarily reflect the official views or policies of any of the public or private organizations which sponsored or participated in the Conference.

Conference Committee

Conference Co-Chairmen: Willard Stockwell, APA Transportation Planning Division, and Jay Christensen, NASA. Conference Steering Committee: John Zuk, Paul Brockman, Gerald Kayten, and Louis Williams, NASA; Lawrence Dallam, Twin Cities Metropolitan Council; David Forkenbrock, University of Iowa; Glen Gilbert, Helicopter Association International; Stanley Green, General Aviation Manufacturers Association; James Mottley, Federal Aviation Administration; James Scott, Transportation Research Board; Steve Smith, Regional Airline Association of America; and Thomas Stuelpnagel, American Helicopter Society.

Conference Planning and Management

System Design Concepts, Inc: Bonnie Berner, Ronald Bixby, Martin Huss, Linda Meredith, and Joseph Stowers.

For further information about the Conference and publications, contact either: Willard Stockwell, Chief Planner, Metro Area Planning Department, City Hall - 10th Floor, 455 North Main Street, Wichita, KS 67202, or John Zuk, Chief, Aeronautical Systems Branch, NASA Ames Research Center, Mail Stop 237-11, Moffett Field, CA 94035.

CONTENTS

PURPOSE AND SCOPE OF CONFERENCE

The objective of the Conference was to reach consensus, insofar as possible, on present and future planning and technological issues involving rotorcraft and commuter fixed-wing air transportation opportunities and benefits, and to develop a statement of direction for policy and action. The Conference Resolves present that consensus statement, along with summaries of the program sessions.

The Conference was organized around six subject areas: The Future Community Environment, Aircraft Technology, Community Transportation Planning, Regulatory Perspectives, Rotorcraft Air Transportation, and Fixed-Wing Air Transportation. The Steering Committee arranged for a series of prepared papers on these subjects by a futurist, various technologists, urban and transportation planners, operators, and manufacturers. A general discussion followed each of these presentation sessions. Participants met in ten simultaneous workshop groups on each day of the Conference to discuss and work toward consensus on the principal issues raised by the speakers and panelists. Their conclusions were presented at general sessions where the formal consensus statements were developed.

The consensus statements, or Monterey Resolves, are presented in the first section of this document. Included are descriptions of conditions and factors which will shape future short-haul air transportation, and specific recommendations for public and private sector policy and action. The following sections contain the major papers and panel remarks for each of the six subject areas.

JAY CHRISTENSEN - SPECIAL RECOGNITION

A special thanks to Jay Christensen who retired from NASA shortly after the conclusion of this Conference. All of us who met Jay know the months of preparation he spent not only on the Conference itself, but in arranging for the spectacular demonstrations of the NASA aircraft for Conference attendees. The Conference could not have been accomplished without his tireless efforts. Jay is now teaching at Stanford University and doing consulting work—we wish him well.

GLEN A. GILBERT - IN MEMORIAM

We were saddened to learn of the passing of Mr. Glen Gilbert just before this document went to press.

Mr. Gilbert was one of the main contributers on the Steering Committee for this Conference, and chaired Session V. In his role on the steering committee, Glen contributed to strengthening the understanding between planners and the aviation industry. He prepared, and frequently presented on Capitol Hill, the testimony given by HAI on behalf of the helicopter industry. The entire aeronautics community lost a true friend and important leader with the passing of Mr. Gilbert on September 15, 1982.

STEERING COMMITTEE MEMBERS
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Dr. John Zuk, Chief
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MONTEREY RESOLVES

Highlights of the Resolves

On August 31 through September 4, 1981, a major conference was held in Monterey, California, that brought together, for the first time, a representative group of planners and public officials from all levels of government, and a select group of rotorcraft and commuter aircraft manufacturers, operators, and reseachers to exchange viewpoints on planning for rotorcraft and commuter air transportation.

After an intense series of presentations and working group meetings, the following major points were resolved which should be adopted as a plan for improving the benefits of air transportation to the citizens of the U.S.

1. **AN AGGRESSIVE, NEW NATIONAL AVIATION POLICY SHOULD BE DEVELOPED WHICH WILL PROVIDE THE MEANS FOR BRINGING THE BENEFITS OF ADVANCED ROTORCRAFT AND COMMUTER AVIATION TECHNOLOGY TO THE CITIZENS OF THE U. S. WITHIN A REASONABLE TIME FRAME.**

- **An aggressive rotorcraft technology program, with emphasis on noise reduction, safety, and economics should be pursued by the government with industry participation.**
- **Technology development should be continued by the government and industry to improve the noise, ride quality, safety, and economics of future commuter aircraft.**
- **Promising advanced vehicle concepts should be demonstrated by the government to provide industry with sufficient confidence to put them into operation.**
- **Manufacturers and operators should acquaint planners and public officials with state-of-the-art technology and work with them in heliport development.**
- **Air traffic control procedures and other aspects of the National Airspace System should be continually reviewed and revised to provide additional discrete airspace for helicopter operations, and to more efficiently accommodate all major categories of short-haul aircraft.**

2. **COMPREHENSIVE URBAN TRANSPORTATION PLANS SHOULD FULLY INTEGRATE ROTORCRAFT AND COMMUTER AVIATION PLANS WITH LAND USE AND OTHER TRANSPORTATION PLANS SO THAT MAXIMUM ADVANTAGE IS TAKEN OF AIR TRANSPORT OPPORTUNITIES.**

- **The Airport Development Aid Program (ADAP) should be continued, and funding provided for both planning and aviation facilities.**
- **Planning data, methods, and reference material should be developed and disseminated to community planners as a cooperative effort between planners, operators, manufacturers, and researchers.**
- **FAA and other U.S. DOT regulations and guidelines should be reviewed and revised in accordance with the Monterey Conference Resolves.**
- **Industry should take the initiative in working with planners in gaining public acceptance of rotorcraft and commuter air transportation.**
- **A model helicopter ordinance should be prepared to provide guidelines for local governments.**
- **The FAA and planners should work closely with airport operators to develop and use flight procedures to minimize noise impacts on communities.**
- **Planners should work to improve land use controls in airport environs and to facilitate environmental review processes.**

3. **A MECHANISM SHOULD BE SET UP TO PROVIDE A CONTINUING FORUM FOR PLANNERS AND TECHNOLOGISTS TO WORK TOWARD THE ACHIEVEMENT OF THE MONTEREY CONFERENCE RESOLVES.**

These Resolves are reviewed more thoroughly in the text of this report.

Introduction

The Monterey Conference brought a representative set of community planners and public officials together with rotorcraft and commuter aircraft (fixed-wing) manufacturers, operators, and researchers, to exchange viewpoints on planning for rotorcraft and commuter air transportation.

The objective of the Conference was to reach consensus, insofar as possible, on present and future planning and technological issues involving rotorcraft and commuter fixed-wing air transportation opportunities and benefits. For planners a principal product of the Conference was to be a summary of information that could aid them in evaluating opportunities for rotorcraft and commuter air transportation. For technologists (manufacturers, operators, and researchers) the Conference was intended to provide an interchange of planning experience and local governmental perspective to improve the responsiveness of researchers, manufacturers, and operators to community needs and concerns.

To provide basic technical background for the Conference, NASA sponsored two state-of-the-art surveys of technology and planning. These two pre-Conference studies are described briefly below:

Community Rotorcraft Air Transportation Benefits and Opportunities, prepared by the Helicopter Association International (HAI) and Vitro Laboratories Division, Automation Industries, Inc.

The objective of this study was to provide information about rotorcraft that would assist community planners in assessing and planning for the use of rotorcraft. The three primary topics of the study were:

— The current status and projections of future rotorcraft technology, and the comparison of that technology with other transportation modes
— Community benefits of rotorcraft transportation opportunities
— Integration of rotorcraft with other transportation systems

The helicopter industry is in a period of rapid expansion—several years of growth in sales at 10 to 15 percent per year. While much of this has come from growth in the use of helicopters to support offshore oil operations, there have been definite increases in most of the major uses, including executive travel, public service, construction, and forestry.

The primary reason for this rapid growth is the technical and operational improvements of helicopters. The reduction in noise and vibration, the increase in performance (speed, comfort, and safety), and the vastly improved instrument flying capability are all important contributors. In essence, the helicopter is now a greatly improved and a more publicly acceptable means of transportation.

Few, if any, new airports are being built to service large urban centers. Either the land to build such airports is not available or the costs are prohibitive. Furthermore, many existing airports are nearing their maximum air traffic capacity. New solutions are needed for handling the projected increases in demand for air transportation. Some of this demand could be accommodated by helicopters operating out of community heliports.

A barrier to the increased use of helicopters is the lack of public-use heliports. Resistance to public-use heliport development has occured in part because of public concerns about helicopter safety and noise in a community setting. If community planners, and the public in general, would become more aware of the current capabilities and characteristics of helicopters, mutually agreeable solutions to the need for new heliports could be developed.

Planning for Rotorcraft and Commuter Aviation, prepared by the Transportation Planning Division of the American Planning Association (APA) and System Design Concepts, Inc.

The objective of this study was to identify community planning needs, criteria, and regulatory requirements relating to rotorcraft and fixed wing commuter air transportation, and to provide a broad range of planning guidelines and information which could be used to:

— Increase communication between aircraft technologists and planners
— Direct anticipated aircraft technological improvements during the 1980s
— Assist planners in identifying and evaluating the opportunities and tradeoffs presented by rotorcraft and commuter air transportation relative to other modes of transportation

The primary tool for identifying and analyzing planning requirements was a detailed questionnaire administered to a selected sample of 55 community planners and others involved in planning for helicopters and commuter aviation. Secondary information sources included planning documents, available literature, local ordinances, supplemental phone contacts, and the results of a workshop conducted at the national APA conference in Boston, April 27, 1981.

Some of the more important conclusions of the study include the following:

— Rotorcraft and commuter air transportation have substantial growth potential but major hurdles must be overcome. Solutions depend, at least in part, on cooperation between industry and the planning profession.
— If major hurdles relating to community acceptance of heliports in urban areas could be overcome, helicopter public transportation could become an important growth market.
— Airport and heliport location issues rank first in importance to planners, followed by the need for planning data and methods.
— Planners are particularly concerned about the lack of data, methods, guidelines, and availability of model ordinances.
— Some form of communication mechanism is needed to provide a continuing forum for planners and technologists to exchange views and work toward common goals.
— The most important recommendations which planners have for researchers concern the need for market analysis, improvement of ride quality, and the reduction of noise.
— The most important recommendations for manufacturers concern noise reduction and improvement of fuel economy.
— For operators, planners stress the need to educate the public regarding the performance characteristics and benefits of both rotorcraft and commuter air trans portation.
— A model helicopter ordinance should be developed.

— Guidelines should be developed by planners and other interested groups as to the roles that government at all levels should play in the planning and development of rotorcraft and commuter air transportation.

This document summarizes the findings and recommendations of the Conference under the following topics:

- The Future Community Environment
- Community Transportation Planning
- Regulation
- Rotorcraft
- Commuter Air Transportation

To produce these Resolves, the Steering Committee for the Conference planned and organized a series of papers and presentations on each of these topics by the most knowledgeable persons in the concerned professions and industries.

These Conference Resolves were then developed through a series of workshops which met throughout the Conference. Participants debated issues raised in the formal sessions and worked toward the consensus findings and recommendations reported in these Resolves.

The Proceedings of the Monterey Conference will be published early in 1982 and will include the Resolves, the commissioned papers, and presentations and summaries of the discussions which occurred during the general sessions.

The Future Community Environment

Rotorcraft and commuter air transportation have experienced rapid growth over the last few years. These short-haul modes of air transportation are likely to continue to grow more rapidly than long-haul commercial air transportation or most forms of ground transportation because of their potential for satisfying some special types of travel demand which are likely to grow rapidly as a result of emerging patterns of population shifts, land development, and business relocation —involving both decentralization and new forms of concentration. These special types of travel demands are expected to include a substantial amount of movement that has traditionally been considered part of the ground transportation market.

Although rotorcraft and commuter aviation can conveniently be discussed in common to some extent because they have somewhat similar growth rates and stage lengths, their dissimilarities become pronounced when considering many of the problems they are encountering in attempting to realize their growth potential. At the risk of failing to recognize some of these dissimilarities sufficiently, however, Conference participants first attempted to reach consensus on issues and broad policy directions dealing with the emerging environment for both rotorcraft and commuter air transportation as a common class of short-haul transportation.

Some of the most important common emerging issues and problems are:

- The general public and local officials are usually not aware of the potential benefits as well as environmental and other consequences of short-haul air transportation. This is partly due to recent rapid changes that occurred in the field in technological capabilities of the aircraft and partly due to lack of communication between the aviation industry, the planning profession, and local officials.
- The long-term future will involve continuing rapid advancements in telecommunications, which may reduce the need for face-to-face contact, and therefore reduce travel demand. The potential for reducing demand could be significant in terms of long-haul intercity business travel and for longer business-related trips within metropolitan regions, in the eyes of some people. On the other hand, history tends to show that major telecommunications advances such as the telegraph, telephone and televison have stimulated awareness of business and personal opportunities, and have tended to encourage a net increase in long-distance travel. The long-run effects are quite uncertain; however, no substantial substitutability of telecommunications for short-haul air travel is foreseen in the short-term.
- Substantial uncertainty exists as to the long-term prospects for aviation fuel supply and prices. Arguments are made for expecting that reliable alternative fuel sources will be brought into production at, or near, current real prices, thus providing improved long-term prospects for achieving domestic liquid-fuel supply in sufficient quantity to assure that the current aviation fuel supply/price problem will be diminished in the future. Good arguments are being made on the other side, however. Alternative domestic fuel sources will take several years to develop in large quantities, and their potential may never be fully realized due to environmental, political, technological, and cost problems. Meanwhile the potential for supply disruptions continues or increases. The only relatively sure conclusion is that substantial uncertainty exists regarding future supply and prices. Regardless of the seriousness of the problem, short-haul air transportation has little effect upon national energy conservation objectives because it accounts for such a small proportion of energy consumption. The primary issue in this area, therefore, is the potential role of fuel prices on the competitive economic position of short-haul aviation.
- Current mechanisms for communication among all those who have a legitimate interest in shaping technological development are inadequate. A need exists for establishing a general national-level forum for communications between community interests on the one hand (planners and local officials) and technologists involved in advancing short-haul aircraft (researchers, manufacturers, and operators).

- Several types of changes are occurring in urban and regional economics and land use patterns which will have a bearing on the demand for short-haul air transportation. These include the rapid growth of many smaller communities beyond the fringes of metropolitan suburbs, the agglomeration of business activity in outlying commercial areas, the decentralization of high technology industries with need for rapid travel and shipments among plants, the increasing congestion of large city downtowns and major hub airports, and the increasing cost and political resistance to provision of new ground transportation facilities.
- There is a need to capitalize on NASA research efforts and to implement these research results in operating rotorcraft and commuter aviation systems. However, the implementation of new technology is severely hampered by continuing inflationary trends and R&D budget cuts at the national level. Traditional forms of financing technological advancement in the U.S. aviation fleet are, therefore, becoming less available. If the U.S. is to maintain its leadership in world aviation equipment and manufacturing, innovative measures should be taken. The benefits of such measures include, among others, an increased national capability to maintain a favorable balance of payments.
- The last time a comprehensive national aviation policy statement was prepared was in the early 1970s, by a Presidential Commission. Since that time a great deal has been accomplished and conditions have changed, and are continuing to change dramatically, making the earlier statement outdated. Current efforts to respond to rapidly changing conditions deserve the benefit of a focused orderly review of national aviation policy.

Conference Recommendations

1. **Technologists should work closely with planners to develop and provide the type of information and analytical methods needed to effectively evaluate short-haul air transportation opportunities. This will enable planners to be in a much better position to provide solid objective assessments of air transportation needs and impacts to local officials and the public.**
2. **Because of the wide range of uncertainty regarding future fuel supply and prices, fuel-economy improvements in short-haul aircraft should continue to receive a high priority in NASA and other R&D efforts. Even under the more optimistic forecasts, fuel-economy will be a more important factor in the realization of future opportunities than was true prior to the recent rapid fuel price increases.**
3. **The major organizations and groups involved in the Conference should cooperate in establishing a continuing forum for exchange of views among planners, local officials, manufacturers, operators, and researchers regarding the needs for responsive technology to most effectively serve future community needs.**
4. **Research should be conducted on the relationship between emerging urban and regional economic land development patterns and future demand for short-haul aviation and its relationships with other modes. This research is needed to provide an improved basis for long-range planning of heliports, airports, and related needs. The assistance of the Transportation Research Board should be sought in implementing this recommendation.**
5. **National aviation policy should be reviewed as it relates to financing short-haul air transportation technology and systems, including aircraft and ground facilities. Lessons can be learned from both the positive and negative experiences in the parallel efforts in the transit field by the Urban Mass Transportation Administration (UMTA). The Federal government should conduct basic research including proof-of-concept research programs, however, the private sector should take the lead in developing production aircraft prototypes. Government should provide incentives for the development of selected, promising prototypes. Some felt this area important enough that direct support should be provided, such as through grants or loan guarantees.**

   The Conference reached a definite consensus that priority should be given to the implementation of innovative financing mechanisms in this field, but did not devote sufficient attention to be specific in recommending the appropriate mechanisms. More attention to this subject is urgently needed.

6. **National aviation transportation policy should be reviewed, and restated as appropriate, to provide more effective guidance in the following areas:**
   - **Develop goals for rotorcraft and commuter aviation research and development in both the short and long-run**
   - **Reevaluate the role for Federal agencies in working with industry on common interests: market research, technological development priorities, etc.**
   - **Establish guidelines for liaison with industry to encourage cooperation where appropriate, while defining limits to protect the public interest and competition**
   - **Provide for equitable consideration of different modes of transportation which may be in competition, while fostering intermodal complementarity and cooperation**
   - **Define roles of the various agencies (NASA, FAA, CAB, and others) in a manner so as to**

avoid overlap but assure coordination of the overall Federal effort and assure that important functions are not overlooked

- **Include responsibility for training and technical assistance to planners and other local officials in furthering aviation and Federal policy objectives related to short-haul air transportation**

Community Transportation Planning

The Conference was especially successful in developing a consenus on the nature of the current deficiencies in planning for rotorcraft and commuter air transportation, and in identifying the roles that should be played by various groups in improving the planning process.

The need for increased attention to improving the planning process has become more critical recently for several reasons

- The rapid growth of both rotorcraft and commuter aviation has created greatly increased need for planning of these modes of transportation, which receive very little attention by planners compared to other, less rapidly growing modes.
- Operators of the short-haul air transportation modes are usually not involved in the transportation planning process at the metropolitan and state levels, and this lack of participation has contributed to the inattention to needs of these modes.
- Deregulation is creating planning problems for the public sector because of the rapid changes in use of publicly owned airports.
- The complexity of airport system planning has vastly increased because of opposition to new airport and heliport development or expansion, encroachment of land development on existing airports and heliports, and the increasing diversity of aircraft and types of services serving major hub airports.
- At the same time as these increasing planning demands are occurring, the Federal government is dramatically cutting back on categorical financial support and requirements for transportation system planning, as well as for comprehensive urban and regional planning.

The Conference also made some progress in defining the specific areas of inadequacy in existing technical capabilities. Data on demand for rotorcraft and commuter aviation are woefully lacking. Although planners are capable of performing the required types of analyses, they do not have adequate reference material or guidelines for performing comprehensive assessments of the benefits and costs of operations involving short-haul aircraft and related facilities.

The lack of information about short-haul air transportation is a major contributing factor to the lack of support from public officials and the general public. The helicopter industry in particular is frustrated by the lack of public understanding and acceptance; the industry and other Conference participants attribute this in large part to the inaccurate perception people have of the noise and safety characteristics of modern helicopters. This is a major factor in resistance to the installation of public use heliports and helicopter public transportation service. It is also a significant problem for commuter aviation.

Other planning data needs of high priority include information on the economic benefits to communities of short-haul aircraft services—e.g., the role they can play in attracting industry and creating jobs, as well as retaining existing industries.

Another broad area of concern is the need for greater attention to intermodal planning, including such specific items as:

- Data on transfer requirements from short-haul modes to both long-haul air and local ground transportation modes
- Improvements in ground access to airports
- Provision of heliports in locations which provide high quality ground transportation access to major business concentrations, including direct pedestrian access to major office concentrations
- Improvement of facilities for short-haul air transportation within major hub airports—i.e., passenger transfer facilities, passenger waiting areas and ticket counters, freight transfer facilities, and loading gates

A final basic issue of critical importance in improving planning for short-haul aviation is the question as to whether it is possible to define a basic geographic spatial structure for an optimal pattern of commuter airports and heliports at the metropolitan and regional scales. The Conference made some progress in defining such a structure.

Conference Recommendations

1. **Planning for rotorcraft and commuter aviation is a function that cannot be effectively carried out by industry alone, nor can it be effectively performed by separate local governments. Such planning should be fully integrated with the comprehensive transportation planning process being carried out at the metropolitan and state levels, and should be adequately supported by all levels of government on a continuing basis.**
2. **The principles and concepts of the National Airport System Plan (NASP) and the Airport Development Aid erly planning and development of an integrated Program (ADAP) are sound and essential to the air transportation system to serve the Nation. ADAP should be maintained and funding provided for the development of planned aviation**

facilities through the next five years. Federal leadership and financial support should be provided through the continuation of the planning grant programs to plan needed facilities at the national, state, and local levels.

3. The OMB Circular A-95 process for the review of all applications for Federal aid projects by a designated regional planning agency should be maintained as a principal mechanism for coordination of projects for all modes of transportation with all other elements of comprehensive plans. In particular, the A-95 process should continue to require review of all applications for airport improvements and planning grants.
4. A clear need exists for rotorcraft and fixed wing commuter air transportation planning information, and for the establishment of a continuing means of communication between community planners and operators, manufacturers, and researchers at the national level to achieve this objective. An early by-product should be a technical manual, or series of manuals, to serve as reference material in the following types of activities:
   - Develop and evaluate ground/air transportation system alternatives including rotorcraft and fixed wing commuter air facilities and services
   - Plan, locate, and develop new heliports and general aviation reliever airports to provide additional airspace capacity
   - Determine the need and appropriateness of local laws and regulations including zoning and helicopter ordinances
   - Evaluate economic benefits of improved ground/air transportation connections and services
5. To help in achieving many of the other recommendations a mechanism should be created to provide a continuing working relationship among planners, operators, and manufacturers, including national and regional conferences and meetings. NASA, APA, FAA, industry associations, and the other primary participants in this Conference should take the lead in setting up this mechanism. National organizations representing all concerned public officials and professions (NLC, Conference of Mayors, NARC, NGA, and others) should actively participate. In addition, the Transportation Research Board should be asked to establish an overview committee in this field to guide the development of a research forum and an accelerated research program.
6. FAA and other U.S. DOT regulations and guidelines should be reviewed and revised in accordance with these Monterey Conference Resolves. In particular, planning guidelines should:
   - Encourage participation of industry and metropolitan planning agencies in all aviation planning programs at the local, metropolitan, and state levels
   - Require due consideration of rotorcraft and commuter aviation facilities and services within all air system plans, including separate airspace allocations for helicopters
   - Provide some guidance as to the range of rotorcraft and commuter air transportation facilities that should be considered for metropolitan areas of different sizes and characteristics
   - Give attention to planning for the ground/air system interface and to services connecting general aviation reliever airports and heliports
7. Industry is anxious to enlist the assistance of planners and public officials in achieving public acceptance for rotorcraft and commuter air transportation improvements and services. Planners and public officials are often required to refrain from advocacy roles until after basic public policy decisions are made on plans and programs. Even after such actions, their roles often must be restrained to providing objective information in support of these plans and programs. Nonetheless, within these constraints a great deal of cooperative effort is possible and should be encouraged. Professional and industry associations can provide the means for such cooperation. Activities that should be considered include:
   - Provision of public information on benefits: e.g., jobs created, income to the area, attraction of new industries or retention of existing ones. Show examples of successes from other areas
   - Provision of public information on impacts to respond to expressed concerns of the public: noise, safety, emissions, fuel consumption, implementation costs, etc.
   - Provision of public information on unique capabilities of helicopters for police, fire, rescue, emergency medical services, etc.
   - Set up a public information group composed of industry representatives, planners, and local officials to assume responsibility for providing credible facts to the media on plans, benefits, costs, impacts, and other desired information
   - Develop reasonable constraints on operations to assure that operators and air facilities are good neighbors, such as through control of approaches
8. The Conference developed consensus on several general principles that should be considered in short-haul air transportation planning:
   - Planned and projected regional land development patterns should be used to assess the need for new facilities, expanded facilities, or to

identify potential problems of encroachment.

- **Ground access by transit and by auto should be carefully assessed in all location studies for airports and heliports. Walking access to business concentrations should also be carefully assessed in heliport location studies.**
- **Highway access to all existing and planned air transportation facilities should be assessed in terms of directness of routing, capacity, level of service and potential for priorities for high occupancy vehicles.**
- **Land use controls should be assessed in relation to all above factors to provide early guidance for local governments.**
- **If encroachment cannot effectively be prevented by zoning (which is often, but not always true), then a variety of other mechanisms should be considered to maintain land use compatibility including purchase of land development rights in airport approach and departure paths, purchase of easements, building code limitations and standards, and outright purchase, with or without lease-back.**
- **Within major hub airports, interline transfer and ground access requirements should be carefully considered in planning all short-haul air transportation facilities.**

Regulation

Federal, state, and local governments are all involved in regulation of most types of helicopter and commuter air facilities development and operation. The Federal role is clearly defined and limited under the Federal Aviation Act of 1958, other legislation implementing Federal Aviation Regulations (FARs), supplemented by Advisory Circulars.

The state, metropolitan, and local roles, however, vary widely even within a single urban area, and are often overlapping. This problem is rapidly growing in importance because of the substantial increase in state and local regulations and the lack of any clear means of dealing with this problem.

The following concerns regarding Federal regulations deserve priority attention:

- At present all aircraft operations under instrument flight rules have to conform to procedures which have been developed by FAA to handle the full range of fixed wing aircraft. Existing flight regulations do not fully consider the operating characteristics of advanced technology STOL (short take off and landing aircraft), rotorcraft, and other aircraft with unique operating capabilities.
- FAA regulations and procedures may result in unnecessary cost and delay in aircraft certification. This is particularly critical at this time when both rotorcraft and commuter airlines are involved in a rapid growth period with changing market requirements.
- The international aircraft certification process is overly complicated and time consuming because procedures are not standardized among the major industrial nations.
- The short-haul sector of the airline industry needs a fare system that is integrated with the major airlines. This is an area where deregulation of air fares could have a seriously disruptive impact on a major growth industry.
- Failure to separate planning and construction programs in Federal airport funding legislation would probably tend to result in a lessening of support for planning, because of the reduction of overall funding and the emphasis on short-run capital needs.

The following concerns regarding state and local regulations deserve priority attention:

- A few states have been aggressive in developing air transportation facility guidelines for use by all local governments within the states. However, many states do not have adequate guidelines.
- Local ordinances vary widely in their scope, level of detail, and restrictiveness. They generally do not address air transportation needs adequately and often inhibit development without effectively protecting the public or assuring that potential community benefits will be realized. The range of deficiencies includes:
  - — Lack of any air transportation ordinances in some communities
  - — Provisions and standards which effectively block aviation development unless modified
  - — Inconsistencies of ordinances in adjoining communities in many urban areas
  - — Provisions which are unenforceable
  - — Excessive time required in permit approval process
  - — Lack of a coordinated approval process when multiple agency approvals are required
  - — Lack of requirement for helicopter landing areas on high rise buildings for emergency helicopter evacuation (Los Angeles and Chicago have such requirements in their building codes)
- Potential problems and conflicts may occur after CAB's authority to regulate fares expires. States may impose fare regulations for intra-state air carriers that connect with the interstate carriers, thus making it impossible to continue a rational process for determination of joint fares.

Conference Recommendations

1. **Efforts should be made to periodically review air traffic control procedures to more efficiently**

accommodate rotorcraft and commuter aircraft. FAA should continue to develop discrete routes, approaches, and procedures for helicopter operation which take advantage of their unique performance capabilities, particularly in congested urban traffic control areas. Also, wherever operational restrictions on special uses of rotorcraft and other special performance aircraft are caused by air traffic controls, these restrictions should be reviewed in consultation with industry and adjustments made as appropriate.

2. Aircraft certification procedures should be reviewed in anticipation of newer types of short-haul aircraft such as the tilt-rotor, the QSRA (quiet short-haul research aircraft), and other types of commuter aircraft.
3. Procedures associated with aircraft certification in different countries should be standardized and reciprocity should be recognized among user nations.
4. The policy associated with joint air carrier/commuter fares should be reviewed. Air passengers will benefit if commuter airlines can be assured of continuation of a fare system that is integrated with the major airlines.
5. Separate funding for planning should be retained in new Federal legislation. It is a matter of national interest to assure that a comprehensive long-range perspective and adequate consideration of national and other goals are carefully taken into account in the development of plans and programs for air transportation development. A national interest in planning is also warranted because the facilities and services planned in each urban area will affect all users, not just the local residents.
6. Federal agencies should consult with affected industry, and state and local officials regarding the administration and interpretation of existing laws and regulations and their impacts on rotorcraft and commuter air transportation. In this review attention should be paid to consistency of interpretation among Federal agencies, including all field offices.
7. State statutes should be reviewed, updated, and modified as appropriate to clarify Federal, state, and local responsibilities. State and local statutes should recognize jurisdiction which has been preempted by Federal law. Similarly, local ordinances should complement but not overlap state statutes, which vary substantially among the states. This review should include landing area permits, noise considerations, pilot licensing, aircraft registration, emergency planning, and other responsibilities.
8. A model helicopter ordinance should be prepared to provide guidelines for local governments. These guidelines should cover zoning, fire regulations, building standards, permit approval procedures, and other provisions based on experience in various types of communities. The development of these guidelines should be conducted in cooperation with all concerned industry groups, FAA, APA, NLC, and the Conference of Mayors.
9. Zoning should provide for limited private use heliports to be allowed by right in selected industrial and commercial zoning categories, so that unnecessary delays are avoided in extended rezoning or other procedures when industrial plants or other appropriate types of developers decide to provide helicopter landing areas.
10. Local governments should be encouraged to amend or enact building codes to require helicopter landing areas on all high rise buildings and other appropriate locations, to provide for emergency helicopter operations.
11. The FAA and planners should work closely with airport operators to develop and use flight procedures to minimize noise impacts on communities.
12. Potential problems for commuter airlines may be caused by the termination of CAB regulation of fares. As deregulation of fares continues to occur the impacts on industry and users should be reviewed as a cooperative effort of all concerned Federal agencies and industry groups. Options that might be considered in the event that substantial negative impact occurs include:
    - Continuing limited Federal regulation to assure joint fares
    - State regulation of fares through some form of cooperative state association, in selected markets which are heavily impacted
    - Federal regulation of fares for all markets which lack a specified minimum degree of competition
    - Self-regulation of fares by an industry organization, under certain market conditions

Rotorcraft

Civil benefits from the use of helicopters have increased significantly since 1960 and are expected to continue to increase in response to new and growing transportation needs. These needs have already resulted in major increases in the size of helicopter fleets, and heliports (mainly privately owned), and in operators, with some years seeing growth rates of ten to eighteen percent in the helicopter fleet.

Present helicopter designs have incorporated impressive improvements in performance, reliability, quietness, and vibration reduction over previous designs. For the first time, helicopters have been specifically designed for the civil markets and for civil environments, and there will be increased near-term use of these rotorcraft for various transportation purposes. Rotorcraft capabilities should grow more significant during the next decade as continued improvements are made in performance, cost of operations, and noise reduction.

In those applications for which the helicopter is uniquely qualified, it has already made important contributions to society. The public service role in police, fire fighting, search and rescue, medical evacuation, energy exploration, and agriculture are paramount examples.

Civil rotorcraft technology advances in the 1980s and 1990s will be directed toward the following major objectives:

- Safe and quiet operation from small city center heliports
- Increased productivity from higher speed and greater payload, and enhance weather capability
- Reduced fuel consumption and cost of operation
- Improved ride comfort
- Increased reliability
- Enhanced capability to operate in congested terminal areas

Public use city center heliports are difficult to develop, and existing heliports are often being closed because of land development or other pressures. The helicopter community alone is unable to develop heliports due to ever-increasing competition for land use, lack of public understanding, and lack of advocacy for helicopter transportation and its benefits. Therefore, while helicopter sales nationwide are increasing at 10 to 15 percent per year, access to Central Business Districts (CBDs) and other major business concentrations is being restricted by forces outside the control of the helicopter community.

The major problems relating to heliport location and planning are:

- Lack of city center public use heliports
- Omission of city center heliports in regional aviation plans
- Low priority placed on heliports by planners
- Lack of understanding of community benefits derived from an active and successful helicopter operation
- Lack of knowledge of noise and safety characteristics of modern helicopters
- Lack of media support

For these and other reasons, rotorcraft use may be constrained by lack of landing areas in appropriate locations. Only eight percent of heliports are available for public use and very few new public heliports are being constructed.

Heliports may offer the potential for relieving some portion of the congestion at major hub airports, but too little attention has been given to this potential by airport operators, by FAA, or by regional planning agencies.

Helicopters are extremely versatile tools capable of a broad range of public services. Among these are police, fire protection, rescue, emergency medical services, and surveillance services. However, the vehicles are expensive to buy and operate, which precludes many local governmental from utilizing them. Although capital costs for simple helipads can be low, centrally located heliports can be difficult for a single agency to implement. Mechanisms could be developed for sharing the cost of facilities and helicopters in order to reduce costs and realize greater benefits of public service helicopters.

In order to maximize the benefits and opportunities that rotorcraft offer society and be fully accepted by the public, technology improvements are necessary for helicopters, as well as for guidance and control systems. A major barrier to full rotorcraft acceptance in urban and residential environments is the public concern and image regarding noise and safety. An aggressive technology program is needed to develop innovative technical and operational advances which will enable the industry to design and operate quieter, safer helicopter systems. Improvements in ride quality and reductions in internal noise will contribute to greater passenger acceptance. Realization of the unique features of rotorcraft in an integrated transportation system requires a second major technological effort to achieve more economical operation. Important technology factors in achieving low cost operation include fuel efficient performance and highly reliable, easily maintainable operation.

Discrete airspace for helicopter operations is required to provide enroute approach and departure to heliports at airports and in urban areas separate from airplane operations to effectively utilize their unique performance capabilities. These discrete routes use less airspace than required for airplanes at lower altitudes, and therefore increase the capacity of the national airspace for aircraft operations. Discrete airspace would contribute significantly to all-weather operation under Instrument Meteorological Conditions (IMC) in urban areas.

The problems can be summarized in the following list:

- Public acceptance: noise, safety, service benefits
- Economical operations: fuel efficiency, reliability and maintainability, vehicle acquisition cost
- Inefficient performance under IMC conditions: helicopters being forced to operate as airplanes in Air Traffic Control (ATC) systems
- All-weather operation
- Possibility of further petrochemical fuel price increases in real terms and/or further shortages: need for powerplants that can use emerging alternate fuels
- Passenger acceptance: a function of several of above problems

Conference Recommendations

1. Manufacturers and operators should take the initiative to work with transportation planners to acquaint planners with state-of-the-art technol-

ogy, and to plan and implement public heliport facilities.

2. **Public acceptance should be sought through the community planning process, since this approach should be the most effective in alleviating perceived public concerns, communicating potential benefits to the community, and gaining support of the media.**
3. **FAA should urge that heliport systems be included in the National Airport System Plan (NASP).**
4. **Materials for planners should include examples of successful heliport planning and implementation, such as operations in New York City and Ohio.**
5. **Planners should give attention to the opportunity to reduce major airport congestion and surface clutter through use of reliever heliports.**
6. **To maximize public benefits and reduce effective operating and acquisition costs, public agencies could share heliport facilities and helicopter use. This relationship will allow governments to more broadly benefit from helicopter service such as:**
   - **Planning: traffic studies and land use reconnaissance**
   - **Police**
   - **Fire protection**
   - **Energy: thermo and heat loss studies**
   - **Emergency medical services (EMS)**
   - **Rescue**
   - **Environmental control**
   - **Executive transportation**
   - **Electronic news gathering (ENG)**
7. **An aggressive rotorcraft technology program that seeks to reduce noise with minimum performance loss should be initiated by the government (NASA and FAA), and should include strong participation by the manufactuers.**
8. **Government and industry should pursue aggressive technology programs in aero-acoustics, vibration reduction, flight controls, navigation and guidance, composite structures, small engine and transmission advanced vehicle configurations, and heavy lift helicopter development (HLH).**
9. **The FAA should continue to develop discrete routes, approaches, and procedures for helicopter operation.**
10. **Government and industry should accelerate alternate fuels and powerplant research, emphasizing solutions especially suited for helicopters.**
11. **A strong generic, aeronautical research and technology program should be maintained by government and industry.**
12. **The Federal government should demonstrate promising advanced vehicle concepts so industry will have confidence in developing these vehicles and operators and financiers will have confidence in purchasing them for use in regular operations.**

Commuter Air Transportation

Commuter air transportation has become a publicly recognized, vital segment of the national air transportation system. The Airline Deregulation Act of 1978 provided congressional recognition of the commuter airline industry, and formalized its status within the transportation system. The commuter airlines are now considered the key ingredient in the service-to-small-community program, providing frequent flights to these communities with small airplanes which are sized to the market demand. The commuter aircraft provides small community access to the national air transportation system. The 250 to 300 carriers in the commuter industry are enplaning approximately 14 million passengers per year, transporting them an average distance of 110 to 120 miles, and providing convenient connections for 65 to 75 percent of their passengers with the long-haul carriers. Commuter carriers enplane 2 to 4 percent of all passengers today, and are expected to enplane ten percent of all passengers in 1990.

The major problems and issues in commuter aviation include:

- Encroachment of residential land use within airport environs is increasing, limiting expansion potential for commuter operations. A need exists for future STOL/commuter facilities at general aviation reliever airports.
- Land use and environmental conflicts for entirely new airports and general aviation airports serving commuter airlines are severe and involve lengthy review and permit approval processes.
- The commuter airline industry has been perceived by the public in rather unfavorable terms because of the modest beginnings of many of the newer and smaller airlines, and because of the contrast with major carriers operating larger, all jet fleets. Although this image is changing rapidly, the problem is still significant.
- In the past, Federal regulations had the unfortunate effect of retarding the market and the rate of technological improvement for small-to-medium sized aircraft. Deregulation has resulted in rapid growth in demand for such aircraft. This growth, coupled with other recent changes in the field, have increased the need for improvements in the following areas:
  - Noise reduction
  - Ride quality and vibration reduction
  - Safety
  - Fuel economy
  - Maintenance cost reduction
- The rapid increase in commuter operations at major hub airports has created problems in providing adequate facilities for handling passengers and freight, transfers among airlines, appropriately designed and located gates, and ticket counter space.

- The rapid increase in commuter airline activity at smaller airports has resulted in greatly increased demand for air traffic control and navigation facilities, as well as increased demand for facilities to handle passengers, freight, and aircraft.
- The rapid growth of commuters is not yet adequately reflected in airport planning.

Conference Recommendations

1. **Planners should work to improve land use controls in airport environs using the most appropriate tools (e.g., easements, outright purchase, more effective zoning). Planners should also work to improve understanding of the steps in environmental review processes and to coordinate response schedules for multiple Environmental Impact Statement (EIS) requirements to reduce the time required for implementation of major airport improvements.**
2. **The following actions should be taken to maintain and enhance the environment for a stable, financially viable commuter airline system:**
   - **Continuance of U.S. airline equipment loan guarantees**
   - **Protection of existing military airfields and other government owned airports which might potentially be transferred to operation as community airports**
   - **Pursue expansion of the capacity of existing airports through the establishment of discrete short take-off and landing runways**
   - **Continue Federal grants for the development of commuter airports**
   - **Re-evaluate necessity for and the proper formulas for integrated fares in order to protect the interests of commuter airlines and consumers**
   - **Evaluate proper level of ADAP ticket and fuel taxes and the equitable distribution of the tax burden to different segments of the airline industry**
3. **The Regional Airline Association (RAA — formerly CAAA), together with APA, NASA, FAA, and industry should assemble, analyze, and summarize the large amounts of existing data on benefits (particularly for non-users) of commuter service. Results should be disseminated as guidance for transportation planners and operators, public officials, and industry.**
4. **Public education programs should be conducted by the industry, with the purpose of familiarizing larger populations with the nature of the commuter airline industry.**
5. **Technology development should be continued by the government and industry to improve the noise, ride quality, safety, and economics of future commuter aircraft. The Federal government should sponsor basic, high risk aeronautical research and technology development, including testing of research vehicles, directed at commuter aircraft.**
6. **A study should be conducted by FAA to investigate the integration of commuter airline operations (air and ground-side) at major hub airports.**
7. **Planners should take the lead, in cooperation with industry, in finding ways to preserve existing airports, where appropriate, for potential commuter airline use.**
8. **FAA should accelerate the implementation of appropriate navigation facilities at airports used by commuter airlines.**
9. **APA should encourage planners to assess the commuter air transportation needs in their areas on a regular basis and include this in the routine updates of the state and regional airport system plans.**
10. **The Monterey Conference has been successful in furthering the understanding of commuter airline operations among planners, manufacturers, operators, and government agencies. A mechanism should be set up to plan subsequent regional meetings and other means of continued dialog.**

PROGRAM

SPONSORED BY

National Aeronautics and Space Administration

Transportation Planning Division of the American Planning Association

CONFERENCE PURPOSE

The Monterey Conference brings a representative set of community planners and public official at all levels of government together with rotorcraft and commuter (fixed-wing) manufacturers, operators and researchers, to exchange viewpoints on planning for rotorcraft and commuter air transportation.

The objective of the Conference is to reach consensus, insofar as possible, on present and future planning and technological issues involving rotorcraft and commuter fixed-wing air transportation opportunities and benefits. For planners a principal product of the Conference will be a sujmmary of information that can aid them in evaluating opportunities for rotorcraft and commuter air transportation. For technologists (manufacturers, operators and researchers) the Conference will provide an interchange of planning experience and local governmental perspective that will improve the responsiveness of research, manufacturing and operating programs to community needs and concerns.

CONFERENCE COMMITTEE

Conference Co-Chairman: Willard Stockwell, Chairman, APA Transportation Planning Division, and Jay Christensen, NASA. *Conference Steering Committee:* Paul Brockman, Gerald Kayten and Louis Williams, NASA; Lawrence Dallam, Twin Cities Metropolitan Council; David Forkenbrock, University of Iowa; Glen Gilbert, Helicopter Association International; Stanley Green, General Aviation Manufacturers Association; James Mottley, Federal Aviation Administration; James Scott, Transportation Research Board; Steve Smith, Commuter Airline Association of America; and Thomas stuelpnagel, American Helicopter Society. *Conference Management and Planning:* Joseph Stowers and Bonnie Berner, System Design Concepts, Inc.

PRE-CONFERENCE STUDIES

To provide substantive technical inputs for the Monterey Conference. NASA sponsored two studies:

- *Planning for Rotorcraft and Commuter Aviation.* Conducted by the American Planning Association and its subcontractor, System Design Concepts, Inc.
- *Community Rotorcraft Air Transportation Opportunities and Benefits.* An assessment and documentation of recent technological developments and trends; conducted by the Helicopter Association International and its subcontractor VITRO Laboratories.

CONFERENCE PUBLICATIONS

- *Conference Summary:* A 20-page summary of findings and recommendations which will be distributed to attendees and over 30,000 planners and technologists throughout the country.
- *Conference Proceedings:* A compilation of edited versions of all presentations and papers, and summaries of session discussions, as well as the Conference resolves.

CONFERENCE FORMAT

The Conference will address major issues of planning for rotorcraft and commuter air transportation, at six separate plenary sessions.

Ten workshops will be formed with a balanced set of planners and technologists (researchers, manufacturers and operators) asked to serve on each workshop. These workshops will independently, and in parallel, develop recommendations based on Conference papers and discussion. The recommendations of the workshops will be synthesized and presented to all Conference participants for discussion and action in the final plenary session on Friday morning. Workshop assignments will be distributed with the Conference registration packet. (Because of time limitations and the need for a balance of disciplines, these workshops will be limited to invited participants. Other interested persons may participate in the plenary sessions, including the final session on Conference resolves.)

Program

NOTE: Asterisks are shown in program for workshop meetings: room assignments are found on separate sheet distributed with Conference registration packet.

MONDAY, AUGUST 31

1:00 pm *(Lobby)* REGISTRATION

3:00 pm *(Windjammer)* WORKSHOP LEADERS' MEETING

4:30 pm *(Pebble Room)* GLEN GILBERT ASSOCIATES HOST BAR

6:00 pm *(Beach Room)* **CONFERENCE DINNER**

OPENING ADDRESSES

WELCOME ON BEHALF OF HOST CENTER—
C. A. Syvertson, Director, NASA Ames Research Center

WELCOME ON BEHALF OF NASA AND INTRODUCTORY REMARKS—
J. L. Kerrebrock, Associate Administrator for Aeronautics and Space Technology, NASA

HOUSE OF REPRESENTATIVES AVIATION AND RESEARCH PERSPECTIVE—
The Honorable Daniel Glickman, Chairman, House Aviation and Materials Subcommittee, Committee on Science and Technology

QUESTIONS/DISCUSSION

8:00 pm *(Pacific Room)*

SESSION I: THE FUTURE COMMUNITY ENVIRONMENT

CHAIRMAN: ***Clifford Graves,*** Chief Administrative Officer, San Diego County

CONFERENCE OBJECTIVES AND MECHANICS—
Willard Stockwell, Conference Co-Chairman and APA Transportation Planning Division Chairman

Jay Christensen, Conference Co-Chairman and Special Assistant to the Chief, Helicopter and Powered Lift Technology Division, NASA Ames Research Center

THE COMMUNITY ENVIRONMENT AND PROSPECTS FOR AVIATION, YEAR 2000 AND BEYOND—
Herman Kahn, Director, The Hudson Institute

PANEL:

Robert Simpson, Director, Flight Transportation Laboratory, Massachusetts Institute of Technology

Charles Lave, Chair, Economics, University of California at Irvine

TUESDAY, SEPTEMBER 1

8:00 am *(Pebble Room)*

SESSION II: AIRCRAFT TECHNOLOGY

CHAIRMAN: ***Gerald Kayten,*** Deputy Director, Aeronautical Systems Division, NASA

ROTORCRAFT STATUS AND PROJECTIONS—
Thomas Stuelpnagel, Vice President, American Helicopter Society

FIXED WING COMMUTER AIRCRAFT STATUS AND PROJECTIONS—
Alan Stephen, Vice President, Operations Regional Airline Association

PLANNING NEEDS AND ISSUES ATTENDANT TO ADVANCING AIRCRAFT TECHNOLOGY—
David Forkenbrock, Professor, Graduate Program in Urban and Regional Planning, University of Iowa

QUESTIONS/DISCUSSION

9:20 am Coffee Break

9:40 am **SESSION II: CONTINUED**

AMES RESEARCH CENTER RESEARCH OVERVIEW—
C. T. Snyder, Director, Aeronautics and Flight Systems, NASA/Ames

THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA) PROGRAM—
John Cochrane, Manager, Quiet Short-Haul Aircraft Office, NASA/Ames

THE TILT ROTOR RESEARCH AIRCRAFT (XV-15) PROGRAM-
John Magee, Manager, Tilt Rotor Aircraft Office, NASA/Ames

QUESTIONS/DISCUSSION

11:45 am *(Beach Room)* **CONFERENCE LUNCH**

REMARKS BY PUBLIC OFFICIALS

INTRODUCTIONS
C.A. Syvertson, Director Ames Research Center

The Honorable Norman Mineta, Chairman, House Aviation Subcommittee, Committee on Public Transportation

Judith Connor, Assistant Secretary for Policy and International Affairs, U.S. Department of Transportation

1:45 pm Bus Departure for Monterey Airport

2:30 pm OBSERVATION OF NOISE RESEARCH FLIGHTS (QSRA, and XV-15) AND STATIC DISPLAY OF COMMERCIAL STATE-OF-THE-ART AIRCRAFT

3:45 pm OPEN FLIGHTS ON ROTORCRAFT FOR CONFERENCE PARTICIPANTS AND GUESTS

DINNER ON OWN

8:30 pm *(★)* WORKSHOP MEETINGS

WEDNESDAY, SEPTEMBER 2

8:00 am *(Pebble Room)*

SESSION III: COMMUNITY TRANSPORTATION PLANNING

CHAIRMAN: ***Dorn C. McGrath, Jr.,*** Chairman, Urban and Regional Planning Department, George Washington University

THE TRANSPORTATION PLANNING ENVIRONMENT, STATUS AND PROJECTIONS—

Willard Stockwell, Chairman, Transportation Planning Division, American Planning Association

RESULTS OF NATIONAL SURVEY OF PLANNING FOR SHORT-HAUL AIRCRAFT—
Joseph Stowers, Vice President, System Design Concepts, Inc.

Martin Huss, Transportation Planner/Engineer, System Design Concepts, Inc.

RESPONSIVE TECHNOLOGY RECOMMENDATIONS—
Lawrence Dallam, Director, Transportation Planning, Twin Cities Metropolitan Council

OVERCOMING OBSTACLES TO HELIPORTS AND COMMUTER AIRPORTS—
John Glover, Transportation Planning Supervisor, Port of Oakland

PANEL:
- A Rotorcraft Operator's Perspective and Comments

Lt. Robert Morrison, Hunting Beach, CA Police Dept.

QUESTIONS/DISCUSSION

10:20 am Coffee Break

10:40 am *(Pebble Room)*

SESSION IV: REGULATORY PERSPECTIVES

CHAIRMAN: ***Jean Ross Howard,*** Director of Helicopter Activities, Office of Public Affairs, Aerospace Industries Association of America

HELIPORTS AND COMMUTER AIRPORTS IN PERSPECTIVE—
James Mottley, Chief, National Planning Division, Federal Aviation Administration

THE NEED FOR A MODEL LOCAL ORDINANCE—
Ronald Bixby, Director of Planning, System Design Concepts, Inc.

CAB ESSENTIAL AIR SERVICE PROGRAM—
Charles Beatley, Mayor of Alexandria, Virginia

REGULATORY CONSIDERATIONS—
Jack Thompson, Aviation Representative (Heliport Planning), Ohio Department of Transportation

12:00 m Lunch (On Own)

2:00 pm (★) WORKSHOP MEETINGS

6:00 pm *(Oak Room)* COCKTAILS
Cash Bar

7:00 pm *(Terrace I)* **CONFERENCE DINNER**

REMARKS BY LOCAL OFFICIALS

CHAIRMAN: ***Richard Richardson,*** Executive Director, Helicopter Association International

Clifford Graves, Chief Administrative Officer, San Diego County

Robert Farrell, Councilman, City of Los Angeles

Lawrence Dahms, Executive Director, Metropolitan Transportation Commission (Berkeley, California)

QUESTIONS/DISCUSSION

9:30 pm *(Windjammer)* WORKSHOP LEADERS' MEETING

THURSDAY, SEPTEMBER 3

8:00 am *(Pebble Room)*

SESSION V: ROTORCRAFT AIR TRANSPORTATION

CHAIRMAN: ***Glen Gilbert,*** Helicopter Association International

INTERMODAL RELATIONSHIPS—
Robert Winick, VITRO Consultant

HELIPORT PLANNING GUIDELINES—
Jack Thompson, Ohio Department of Transportation

HELIPORT NOISE—
Charles Cox, Acoustics Group Engineer, Bell Helicopter Textron

ROTORCRAFT SAFETY AND OPERATIONAL RELIABILITY—
Arthur Negrette, President and CEO, Flight Safety Institute

ROTORCRAFT BENEFITS AND OPPORTUNITIES IN URBAN APPLICATIONS—
David S. Lawrence, Manager, Business Planning, Sikorsky Aircraft

OPPORTUNITIES AND BENEFITS OVERVIEW—
Darral Freund, Project Leader, VITRO Laboratories

PANEL:
- ***Margorie Kaplan,*** Assistant Director, Transportation Planning, Southern California Association of Governments
- ***Edward Hall,*** Office of the City Manager, Phoenix, Arizona

QUESTIONS/DISCUSSION

10:20 am Coffee Break

10:40 am *(Pebble Room)*

SESSION VI: FIXED WING COMMUTER AIR TRANSPORTATION

CHAIRMAN: ***Lou Williams,*** Manager, Commuter and General Aviation Programs NASA, Langley

LESSONS FROM THE PAST: STOL SYSTEM STUDIES AND OTTAWA-MONTREAL STOL DEMONSTRATION—
Robin Ransone, Senior Specialist in Communications, Vought Corp.

KEYS TO SUCCESSFUL COMMUTER AIR TRANSPORTATION—
Watson Whiteside, Vice President for Marketing, Air Wisconsin

THE GENERAL AVIATION MANUFACTURERS ASSOCIATION PERSPECTIVE—
Stanley Green, Vice President and General Counsel, General Aviation Manufacturers Association

OPPORTUNITIES AND BENEFITS—
Thomas Galloway, Group Leader, Configurations Assessments, Aeronautical Systems Branch, NASA/Ames

12:00 m Lunch (On Own)

1:15 pm *(Pebble Room)*

SESSION VI: CONTINUED

INTERMODAL REQUIREMENTS—
Christopher Brittle, San Francisco Metropolitan Transportation Commission

AN AIRPORT MANAGER'S PERSPECTIVE—
O.N. Ford, District Manager, Airport District Staff, Monterey Peninsula Airport District

A PLANNER'S PERSPECTIVE—
Dan Nelson, Aeronautical Planning Engineer, Utah Department of Transportation

QUESTIONS/DISCUSSION

2:30 pm (★) WORKSHOP MEETINGS

6:00 pm STEERING COMMITTEE AND WORKSHOP LEADER

(Pacific Room) WORKING DINNER
(Other Participants Have a Free Evening)

★ *Workshop meeting room assignments are found on separate sheet distributed with Conferencc registration packet.*

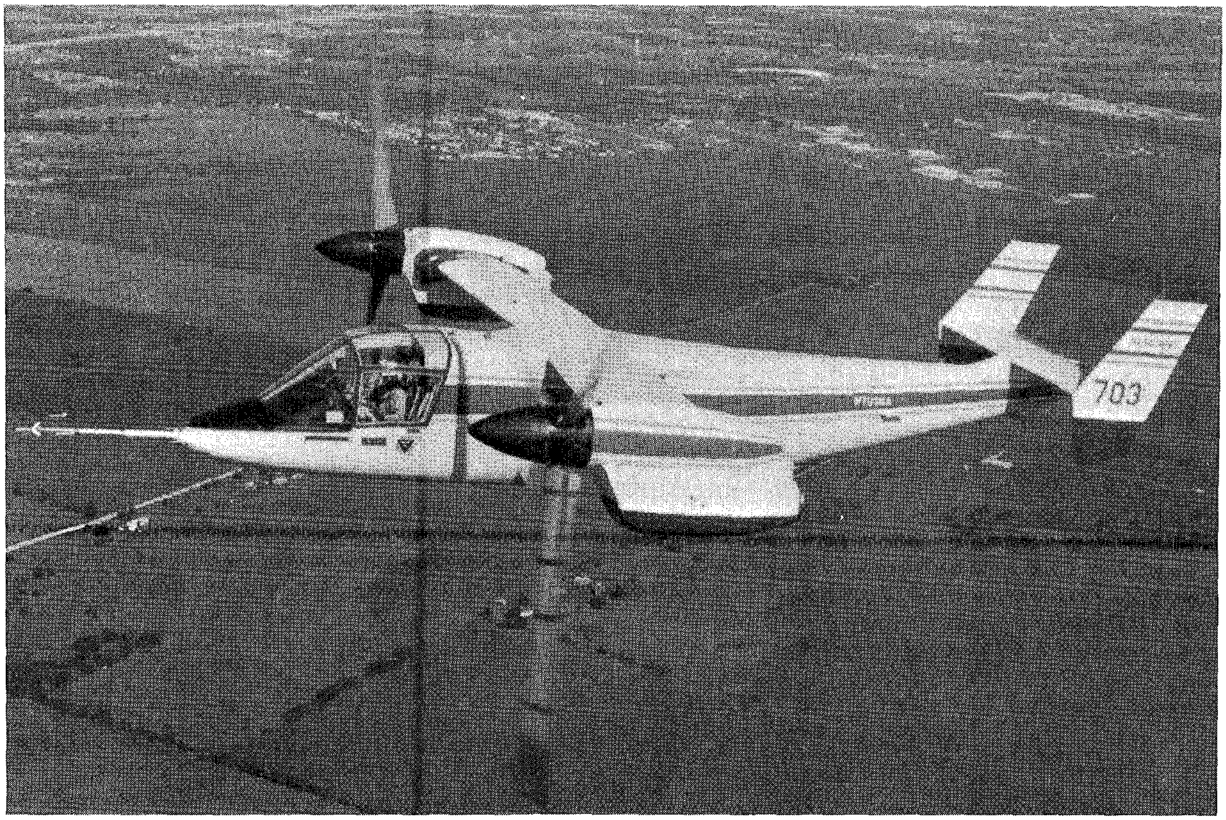
FRIDAY, SEPTEMBER 4

9:00 am **CLOSING SESSION**

(Pebble Room) **CHAIRMAN: *William Stockwell,*** Conference Co-chairman,

Review and Approval of Conference Resolves and Recommendations

12:00 pm ADJOURNMENT



MODERATORS AND RECORDS

A special thanks to the following persons for serving as Moderators and Recorders for the Conference Workshop Sessions:

Workshop A:	George Wickstrom, Moderator; Donald Proctor, Recorder
Workshop B:	Ken Dueker, Moderator; Williams Walls, Recorder
Workshop C:	Darwin Stuart, Moderator; Arthur Toplis, Recorder
Workshop D:	Bruce Wilson, Moderator; Tom Snyder, Recorder
Workshop E:	George Sheuernstuhl, Moderator; Ron Reber, Recorder
Workshop F:	John Zuk, Moderator; Gary Barrett, Recorder
Workshop G:	Richard Stutz; Moderator; Ron Bixby, Recorder
Workshop H:	John Meehan, Moderator; F. Roy Madgwick, Recorder
Workshop I:	Clifton Moore, Moderator; Clifford Bragdon, Recorder
Workshop J:	Marty Huss, Moderator & Recorder

OPENING REMARKS

CONFERENCE DINNER -
Opening Session

Welcoming remarks were given by Mr. C.A. Syvertson, Director of the NASA Ames Research Center which was the Host Center for the Conference on Planning for Rotorcraft and Commuter Air Transportation.

Dr. Jack L. Kerrebrock, Associate Administrator for Aeronautics and Space Technology, NASA Headquarters, welcomed participants on behalf of the National Space and Aeronautics Administration Headquarters Office in Washington, D.C.

GUEST SPEAKER

The Honorable Dan Glickman
House Aviation and Materials Subcommittee
Committee on Science and Technology
Congressman, Fourth District, Kansas

I would like to begin my remarks by expressing appreciation to the two Conference Co-Chairmen for their foresight in recognizing the need for this dialog between planners and technologists. Bill Stockwell, Chairman of the American Planning Association's Transportation Planning Division and Jay Christensen of NASA/Ames are the two men who saw the need for this diverse group to get together and I believe their efforts will be rewarded if we achieve half of what they have set out for us to do while we are here.

I truly believe in the purpose and timeliness of this Conference. An exchange of views among community planners and aircraft manufacturers, operators, and researchers is critically important in this period of rapid growth in rotorcraft and commuter air transportation. This exchange is important not only because of the rapid growth, but because of some important current issues:

1. Deregulation has already resulted in increased use of commuter airlines. Further rapid increases are projected and this growth is giving rise to new problems which must be faced by planners and technologists in accommodating this growth and in facing new regulatory issues which are surfacing.
2. Airport congestion is increasing and the solutions are more likely to be found in a Conference of this type than in the old-fashioned solutions of the 1950s—community opposition will probably prevent any major new airports from being built. Rotorcraft and commuter air transportation both should have a role in dealing with this problem, and new technology may be critical in determining the success that each will have.

Our House Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology has two principal interests relating to this Conference:

- The NASA aeronautics authorizations, which have been $500 million per year, are aimed at advancing the state of technology for all classes of aircraft. This program is the key to successful U.S. competition with European manufacturers.
- The FAA authorizations for R&D, which have been $85 million per year, are primarily directed at the front-end of the acquisition cycle for new air traffic control equipment. This program is the key to greater safety and productivity of the air traffic control system.

Although short-haul aircraft may currently be a relatively modest proportion of commercial air transportation, the importance of this sector must be viewed in light of the fact that it is the sector with the most rapid rate of growth, and therefore is the sector that could have the best potential for spurring continuing U.S. leadership. During the past 30 years aircraft sales of all types have grown eight times as fast as GNP. In 1980, aviation sales resulted in $13.3 billion in surplus balance of trade—more than any other sector including agriculture. Export sales alone accounted for 400,000 jobs.

The key factor in this success has been the government partnership with industry—in fact, this partnership has been a model for other potential growth sectors to emulate. NASA and DOD have provided two commodities that individual firms can not provide:

- A large pool of talent to facilitate technological information exchange and assure program continuity.
- Expensive facilities for testing of research aircraft and components.

NASA in particular has provided the front-end, high risk R&D component that has been critical to continuing U.S. leadership. In any major new technology product development it is typical that ten percent of the risk capital gets you ninety percent of the way—the last ninety percent is needed for lower risk but expensive tooling and product engineering.

The history of the relationship between government and industry in this field is unique—one that should be studied by those in other troubled U.S. industries. NASA has no regulatory role, and that has supported a highly cooperative attitude between NASA and industry. An extremely high proportion of new technology developed by NASA has been, or is being, transferred to useful commercial products. An impressive measure of the cost effectiveness of this program is that the total NACA/NASA R&D expenditure over sixty-five years has been less than one half of the dollar value of U.S. exports in this field in 1980 alone.

The growth in use of rotorcraft is unique in that a large part of this growth has resulted from the continuing development of new applications. The use of helicopters as ambulances is a good example. There were only a very few in 1978, and this increased to 29 in 1979. A total of about 350 U.S. hospitals now have helipads. In a few years this number will probably multiply, facilitating the trend toward hospital specialization and saving ever more lives through quick emergency response.

Similarly the use of helicopters for news gathering and live coverage by television has mushroomed almost overnight—there were only five such helicopters in 1978, but 70 were in use in 1979.

The use of helicopters for crew rotation and for supplying equipment to off-shore oil platforms has already become the standard mode of operation in this vital growing sector of the petroleum industry. Over 500 helicopters are now engaged in this work in the Gulf of Mexico alone.

There are now over 8000 helicopters in operation in the U.S. and the annual growth rate has been consistently in the 10 to 15 percent range—a growth rate that was sustained for a lengthy period by fixed-wing aircraft sales during its primary expansion period.

The international market for U.S. made civil helicopters is now rapidly opening up and should help sustain these growth rates if U.S. manufacturers can continue to successfully compete with foreign manufacturers' technology. At present the U.S. is still pre-eminent in the commercial transport field—about 80% of the total world civilian fleet is U.S. manufactured. Our manufacturers presently supply about 60% of the total world helicopter market. In 1980 about 52% of the 1200-plus helicopters produced by U.S. manufacturers were exported. However, it will be difficult if not impossible for U.S. manufacturers to retain a constant proportion of total sales in the world market.

One important future application that has yet to be demonstrated is downtown-to-downtown helicopter passenger service. The potential would appear to be attractive because of increasing ground congestion and delays at all major airports. Successful penetration of this market will depend on the availability of centrally located heliports. The amount of intercity passenger movement that can be captured will depend greatly on the extent to which new technology can be developed to provide economical service with a high level of passenger comfort and all-weather reliability.

The Soviets are expanding more rapidly than the U.S. in military helicopter production, particularly high performance and armed helicopters. The gap appears to be widening over the last several years. A benchmark in Soviet achievement occurred in 1978 when a HIND-D captured the world helicopter speed record.

We have several promising directions for future motor technology which you will be seeing and hearing about this week. Most impressive, I think, is the Bell/NASA tilt rotor, which is capable of 300 knots—double the speed of current helicopters. It was the hit of the Paris Airshow in June, and had remarkable reliability for an experimental aircraft—it flew every day on schedule. The tilt rotor is one of the very few new technologies that offers the promise of achieving a major increase in productivity, because of having the vertical take off and landing capabilities coupled with the efficiency of higher speed flight as a fixed-wing aircraft. It has fuel efficiency close to a helicopter in hover and close to a turboprop in cruise.

Yet rotorcraft today must be characterized as a immature technology relative to most other types of transport. Much remains to be improved upon before the full technological potential of rotorcraft is realized. The most important subjects for R&D attention where payoffs will result seem to be in the following areas:

Noise	All Weather Operations
Vibration	Lighter Materials
Fuel Efficiency	Reliability
Higher Speeds	

NASA should be given the resources to allow it to continue to work on these problem areas if we are to hold the international lead in rotorcraft.

The status of commuter aviation is a quite different picture, although there are some common problems, some similar opportunities, and some reasons for considering both of these short-haul air transport modes together in this Conference.

During the late 1950s and early 1960s, commuter airlines began to fill the gap which was being left as regional carriers pulled out of smaller communities. The growth rate of commuters, however, tripled after deregulation occurred in 1978, so that it has been the fastest growing segment of aviation. The average growth rate for the 1970s was 10%. The number of commuter carriers jumped from 12 in 1964 to almost 300 in 1981.

Deregulation has brought growth to the industry, but it has been a mixed blessing to communities. Some small communities have lost service as airlines moved to larger aircraft and more profitable routes. Service between pairs of small communities decreased 16% since deregulation, as the system has generally moved to a hub and spoke configuration, as compared to the older pattern which tended to link communities as intermediate stops on longer route systems.

The international aircraft market for commuter aircraft is much the reverse of the situation for large transport aircraft. Foreign aircraft manufacturers have captured most of the commuter market, especially the rapidly growing market for aircraft above 19 seats. The largest selling aircraft are:

1. Aerospatiale Nord 262 (France)
2. Shorts SD3-30 (N. Ireland)
3. de Havilland Dash 7 (Canada)

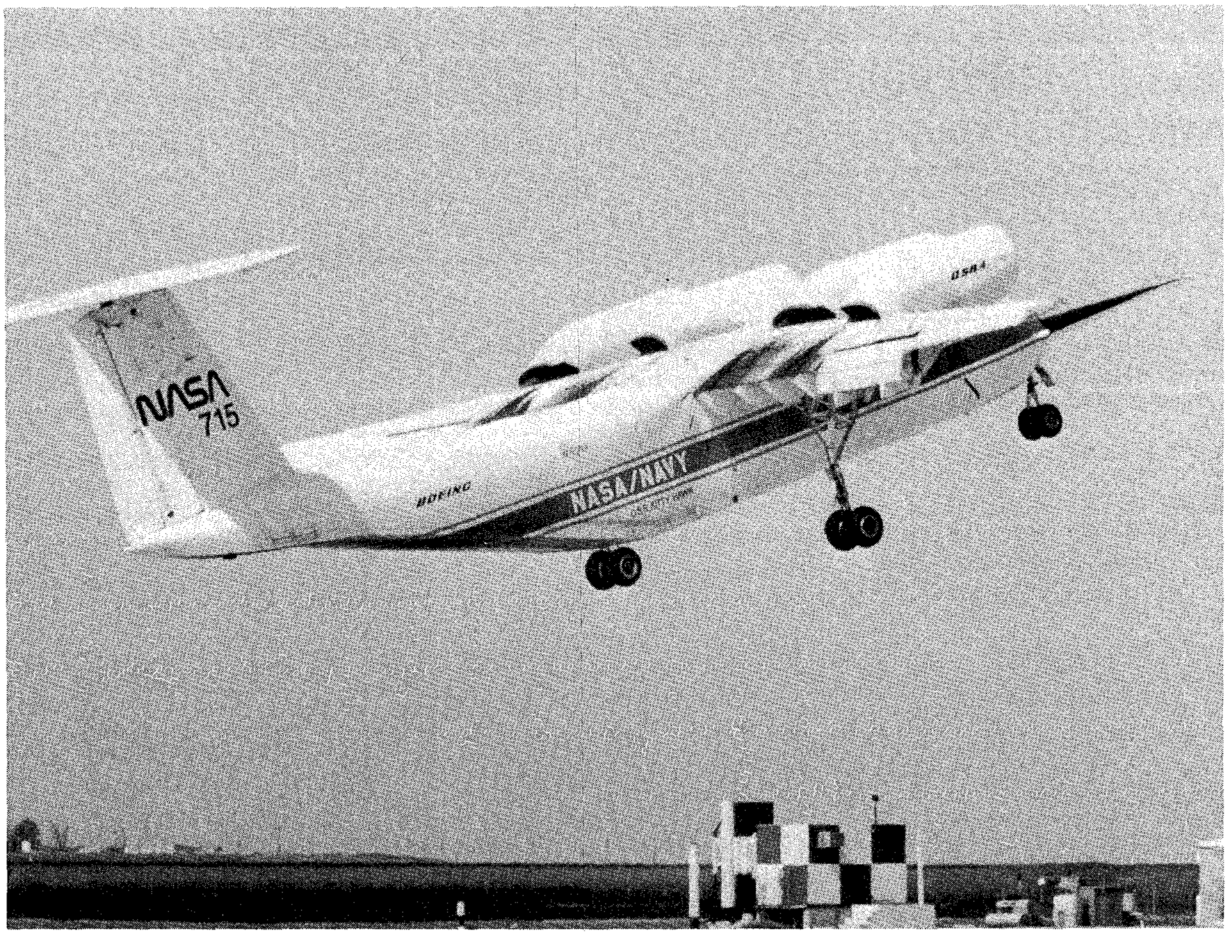
The total U.S. commuter fleet grew from 361 to 1,333 aircraft from 1965 to 1980. Since the C.A.B. lifted the 19 seat limit on commuters in 1972, the number of aircraft in the 21-50 seat range grew 900%. Forecasts indicate a worldwide demand for 8,000 commuter aircraft in the 15-60 seat range by the year 2000, of which about 2,500 should be in the U.S.

Only Fairchild (in partnership with SAAB) has started a new technology commuter aircraft production effort in the U.S. We simply will not be able to match the leadership we have in other aircraft categories unless other manufacturers jump into this field. In the longer run NASA can help in certain technology areas such as aerodynamics, propulsion, and materials, but the real need now is for risk taking by U.S. manufacturers.

The role that NASA is going to play is by no means certain at this time. The Reagan administration must be convinced of the value of NASA aeronautical R&D. At this time key administration officials do not yet fully appreciate the critical relationship of government-sponsored R&D to success in the market place. Their attitude is "let industry do it." Only industry can convince them otherwise—but unfortunately, industry is not yet making a concerted effort to do this.

Congress is supportive of the needs in this area. Extra funds have been added this year in draft legislation. The Senate appropriations bill has a $45 million increase for the NASA aeronautical R&D program. However, this amount could easily change in the next few weeks since the House and Senate authorizing committees are still in conference over this bill.

Groups like this one must get their message to the administration and to Congress.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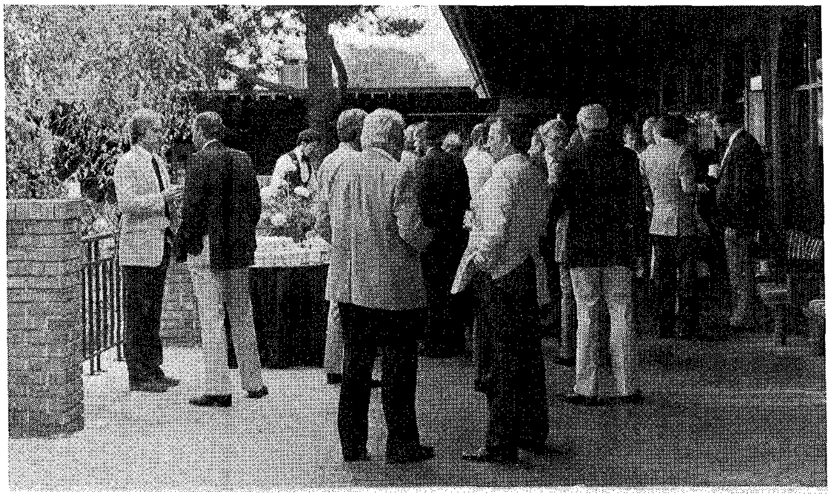


Proceedings of the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation

Monterey, California, August 31—September 4, 1981

SESSION I: THE FUTURE COMMUNITY ENVIRONMENT

Chairman: Clifford Graves, Chief Administrative Officer, San Diego County

KEYNOTE ADDRESS

THE COMMUNITY ENVIRONMENT AND PROSPECTS FOR AVIATION, YEAR 2000 AND BEYOND

The Community Environment and Prospects for Aviation, Year 2000 and Beyond
Herman Kahn, Director
The Hudson Institute

The basic thing going on in America is the movement of quality of life. We're richer, we're more technological, so we can choose where to live. What we choose tends to be sun for most of us sane people, winter sports for the less sane.

It's common to run against government as if the government was a bunch of enemies; in some ways, it is. An old joke has been revived in the last couple of years. There are three great lies in America. The first is the check is in the mail, the second is I'll respect you in the morning as much as I do tonight. The third is, I'm from the government, I'm here to help you. You may remember the slogans in the campaigns of '72 and '76: "Be happy you're not getting as much government as you're paying for; please don't help me this year, I'm still trying to recover from what you did last year."

Today I'm going to talk mainly about the process that started with Roosevelt's New Deal, which on the whole is very acceptable to the country. This country is very committed to a welfare state but Americans would like it to be an austere welfare state. Alone among the industrial countries of the world, we want to preserve a distinction between deserving poor and undeserving poor. These are very controversial issues.

We did a study on the future of Arizona. It was a prototype study of what we call an emerging post-industrial culture. We talk about a marriage of machine and garden. There are two themes in American literature and much European literature on America. This is the virgin country. The U.S. is also the most technological country in the world. Most of this literature argues there's a clash between these two themes.

We argue that in Arizona a marriage of machine and garden is occurring -- the use of advanced technology and affluence to live very well, and Arizonians do live very well. People who come to Arizona are not the old and retired; they have no higher percent of old people than the rest of the country. They are more than balanced by the young and lower income, who still want to live well.

In Arizona, we see the future of the rest of the country. The real growth has taken place in the very small towns; it's exurbia, outside the suburban area. The Hudson Institute has a kind of competitive advantage in doing studies of this sort. We're the only intellectual organization I know of that doesn't have a manic hatred for the automobile. We also like low density living, which other people call suburban sprawl. And since these two seem to be the wave of the future (combined with the rotorcraft), if you're hostile to these things, you have a real problem of grasping the main trends. We did a study of Paris which is kind of a landmark, mainly because everybody else in Paris was hostile to the automobile, including the planning organizations. I gave two talks about fifteen years ago to the two major planning organizations in the United States. I told them that we had a problem in planning. Most of the planners at that time were in favor of big cities, tall buildings with lots of green area around them. In America these are crime areas.

The American public liked Greenwich Village-type living on the Jane Jacobs model, or Paris-type living, high density and spread out. Tokyo is a two-story city with ten million people. It just doesn't work.

Some of the planners said they might like a different kind of city if they saw one that was well-designed. Well, I haven't seen one yet. They also asked whether planners should lead or follow. I suggested that at least two-thirds of the planners should work for the customer, and one-third could lead. I think the planning profession is relatively sober today.

I believe that this country went into a period of malaise in the early '60s. From '63 to roughly '67, things began to fall apart in many, many areas; crime, education, productivity, morale, alienation, and so on. I don't think this phenomenon was accidental. I believe we're coming out of this malaise in the early '80s, due partly to the Reagan Administration.

By way of contrast, Europe went into this kind of malaise period in the early '70s. At the moment, Europe shows no particular sign of coming out of it. I guess they won't do so before the early '90s.

These are some of the problems that the Reagan Administration is trying to deal with:

1. Tight money policy
2. Reform regulation
3. Reduce expenditures
4. Reduce taxes (supply side economics?)
5. Reduced corruption, waste, inefficiency; and
6. Change people's expectations

Except for (2) there is very little focus on important institutional and related reforms, as given below. They are complicated problems, we don't understand everything about them. There's been a lot of revisionist literature recently on the cause of the Great Depression. It may have been the biggest single event in the twentieth century, and it occurred fifty years ago. If we don't understand the Great Depression perfectly, we may be even more confused about current issues.

There are seven attitudes you can take towards the kinds of things I'm talking about today.

The Seven Levels of Belief

1. Atheism	- Reject concept but not necessarily the metaphor
2. Agnosticism	- Consciously ignorant about the issue
3. Skepticism	- Could or would like to believe but needs more evidence or discussion
4. Deism	- There's something to the (idea, concept, argument), but it is not clear what
5. Scotch Verdict[1]	- There is a high level of evidence supporting the (idea, concept, argument) but it cannot be rigourously proven
6. Acceptance	- Some important group believes the concept
7. Divine Revelation	- Absolutely certain (with religious or ideological conviction) of the truth of the concept

One of the great virtues and defects of the current Reagan administration is they have a well-developed ideology, a theory of man, of nature, of economics. At least you know where they stand. Ideology is good, it gives you continuity and commitment; but it can be bad if you go in the wrong direction.

The big issue in government is what can you change, what you have to live with, and whether you know the difference. And the most extraordinary thing about the Reagan Administration is this: they can change a lot of things which were generally judged to be unchangeable.

In terms of fixing the current problems, just straightening out the current inflation, if you will, and getting the country started again, all you need is a tight money policy and some deregulation of the economy. The tight money policy must be done properly. That's an important caveat.

Here is a useful analogy. You are walking down a narrow path; on one side is a 10,000 foot drop; we call that a hyperinflation. On the other side, there's a catastrophic recession, say a forest fire. Now, as you walk down that path, it's not at all clear that you can get through unburned and intact. But you have a tendency to lean towards the forest fire. That's what the government is doing at this point. There is a path which gets you neither burned nor smashed and the government will probably find it. But they do not have the kind of confidence I would like. The reduction of taxes has gone a lot further than anybody expected. In effect, corporate taxes have almost been disbanded.

You would have thought that the stock market would be booming but instead it dropped 120 points. The bond market collapsed because business and bonders just don't believe that interest rates are going to go down; this is the so-called smart money. In my opinion, both the bond market and the stock market are simply reacting incorrectly. I am a little unsure myself. I do believe that the interest rates will drop rapidly, and inflation will drop even more rapidly. I expect real interest rates to be relatively high and that the stock market will, in fact, recover quite rapidly. My advice goes very much against all the signals we've seen in the last three months. The so-called smart money is against almost everything I'm about to say.

Basically, I think things can be done and will be done that may have an impact over the next two decades.

Let's take a look at inflation. It's the biggest single issue. If the inflation stays up there, if you really have to pay 13, 15, 17, or 20% interest, a lot of programs won't work. The biggest single problem in the United States today is the absence of the 30-year two-and-a-half percent bond. This country was built on such bonds roughly from 1800 to 1950. As late as 1950, long-term triple A bonds went for 2.8%. What's the current situation? Everybody wants 15 to 20% discounted cash flow after taxes. Before the recent tax change bill, that meant 25 to 30% before taxes. Your project was supposed to pay for itself within three to four years. In other words, businessmen were treated in the United States the way the oil companies used to treat the Middle East. If you can't get your money back in three years, forget it. If that had been the criterion, we would never have built the canals, railroads, toll roads, bridges and utilities in this country. And you can't finance commuter airlines under present conditions.

Interest rates will drop rapidly and just ignore the bond market. The bond market is saying that high inflation will continue. They're willing to concede the inflation may well drop down to 8-9%, but then it hits the resistance point, the so-called imbedded inflation, and bounces up again. That's the conventional wisdom today. I don't agree. This single factor will dominate your plans more than any other item that I have to talk about. Do you or do you not get the financing that's needed for a really huge expansion of the commuter aircraft? The basic economic, social, cultural, and technological situation calls for a huge expansion in this kind of commuter short distance aircraft. Civilization is changing; it needs this marriage of technology and affluence, this machine and garden. People want to live out in exurbia. They want to move out, but they want to have quick access and good communications.

All this adds to the old trends. If that curve doesn't come down, and you can't treat it in an *ad hoc* way, very few of these dreams will be realized to the extent that we're talking about today. It's a number one issue.

The quality of discussion about inflation is, in fact, very low. For example, I've never heard anybody on T.V. talk about inflation being caused, say, by monetary policies. I believe that indexed bonds will be the wave of the future if inflation is not brought down. In many cases indexed bonds can restore the ability to finance projects.

It makes a big difference whether an economy has a pure monetary inflation or one which was touched off by some kind of impoverishing event or supply side shock. In both cases, as a monetarist I believe that inflation won't occur without a permissive money policy. Americans used to be fond of pointing out that inflation was less in the United States than in the rest of the world. But that was completely misleading. One of the main causes of the worldwide inflation was that we sent out billions of dollars more money that the world really wanted, due to our exchange policies. By doing so, goods entered this country, which helped us to fuel our inflation, and we sent money out, which helped fuel inflation elsewhere. In particular, we got fixed exchange rates and permissive money policies; our policy was to export inflation. But today we are having the same problems as the rest of the world. And there is no reason why we shouldn't. Oil had nothing to do with the inflation. The first oil shock was in 1973, when inflation already was on the way to a peak. Oil didn't cause more than 1/3 of the inflation since the oil shock.

Let's talk about indexing Social Security. You have two theories. You want to protect the people concerned from any kind of an interruption of their standard of living, or you want them to at least do as well as the rest of the country.

We don't discuss inflation well. Almost everybody believes that the U.S. government is in deficit—that in some reasonable sense they're spending more money than they're taking in. In some basic sense that statement is incorrect. My first indication that it is incorrect is this: total U.S. national debt has been constant for about twenty-five years. Well, the U.S. pays a nominal interest of say ten percent on its debt, but the real interest is zero. If I can find you a $100 billion item in the U.S. budget for interest, which is actually balanced in the real world by the fact that the purchasing power of the bonds went down by ten percent, then in fact, the government made money on the deal.

This is a very trivial concept; if I was a martian economist coming down to lecture you today, I would have the right to believe that you all knew about it. The deficit is right at the center of the discussion.

This is not true in Germany and Japan. There the governments are spending a lot of real money; in fact, their deficits are going up, and their bonds are going up. How nominal deficit is financed is very important. In other words, $100 billion which we call interest is really rollover of debt. If a bond becomes due and you borrow money to pay it off, you don't call that a deficit. You call it rollover. How you finance the rollover is night and day difference. If you finance it through the Federal Reserve system, it's inflationary. After twenty-five years we've financed that rollover through the Federal Reserve system. For twenty-five years the Federal Reserve system has said we're going to follow a tight money policy. For twenty-five years they didn't do so. Therefore, people doubt that the Reagan administration will stick to a tight money policy. Of course, it's very painful.

A lot of you worry about energy, and I think too much. I can give you ten reasons why the government policies forced the energy crisis to continue. This is a problem of policies. The most important policy, of course, was keeping the price low. For example, when the world price was $14 a barrel, the price in the United States was $9 a barrel. Consumers were being subsidized at the rate of $5 a barrel. Since we were consuming 6 billion barrels a year, there was a subsidy of $30 billion for using energy. The result was excessive consumption. Carter was trying to make conservation a moral issue. What chance is there that you can have a twenty-year program based on voluntary self-discipline? None, so why talk about it?

Many people believe that the current oil glut is temporary. We took the position in 1977 that the oil price would never to go more than $20 a barrel in 1976 dollars, or $30 a barrel in 1980. It actually went to $35. But we also took the position in an article published in Fortune Magazine two years ago that this price was unsustainable. $35 a barrel in 1980 dollars is probably the peak oil price for all-time. We would make a bet, even money, that the world price will be lower one year from now, five years from now, ten years from now, twenty years from now, forty years from now, eighty years from now. Each of thee propositions is a separate proposition, you know, because the argument is different for each proposition.

Civilization has been around for about ten thousand years. During almost that entire period we never had a concept of material progress. In other words, people thought in terms of spiritual progress. In material terms, the future would be like the past. And they were right. We never had economic growth during those ten thousand years, we never had sustained rapid changes of technology. This process which we call the industrial revolution started two hundred years ago in England and Holland. It had never occurred before. People like Adam Smith and Karl Marx believed that the industrial revolution spread very rapidly. But in fact until 1950 it had spread to only 17 countries, basically western culture, Japan and the Soviet Union. Until their industrialization was purely a property of western culture, Japan and the Soviet Union. The most remarkable thing to happen from 1950 to 1975 is that the world industrialized.

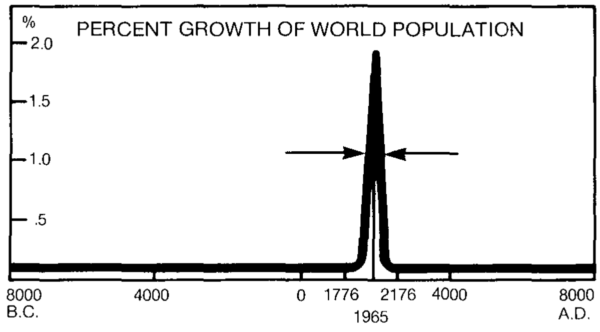
The basic world picture I'd like to give you is that two hundred years ago mankind was everywhere poor, everywhere scarce, everywhere powerless before the forces of nature. Two centuries from now, barring some combination of back luck or bad management, mankind should be everywhere numerous, almost everywhere rich, almost everywhere largely in control of the forces of nature. The question of management is important.

That's not the view which you find in the most recent study by the U.S. government, **Global 2,000**, which really argues that big trouble lies ahead. The study's careful; it says, "If current trends continue." But they take as current trends things that are not current trends. This study was done by the Federal government coordinated through the Environmental Protection Agency and the State Department. President Carter sent copies to every head of state in the world. Forty percent of his farewell address was based on this study. If he had been reelected a good deal of his foreign policy would be based on this study. I think that would have been a disaster. We feel that the government has an obligation to correct this kind of thing.

Figure 1 is the most interesting curve I know about; it appears in every book I've written in the last five years. It says that for 10,000 years world population growth was hardly noticeable. Then all of a sudden it started to go up very fast; then it will come down equally fast. It peaks at about 2.1 percent fifteen years ago; it's now about 1.7. That curve is a good solid Scotch verdict. Two out of three demographers would accept it.

This curve has not been hidden. It was first published in 1974. It has been republished in professional journals and

FIGURE 1: THE DEMOGRAPHIC TRANSITION



has been on page one of the *New York Times* and *Washington Post*.

Why is it that this curve is not better known? Why is it that there's not a single school system in the world that teaches it?

In the next twenty years we'll be doing all kinds of things where we don't quite know what we're doing. As far as we can tell, it's a lot safer to go ahead than to pull back. When we reach the end of the century this will be largely a problem-controlled economy. In other words, this is kind of a growing pain.

I am not saying that we won't have any serious diasters during this period. I don't know. I'll be very surprised if we go through the period without some disasters. Three Mile Island doesn't represent a disaster; it represents almost the exact opposite. It represents an operation of Murphy's Law where everything went wrong with a bunch of incompetent people. But nobody got hurt. It's really an impressive example of how safety can transcend idiocy. But it was a scary event.

As long as you're alive, you're going to have problems. But I don't foresee an exponential increase in the kinds of problems we're getting right now. This is a temporary situation. . .there'll be a lot of problems after 2000, but they're not going to come as fast as they will in the next twenty years.

For 10,000 years, there was no economic growth because of what we call social limits to growth. In every society something prevented the economic takeoff. We argue that social limits to growth are beginning to operate again today. This explains why there is less growth today than could have been attained. These limits operated with great strength in the last ten years; at the moment they're in abeyance. That's one of the most important things about the Reagan administration. On the other hand, they will unquestionably come back, perhaps in a different form. But they may not come back with enormous intensity for another two or three decades.

The most important thing about the United States I know of is that for twenty years the transcendental religions have been growing. The Moral Majority, the twice-born

Christians. These are the social conservatives, people with traditional values. A good part of the Reagan vote comes from these people. When you change American politics, you go from 47% to 53%; a six percent change. And you've changed the country.

What do I mean by conservative value? There are really three very different groups that are supporting the Reagan program, plus a lot of others. First, are the so-called free enterprise people, people who really believe in market forces. They represent about 20% of the country. They don't win elections. The military conservatives, people who want a stronger America, overlap with the free enterprise people. Finally, you have about 40% of America, we would call social conservatives. About 20% are twice-born Christians. Others are just conservative; they believe in traditional values. Normally these people don't vote; they are interested in their private affairs. So they're the forgotten majority, the silent majority, and so on. Now they're voting. They're furious.

Reagan may well be able to put together these three groups of conservatives into a permanent coalition. Now the last time we saw this in American politics was under Roosevelt. He put together a group of about ten different groups—a coalition of people who really didn't like each other: liberal Jews, Blacks, Irish Catholics, Polish Catholics, Italian Catholics, rural whites, white Southerners, rural poor, older people, and so on. H.L. Mencken called it a coalition of mutually contentious hostile groups. These people learned that, by working together, they could get their programs through. So for fifty years they ran the country, and did a lot of good things.

If Reagan can put together these three groups, and if the social conservatives continue to vote as I think they will, he's got a majority which can run this country for the next two decades. And what you've got has not been a temporary change but the kind of watershed change that we've seen in Roosevelt. People are increasingly making comparisons between Reagan and Roosevelt, which usually shocks his opponents. They do share a lot of things together. First of all, neither knows much about economics. But they know how to formulate the major economic issues of their time in ways that the average guy understands, finds persuasive, and accepts. And while their formulations may drive the expert up the wall, they're basically right. Both are incredibly charming people.

Now if Reagan's program fails there'll be a backlash. If the program succeeds, the Democrats will try to take it over. They might even succeed. My own guess is (a) the program will succeed and (b) you will get this coalition. And this coalition means a boom in America, not just a boom in economics, a boom in traditional values, a boom in school scores, kids will be respectful to parents, all good things will happen. I'm overtstating wildly...but the boom will be broad. If it works, a speed up will occur in these basic trends in American life which depend upon affluence and technology. You'll find an enormous acceleration in the movement to quality of life areas. To the average American, that means exurbia, small towns.

They want to get out of the city. Now I myself like cities and I expect to go back to a city but, I'm not the average American. It would be very hard for me to live more than roughly an hour away from a big city, but that's the thing you've got to be able to do for me. I don't want my neighbors disturbed by that helicopter; it's got to be quiet. It could be expensive, by the way; you'd be surprised what people would want to pay for personal transportation now. But it's got to be socially and politically acceptable, to a hypersensitive group. I would urge you to make these kinds of compromises.

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[1]In Scotland, a jury can reach three verdicts in a criminal trial: guilty, not guilty and not proven. "Not proven" means that the defendant was probably guilty, but that the prosecution has not been able to establish guilt "beyond any reasonable doubt." Many of our arguments are offered at the level of the Scotch verdict: we cannot rigorously prove them, but we have enough documentation to support the (possibly hedged) acceptance of concepts or policy.

PANEL:
Robert W. Simpson
Flight Transportation Laboratory
Massachusetts Institute of Technology

Our session tonight is on the environmental and background factors. I guess one of the things that I've noticed with some interest is that it's these exogenous or background factors in both economics and politics that seem to affect very strongly what actually does happen in aviation. I'm going to give you a few ideas of some of the things that come out of what I think Dr. Kahn has said tonight. I warn you as a forecaster, I change my mind. what I'm going to tell you tonight is a song I'm singing currently. If you have the same conference a year from now, I'll sing a different song. I tell my wife that watching the aviation industry, trying to figure out what it's doing, is better than watching "General Hospital" on television—there are suicides, (Yes, we have airline presidents shooting themselves these days!); We have airline bankruptcies from day-to-day; we have employees trying to buy their own airline; there are employees taking wage cuts in the present inflationary times; we have pilots, after twenty years of struggling trying to get three men in the cockpit, giving up overnight and embracing the 2-man cockpit enthusiastically; and then, finally, we have our ATC controllers who are marching like lemmings toward the sea, disappearing off the scene.

We talked a bit about financing tonight, and although we've developed a technology for larger transport helicopters, and we can demonstrate that there are things that we can do with them that are very attractive to society, I think we're unlikely to see them come in large scale, since I cannot see how the financing would be done in the United States today. I think most of you understand that in this country we started out in the 1930's with economic regulations of air transport which franchised our larger airlines. This allowed the government to step back and to allow private financing for introduction of new technology. In the past forty years, traditionally what happened was the airlines said "this new aircraft is very attractive to me; I will order 25 if you build it." Then the manufacturer ran around and got four or five or a dozen such orders. Airlines and manufacturers then marched to Wall Street and said "here we have launching orders for 200 aircraft"; Wall Street said "that's fine. It looks very good to us; you airlines with your public franchise are going to be in business for 25 years or more. So if you want it, I will lend the money to the manufacturer so that he can build the aircraft." At some later point in time, the aircraft are delivered and the financial people are still very happy because their loans are transferred from the manufacturer to the airlines. The institutional arrangements were such that risks associated with these large amounts of money were minimized.

Three years ago, we deregulated the air transport industry in this country and that mechanism is now obsolescent. You will not find an operator or any entrepreneur in this country at the present time who will step forward and say, "I will order five, ten, or 100 helicopters of 100 seats or more." As well, there are problems in the planning of ground facilities. In this Conference, we will probably talk about getting public heliports set up for such service. So there's a couple of strikes against scheduled public intercity transportation by helicopter. As a result, there's one piece of advice I'd give this Conference. Look at what helicopters of a smaller size will be doing over the next twenty years—ten seats, twenty seats, the ambulance public services, the corporate helicopter, and perhaps some air taxi services.

In the area of commuter airline services there's other problems as a result of deregulation. Most of our trunk airlines have left small communities or are leaving as fast as they can. There's been a boom of a transitory nature in the past three years in what used to be called commuter airlines (it's getting confusing now as to what a commuter airline is). I like to think of them as airlines that provide service to the smaller communities in the country, which are the places where Dr. Kahn says we all want to live. They bring air travelers to some hub point or some major point where they can get air service to wherever they want to go in the rest of the world. Now if we have financial problems in the major trunk line industry, we're going to have problems in the commuter airline industry, as well. They have received support in the form of free goods and services that our major carriers have given to them. I think the current boom in the commuter airlines is going to shake out as well. The government has promised, with subsidy specified under deregulation, that we would have continuation of that short-haul service to certain smaller cities. What I see happening is the need for a great expansion of that subsidization to maintain those services; or a major reversal of policy, asking whether or not we're going to continue to insure air services to small cities.

We've talked tonight a little bit about the industrial revolution. I think the most exciting technology that's appearing now is the "information revolution" that's taking place in computers, computer displays, in communications, in the office automation. There is a marriage that is starting to occur right now, between the typewriter, Xerox machine, the television set and the computer. Our offices in this country are going to change very rapidly in the next five years. It will be a revolution, I think, which is an order of magnitude more important to society than the industrial revolution. It's entirely equivalent to what happened then in the manufacturing process where we mastered machines and were able to put goods into our hands much more cheaply. We're going to have the same thing now in the office and other service areas as we start to work with this new set of technologies. As our offices change the practice of business, so will the travel needs of business. One of the staples of air transportation in the last 40 years has been the one day business trip, or the briefcase trade. We've developed, all of us, habits of rushing for the plane and off to another office and to exchange information through face-to-face contact. That staple demand has been about sixty percent of the air transportation in this country in past years.

In the future, there will be much more transmission of business information via electronic media using satellite communications with tracking antennae on our office roofs. I see a tremendous change in our business life-styles. For example, certain professionals will be able to live in Vermont with a coaxial cable snaking through the fir trees up to their cottage and still provide a great variety of their services to the rest of the country. Most of the workers in this country are now involved in the service industry. Many of those services can be performed remotely via communications with the new information capabilities coming online. It is a substitue for the business trip in the sense that there will be other ways of exchanging business information. Normally, in the past when transportation planning circles have suggested this, the communications engineers have said "there's not enough capacity." That's no longer true. The provision of sufficient capacity has come with space satellite communications. We now can transmit video and audio information direct from one office to another. IBM and the Comsat Corporation and a variety of firms are thoroughly committed with large investments to bring in this capability in the next decade. It will provide a significant alternative which affects the demand of business for travel by air.

Finally, I do see for the helicopter, in particular, a burgeoning of private and corporate transportation. There will be a lot of private transportation by corporations, by helicopter and by fixed-wing aircraft in future years. I don't know whether you know that now there is more flying in the ATC system by general aviation aircraft than there is by the airlines themselves. That was not true at the beginning of the seventies. The reason for that growth is that the general aviation fleet of aircraft is now equipped with advanced avionics and flight control systems, auto-pilots, a whole host of things which we normally associated with airline cockpits. It's much easier now for a private pilot or businessman who is a part-time non-professional pilot to fly in the ATC system than it was prior to the 1970s.

What I'm saying is that there will be a strong growth of the private air transportation, rather than the public air transportation in future years. That will come along, I think, with the idea of moving to live in the less-dense parts of our country. Business firms will own and operate their own planes and their own helicopters. So that I strongly recommend that this Conference look at what the planning guidelines are for a small heliport. One of the problems with introduction of large heliports is that there is a strong community resistance to it. It's much easier, I think, if you look at smaller heliports with frequent services, but not facilities which handle 1,000, 2,000, or 10,000 passengers per day. It would be important, I think, to try to establish consistent planning guidelines for communities around the country, so that planners can see what the requirements really are. There may be thousands of them proposed in the next decade.

I think I'll stop; I hope I've given us a few ideas, and I hope to get your reactions to them. There's probably many other reactions to Dr. Kahn's talk, and maybe Charles can give you some of those.

Charles A. Lave
Future of the Automobile Program
Massachusetts Institute of Technology

Since this is an audience of planners and engineers I will speak of the sins of planners and engineers. My remarks will, however, be brief to allow you ample time for rebuttal, and for casting stones at the sins of economists. But first I want to clarify Herman Kahn's point about the peculiar effects of fixed payment, long-term bonds in an inflationary period, and the reason such financing discourages necessary transportation investments. My university is now constructing "cheaper" faculty apartments as a recruiting inducement. They financed the project with bonds which require mortgage payments of $600/month, per apartment, for the next 30 years. The resultant rents are about $200/month more than young faculty can afford—hardly much of a recruiting inducement.

The administration defends the financing plan by pointing out that $600/month may be too high now but the repayment stream is fixed, and a $600 rent will seem like a real bargain in 1999. I suggest that an initial rent of $350, increasing at 5% a year would repay the same loan in a more attractive way; they countered that a constant $600 was the proper conservative method of financing. Thus, you see the basic fallacy of fixed payment bonds in an inflationary era. We pay too much at the beginning and too little at the end, and discourage construction of the energy and transportation infrastructure society needs.

Turning now to our own professional failings, I want to comment on two problems: consumer indifference to the projects designed by urban planners, and the impossible maintenance needs of aerospace-designed transit hardware. That is, I am going to discuss the history of recent urban transit improvement projects to point out what happens when we make an amalgam of aerospace technology and idealistic planning. There is certainly nothing in this history that leads to any optimism about the potential of helicopters for solving urban mobility problems.

The earliest aerospace transit project was the Morgantown "People Mover". I will not dwell on its cost over-runs, breakdowns, or low patronage; presumably early failures are to be tolerated. Instead, consider the BART system, a few hours away. Its state-of-the-art control system was going to revolutionize transit, but as you know, it has never worked under real-world conditions. Instead they recently went back a hundred years to borrow a control technology where they put a man on each segment of track to watch the trains, and he waves when it's safe to proceed to the next segment. I might add that the planners have nothing to crow about either: BART has only attracted half as many passengers as they predicted, and their beloved high-density urban lifestyle has not been promoted by the new railline; rather commuters have continued their well-demonstrated preference for low-density living by using BART's speed to enable them to move out farther into the suburbs. The engineers ignored the problems of maintenance by non-engineers; the planners ignored the fact that people don't share the planners' conception of proper behavior.

Or turn to the Washington METRO system that has those sexy modern ticket machines which were supposed to replace ticket-takers and cut labor costs. I can't swear that it's true, but there's an apocryphal story circulating in the transit community that these machines require about one man-year of labor apiece to maintain.

In Boston advanced engineering gave us something called the "Light Rail Vehicle". Its doors won't open reliably, it jumps its track occasionally, and at any given moment it seems to have a voting majority of its cars down for repair.

It has been said that the military is a system designed by geniuses, to be run by idiots. Well, modern transit hardware was designed by geniuses, to be run by geniuses, and that's where the trouble begins—we don't have aviation technicians doing transit maintenance.

So I would draw two lessons from this recent history that we might apply to the theme of increased use of helicopters in urban transportation. First, for the planners: *never forget that we can design more things than people are willing to use.* We should stop trying to impose our visions on the broad mass of people; if our projects are to have patronage we had better get used to asking whether people want them. Second, for the engineers: *never forget that we can design more things than people can maintain.* Massive use of helicopters implies massive maintenance problems, and the necessary skills are not out there. In the words of my former Chancellor, "never forget that the world is run by the 'C' students."

SESSION II: AIRCRAFT TECHNOLOGY

Chairman: Gerald Kayten, Deputy Director, Aeronautical Systems Division, NASA

ROTORCRAFT STATUS AND PROJECTIONS

Thomas R. Stuelpnagel
Vice President
American Helicopter Society

My contribution at this Conference is to provide you with an overview of Rotorcraft Technology and Projections.

I am going to discuss the status of rotorcraft development, project its future to the end of this century and show you examples of existing and new rotorcraft.

Throughout this Conference, you will hear the terms: "rotorcraft" and "helicopters" used interchangeably. Please understand that rotorcraft, as a term, is intended to cover all aircraft that fly by the use of a rotating wing or rotor. Helicopters are one type of such a vehicle. Their principal characteristic is that their rotor shaft is fixed in a vertical position. To this point in time, the emphasis in rotorcraft development has been on the "helicopter". For the future, as I will show, NASA and Industry are exploring advanced configerations to achieve higher speed and more range and efficiency.

My objective in this presentation is to leave you with four thoughts:

1. Rotorcraft is here to stay.
2. Rotorcraft designs are mature.
3. Rapid growth is underway in their application.
4. Need for Government planning is urgent to accommodate this growth.

There are currently 8500 civil helicopters flying in the U.S. and Canada. The number is projected to expand by two or three fold in the ten years ahead.

Applications for rotorcraft are expanding rapidly, particularly for public service use such as police and rescue. Already public service helicopters account for one-third of all civil helicopter flight hours in the U.S. and the ratio is expected to increase to 50% by 1985.

After forty years of development, helicopters have arrived at their third stage of evolution. This third stage compounds the advancements made in safety, reliability, quiet operation, comfort, all weather operation, and greater range and speed. The result is equivalent to the step made in commercial fixed-wing aviation with the introduction of the jet engine transport.

Equivalent fixed-wing standards for passenger comfort and safety are being provided in the third generation helicopters.

As a means of understanding helicopters, they can be compared to familiar ground vehicles in both application and size. For example, the light single engine helicopter is comparable to the automobile—ranging in size from two seats to seven and in configuration from the compact auto to the full size station-wagon or the one-half ton truck.

The light twin engine helicopter can be compared to the van or the one-ton truck. It seats from six to 15 passengers including the pilot.

Medium and heavy twin engine helicopters equate to the bus. Current ships seat 15 to 44 passengers. They can be expanded to 68 passengers. Larger helicopters, to air-bus size, are being considered.

Development work is underway for fourth generation rotorcraft. Emphasis in these designs is directed toward improving the speed and range of the rotorcraft to achieve lower seat-mile cost and, as a result, wider use. The most advanced of these developments is the NASA/BELL tilt rotor concept. The concept is basically an evolution of the helicopter in which the rotor plane is positioned in flight from horizontal to vertical. In the horizontal plane, the rotor provides lift in hover. In the vertical plane, the rotor then serves as a conventional propeller. Aircraft lift is then transferred to fixed wings. As a result, speed, range, noise and seat-mile cost are substantially improved.

The evolution of new types of transportation—like the steam ship, the railroad train, automobile, and the fixed-wing aircraft—have typically followed the productivity time cycle of a single human life. The rotorcraft, at forty years of age, is another example "that life begins at 40!"

An increase in Government understanding and planning is necessary to extract the full measure of the rotorcraft's future contribution. In civil terms, this contribution can be measured in improved quality of life, improved economy, and improved balance-of-trade.

We in NASA and the Helicopter Industry are pleased that the American Planning Association has recognized the rotorcraft's potential and is working to exploit it for our country's benefit.

FIXED-WING COMMUTER AIRCRAFT STATUS AND PROJECTIONS

Alan Stephen
Vice President - Operations
Regional Airline Association

Your program will show that my good friend, Lou Williams from NASA, was supposed to give this address and I was to be chairman of a panel on Thursday morning dealing with aircraft technology. However, we switched positions. As you are aware, there has been an air traffic control strike, a situation that requires me back in Washington on Thursday.

The commuter airline industry is a worldwide phenomenon. Although it is particularly well developed in the United States, commuter air service is also developing all over the world. In the past two years, I've had a chance to visit with commuter airlines in Africa, South America, and in Europe; and I've found that the factors that are influencing the development of commuter fixed-wing transportation in the United States are the same worldwide. We have a little more enlightened government with respect to deregulation of airlines, but other governments also are recognizing that it is no longer economic to operate large jet equipment over short-haul routes in the economic environment we now face.

Before discussing some of the factors that are influencing the development of commuters, I would like to give you a little background material on the industry. There are approximately 280 commuter airlines in the United States. About 250 of them provide passenger and cargo services. The other 30 provide exclusively cargo service. These carriers primarily operate aircraft that seat from 9 to 50 passengers; but under airline deregulation, commuters can operate aircraft up to 60 passenger seats without grant of CAB economic authority. Some commuters obviously can and will move into larger equipment with CAB authority.

The role of the commuter airline industry is to provide short-haul, high-frequency service, offering passenger connections through major air transportation hubs. Approximately 70% of the passengers commuters carry today interline, that is, get on or get off of another airline flight in traveling to their ultimate destinations. In 1981, the commuter airline industry will carry approximately 15 million passengers, which is approximately double the number of passengers carried just five years ago.We also serve over 700 communities, 88% of all the communities in the United States that sustain regular scheduled airline service.

But, the most important fact is that more than 500 of these 700 communities are served exclusively by commuter air carriers, which means we're really providing a network of service to the small communities and towns of this nation that would otherwise be isolated without commuter airlines.

In terms of our importance in providing overall airline service, approximately 35% of all scheduled revenue flights are flown by the commuter airline industry.

Airline deregulation had an important effect on the development of commuters. One should understand, however, that airline deregulation did not create the commuters. It's a misconception a lot of people have.

The industry was well established before airline deregulation. In fact, some commuters have been operating for more than 20 years. Airline deregulation simply recognized something that is very fundamental: the U.S. airline industry had matured to a point where it no longer needed federal protection for route and fares, and importantly, that economics and competition could drive the airline industry to a more efficient basis of operation.

However, airline deregulation also acknowledged a need to maintain air service to those communities that historically have sustained it, that otherwise might lose air service in the future under a more competitive environment. In so doing the airline deregulation act recognizes the important role of commuters in maintaining this service and thereby adopted several commuter-related provisions. One, commuters should be able to operate larger aircraft, up to 56 seats (subsequently amended to 60 seats by CAB). Two, there should continue to be a national system of air service, or the essential air service program, to those communities that otherwise could become isolated in a deregulated environment. Three, commuters should participate in the joint fares program. And, finally, to assure commuters provide safe and reliable air service, the Act specified that all commuters must be found fit by the Civil Aeronautics Board, and that an equivalent level of safety be maintained in transition from certificated to commuter air service. The Act also empowered the FAA to provide loan guarantees to commuters to assist industry to acquire aircraft that it could not otherwise purchase.

In terms of airline economics and competition, the burgeoning role of commuters can be boiled down to one very simple equation. The economics of the major airlines no longer permit the operation of jets in small commuity, short-haul air service. The fact is, the existing generation of 100-seat and larger jet equipment was designed when fuel was 10 cents a gallon. As a result, they are no longer economic when the in-plane price of jet fuel is $1.06 a gallon and climbing. That is the basic reason that we are seeing so many communities losing their jet service in favor of replacement service by commuters.

A second factor in this economic equation is asset allocation. In this competitive environment, the major airlines are looking at those markets that provide the greatest aircraft productivity, and importantly, offer improved fare yields, as measured by what they're able to charge passengers in those markets.

And a third economic consideration is strategic value; that is the question of where are you going with your resources in the future.

A recent example of strategic value might be United Airlines. Although I don't have the exact numbers, United decided at one point not to operate 737s any longer. The 737 was approximately 10% of United's fleet, probably yielded around 7% of its total passengers. In terms of revenues, however, the 737s probably provided only 4% of United's revenues. The future of United Airlines obviously does not lie in operating 737s, it lies in how to fill the 757s, the 767s, and DC 10s, and the 747s that United is operating.

And so when you start talking about allocating very scarce resources, the strategic value of maintaining small community service is lost, particularly if you can maintain the feeder service from those communities through commuter airlines.

The real success story in airline deregulation is the growing interdependence between the commuter industry and the major airlines in America. This interdependence has taken some interesting forms. Commuters are carried on the reservations network of the various major airlines. Commuters share airport terminals; and, even in some locations, the major airlines host the commuter carrier at its gates and provide the servicing of the commuter aircraft. I can cite one carrier in California that is perhaps the most complete example of this in the nation today. Golden West Airlines, a Los Angeles based regional airline that carries about 700,000 passengers a year, has a very complete interface with TWA. TWA built the terminal Golden West uses as part of its overall terminal complex in Los Angeles and has been participating in the construction of a major new maintenance facility for Golden West. In turn, TWA is getting immediate access to around 400,000 passengers Golden West feeds through Los Angeles International to other destinations.

In terms of aircraft, and this is the important part of the commuter story, we're looking to a very interesting future. The backbone of our industry has been the 9 to 19 passenger seat aircraft, and it always will be. Such aircraft fulfill the small community air service needs that best can be met with high frequency matched to the departure and arrival times passengers like to travel. There certainly are some economic airplanes in this size class that are now available to commuters, while other models are coming online in the next couple of years that will make it even more economic for us to provide such small commuity service.

Looking at the markets where the major airlines are pulling out with their 100-seat and larger jets, we need aircraft that can come in and adequately replace those aircraft. Here our choices are not now so good. As you're aware, we have choice of several aircraft in the 50-seat size: the de Havilland-7, the 748 from British Aerospace, and the Fokker F27. But, we really don't have anything yet in the mid-size, light transport class that seat 30-45 passengers. However, there are eight major models in this class under development that will come online in the next three or four years.

There are several different factors at work here.

One is economics and the productivity that these airplanes are going to have to bring to the commuters. A second factor is the technology issues that engineers will have to overcome in meeting the environment in which these airplanes operate; and finally, a third factor is to meet passenger needs.

In terms of economics, we are looking for major improvements with these airplanes. For example, they will have new generation engines offered by Pratt and Whitney and General Electric that are approximately 22% more fuel efficient than existing transports that these airplanes will be replacing. These airplanes will offer major improvements in aerodynamics and better payload-to-gross-weight ratios. I noted a statistic the other day that I found very interesting. United Airlines determined that one extra pound in a Boeing 727 carried around for a year adds $28 in fuel costs. Like United, we too have to look at what extra airframe weight we carry in the air.

We are looking at maintainability and reliability programs to reduce the number of hours it takes to maintain these airplanes and to improve their dispatch reliability. This is probably the number two factor most important to an airline next to fuel econmy.

Put all these needs together and we foresee that these new generation airplanes should be 40% more economic than the airplanes we have today.

In terms of the design consideratons, there are some tough problems for the engineer. First, there is the fact that the commuter aircraft are used on a diurnal basis about 16 hours each day. Because we have very little operational need in the evening, an airline has only seven or eight hours to perform maintenance and use the airplanes for crew training. During that 16 hour duty day, the airplanes will fly approximately eight flight hours and make 12 or more takeoffs and landings, a factor that holds some very important considerations for the engineer in terms of the fatigue of aircraft structures and landing gear. Contrast that to Boeing-type airplanes that might be flying an average of two hours for every one landing, whereas commuters are looking at one landing perhaps every 35 to 40 minutes or less on average. That type of utilization changes the engineer's concept of the whole airplane. Further, as commuters operate in a low altitude environment, we have ATC, weather, other factors that go into the crew workload and that require special design considerations.

Finally, we are looking at a need for a very high level dispatch reliability, perhaps even higher than that now obtained by jet air transports, since we dispatch more frequently. The simple fact is if you delay a commuter flight by one hour, you have just told a group of passengers that you do not want their business. As an alternative they can get into a car and drive that 100 miles they would have flown and as a result they may never come back to fly by commuter again. We not only have to provide such reliable service, but it must be on an on-time basis, which means we need a dispatch reliability of 99% or better within 10-15 minutes of the scheduled departure time.

Thus engineers face very tough considerations.

Finally, in terms of passenger needs, we have to provide a new generation of aircraft that is equivalent, for all practical purposes, to the DC 9s and 737s that we're replacing. That means the seat pitch has got to be the same for comfort; there has to be capability for in-flight services; there has to be room for carry-on luggage; the airplane must be pressurized and quiet; and they have to have the capability to handle the number and size of bags passengers bring with them. This is particularly true in some of the vacation markets that commuters are now serving where passengers carry a lot of bags.

We think these new generation airplanes adequately offer most of these features, even though there have been compromises.

We are very confident that the air service needs in the middle part of this decade will be assumed by such new generation transport airplanes in a way that will cause the commuter airline industry to grow substantially faster than it has in the past. Although the airplanes we have in use today are doing just fine, the economic factors that are influencing the major airlines are the same factors that influence their operating costs: fuel, labor, cost of handling a passenger, landing fees, etc. Thus, we have to focus on improving the productivity of such airplanes in order to keep them economic in small community air services. The only reason commuters can provide replacement air service is that commuters have lower operating costs than the major airlines they replace. But, with the factors of cost escalating the same for us as they are for the major airlines, unless we see some breakthroughs, particularly in the 9 to 19 passenger seat size aircraft, our future is questionable.

We have been very interested in the NASA program in terms of what types of technology might be applied to new generation airplanes. We are very much in support of it, in particular in those areas where NASA can validate these new technologies. One of the great concerns we have is that when the aircraft engineer comes up with a new design utilizing one of these new technologies, neither the aircraft namufacturer nor the Federal Aviation Administration really understands how to certify it. So, NASA has an important job to create engineering data that allows us to know how to apply these technologies and how the manufacturer and FAA can certify them. In this area, we believe that the NASA program can achieve major payoffs, particularly in the design of airframes and engines.

In terms of legislation, we have a major problem with Congress. Airline deregulation was meant to be a restructuring of the regulatory environment to make it more competitive for the airlines. It was not to be the absence of regulation. We have in Washington today a belief that airline deregualtion should be the absence of all regulation because competition is going to shape the future of the airline industry while protecting passengers. That simply is not the case. There are more than 500 communities that are exclusively served by a single commuter carrier. Even when we look at the service offered by the major airlines operating jets, we find 81% of those markets are monopoly markets. You simply cannot use competition to protect air service on a network basis as some deregulationists would have you believe. Under their theories, places like San Francisco and Los Angeles and Chicago will be well covered, but it does not mean that air service will be maintained on a new work basis to the many small communities now served. And so we are seeking some legislative action on maintaining joint fares, terminating 406 subsidy, maintaining the FAA loan guarantee program, and to ensure that there is a proper federal role in certain areas such as antitrust immunity in fare reporting and regulation, and who must sell the tickets. These are challenges for the future.

We expect that economics will continue to mandate the restructuring of air transportation in the United States, and commuters will have a role. And as a result, we will continue to grow at an average rate of about 15% per year in the number of passengers carried. We expect commuters, by 1990, will carry about 40 million passengers, which will be about 10% of all domestic air travelers.

PLANNING NEEDS AND ISSUES ATTENDANT TO ADVANCING AIRCRAFT TECHNOLOGY

David J. Forkenbrock
Graduate Program in Urban and Regional Planning
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Accessibility is a critical need of all cities. For a city to attract and hold economic activities, efficient movement within it and to other cities is essential. Several trends, however, threaten the accessibility of many cities. The burgeoning cost of fossil fuels is driving up the cost of all types of transportation at a rate far in excess of their economic growth.

A second trend is for air carriers to increasingly concentrate their services on longer, more profitable routes. With passage of the Airline Deregulation Act of 1978, carriers have much greater flexibility in selecting the markets they serve. As trunk carriers move toward longer routes, their abandoned services are being taken up by local service carriers. These local service carriers are gradually shifting to larger aircraft and longer routes. Their service to smaller cities has all but been eliminated.

The result is that an increasing number of small-to-medium-sized cities are becoming dependent upon commuter airline services for their connections to regional hubs. Unless a major restructuring of the airline industry evolves, the role of commuter services is likely to increase, perhaps substantially. This shift in the market, coupled with the steady long-term increase in commuter aviation patronage—13.0 percent on average from 1970 to 1979—portend a significant role for this type of service in future years.

Three factors ultimately will dictate the level of commuter aviation service that evolves:

1. Development of new small aircraft suitable for short-haul service.
2. Ability of commuter airline companies serving smaller, non-hub cities to operate profitably.
3. Availability of support facilities and conduciveness of public policies at the local level.

The first of these factors could be viewed as being beyond the scope of urban and regional planning; it is primarily a technological issue. On the other hand, effective communication between planners and technologists will permit design features to be incorporated which minimize possible adverse impacts resulting from the operation of commuter aircraft in and around the nation's cities.

It is probably not the planner's role to be concerned about passenger amenities aboard the aircraft, cruise speeds, or even fuel economy. To the extent that there is a functioning market for airline services, travelers will choose to patronize those which offer the types of attributes they want at the most attractive price. Quite rarely would a planner employed in a public agency be asked to assist an airline company in its market research activities, especially those pertaining to passenger amenities, pricing, and the like.

Design features that impact other members of society than passengers are clearly within the purview of urban and regional planning. Planners and technologists should work in concert on such attributes as noise levels, emmissions, climb and descent rates, runway requirements, and weather dependency. Several aircraft currently being tested by the National Aeronautics and Space Administration (NASA) in conjunction with its Small Transport Aircraft Technology Program (STAT) are significantly quieter and require much less runway than those currently operated by commuter airlines. These sorts of technological breakthroughs should be of great interest to local planners.

My point is that through their frequent contacts with the general public, planners normally are aware of the sorts of performance features that will make aircraft operations more acceptable to the community. By the same token, through communication with technologists, they are in a position to understand in a basic way the state of the art in aircraft performance. The key here is for planners to ensure effective communications, both with technologists and with the general public; the planner thus acts as a broker of information. "Hard sell" tactics or appeals to agency planners to advocate industry objectives are likely to be inimical to this needed free exchange of ideas on problems and prospects.

The need for assistance from higher government in the development of commuter operations has been acknowledged in the language of the Airline Deregulation Act of 1978. Section 419 of that act established a program for subsidizing the operations needed to sustain "essential air service" (EAS) to smaller communities. The Civil Aeronautics Board (CAB) was charged with establishing eligibility criteria for determining the level of service that is "essential" to a particular community. The need criteria adopted by the CAB are quite minimal, and the subsidy program expires in 1988. The CAB's reasoning is that market forces will attract and support air service when demand is above the levels assured by Section 419 subsidies. Under the current program commuter carries are oftentimes reluctant to initiate services on EAS routes, because if they should later wish to terminate these services, the CAB can require them to continue providing them until a replacement carrier can be found.

The ultimate level of need for subsidies to operate commuter services beyond those provided by Section 419 is not yet clear. Uncertainties surrounding the economic feasibility of these services have the negative effect of discouraging investment in the aircraft and facilities necessary to provide them. Perhaps an even greater uncertainty is under what circumstances subsidies to commuter airlines can be justified from a public policy standpoint.

In the minds of many planners, public investment in any form of project is warranted only when the private market fails to function properly and when the gains to society brought about by the investment at least exceed the costs. As noted earlier, it is not clear whether the market can sustain commuter airline service, particularly when these services are in the developmental phase. Recent experience indicates that, absent any governmental subsidy, service between non-hubs would rarely be feasible and service between a non-hub and a hub would oftentimes have to be skeletal.

A question then rises as to whether the gains to local communities warrant the subsidies necessary to sustain commuter air service. The efficacy of such subsidies is bound to vary with the particular circumstances facing different cities. How important commuter air service is to a particular city in part depends upon:

1. The degree to which industries within the city require rapid personal movement to regional centers (hubs). Local serving industries tend to have less of a need for spatial interaction than is true of those which compete in a national market and those which are a part of an interregional network. For example, a community with an economic base that is heavily oriented toward the manufacture of electronics components is likely to require a relatively high degree of accessibility.

2. The location of the city. So called "independent" cities, those not part of a metropolitan area of megalopolis (e.g., Grand Rapids, Michigan or Cedar Rapids, Iowa) are likely to be more dependent upon commuter air services.

3. The availability of alternative forms of transportation. Commuter rail services, for example, may accomplish some of what commuter air services are intended to achieve.

As noted, planners' willingness to recommend local expenditures to provide facilities for commuter air operations is dependent upon societal benefits exceeding the relevant costs. Costs include:

1. The construction and maintenance of the aerodrome, and access to it, over and above the revenues obtainable through user charges (rentals, landing fees, etc.)

2. The opportunity cost of the resources devoted to the facility. Could the land and capital have been used to achieve even greater social gains?

3. Negative effects brought about by aircraft operations, including noise, environmental degradation, and safety hazards. Again, it is important for technologists and planners to work together in mitigating the negative effects of aircraft operation. The Monterey Conference is a significant first step in the right direction.

One final point should be made regarding the costs of providing the infrastructure and operational support for commuter air services. Not only must the societal costs be less than the benefits, the incidence of these costs and benefits must not be regressive. If, for example, new aviation facilities were to be financed out of the general tax fund and those benefiting are predominately of higher income classes, a regressive redistribution of resources would occur. In such cases, a different financing scheme must be devised that will not be regressive; ideally it will be progressive. Also, in the interest of equity, those who benefit directly from the public investment in aviation facilities should bear most of the costs. For local public investment in these facilities to be warranted, then, the financing plan should not be regressive and in general it should be paid for by those who benefit.

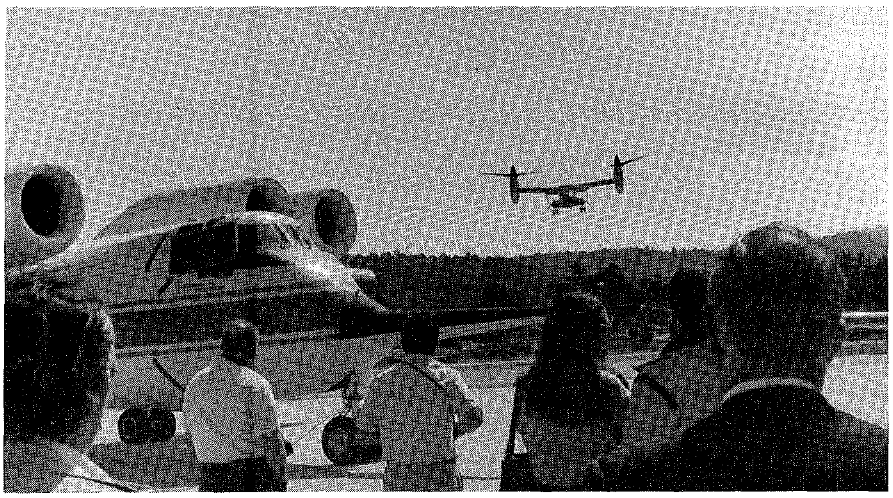
Besides financing, there are other issues present in the provision of needed facilities for commuter aviation that demand planners' attention. More consideration should be given to the appropriateness of existing local regulations as well as the possible need for others. Relatively few communities, for example, have helicopter ordinances. Helicopters have the potential to substantially improve the accessibility of numerous locations within the metropolitan area. Quite soon, both a high quality intraurban taxi service and rapid access to outlying airports will be technologically possible. Planners need to consider the implications of these new services. Some cities have adopted ordinances that specify where and under which conditions helicopters may operate. For these ordinances to be in the public interest, planners must understand the operating characteristics of the vehicles they are regulating.

The sorts of questions planners must contemplate include, how dependent are helicopter operations on weather conditions? Can high winds (or gusts) make rooftop heliports significantly less safe? What about visibility? The prospect of flying a helicopter, even a very advanced one, among tall buildings in the fog causes a good bit of concern among planners and local policy-makers. The advice of aviation experts in assisting planners charged with developing the applicable regulations is invaluable.

In terms of the planning process itself, few cities take adequate account of aviation. Does the comprehensive plan take into account the potential need for expanded commuter air facilities? If so, is the land so allocated suitable for this use? How about air space: is the available air space compatible with the operating characteristics of the aircraft currently in use: their approaches, departures, and enroute structures? The land use implications of new verticle take-off and short runway aircraft are significant, yet they have received very limited attention. Here is a case where planners could well endorse research that could result in the availability of new forms of aircraft able to promote the more efficient use of land.

If advances in commuter aviation allow significantly increased traffic volumes of smaller aircraft in and around the nation's urban areas, planners will need to consider such policy options as curfews (quiet hours) and operating restrictions based on weather conditions. Unfortunately, at the present time too little is known for many such policies to be formulated, let alone be done well enough to promote the community's best interests.

Aircraft technology will continue to improve, of that there is little doubt. Planners will continue to improve in thier understanding of factors important to a community's economy and life quality. The need is for planners and technologists to work together. Doing so will enable the accessibility of cities of all sizes to improve. Without good accessibility a city's economic future is unlikely to be promising.



AMES RESEARCH CENTER OVERVIEW

C. Thomas Snyder, Director
Aeronautics and Flight Systems
NASA Ames Research Center

I would like to give you a brief overview of the aeronautical research that is going on at the Ames Research Center. I will start by reviewing NASA's goal in aeronautics, describe the capabilities at Ames, and then go into a description of the programs underway. I hope that this will stimulate your curiosity and encourage you to take advantage of the tour opportunity on Friday.

NASA's goal in aeronautics is primarily to assure advances in technology to provide safer, more efficient and environmentally acceptable air transportation systems to meet current and projected needs. Second, to maintain the competitive position of the U.S. in the international aviation marketplace - an important point. As you heard Congressman Glickman say last night, aviation has, in the last couple of years, exceeded agricultural exports in contributing in a positive way to the balance of payments. And finally, to provide technical support in maintaining the superiorty of this nation's military aircraft, which is also quite an important one. This military support responsibility is based on a dependence on NASA's unique facilities and the technical expertise of the staff.

First, a few words about Ames. Several site selection criteria were involved in the location of NASA's Research Center at Ames. Ames is located on the San Francisco peninsula, near Stanford University and the University of California at Berkeley. And there are about forty-two other accredited universities and institutions of higher learning in the area. This provides at least two very significant advantages. It provides an intellectual environment that is quite beneficial in the acquisition and attainment of a high calibre of staff. Second, it sets an environment for joint aeronautical research activities that are of mutual interest to both the university community and NASA. Ames enjoys low-cost electrical power from government-owned sources, which is a signigicant advantage in the operation of some nineteen major wind tunnels. And finally, Ames enjoys good flying weather, and is near sea level, an important consideration for the testing rotorcraft and VSTOL types of aircraft.

Figure 1 shows an aerial view of Ames. Ames is located adjacent to the Moffett Field Naval Air Station. Moffett Field

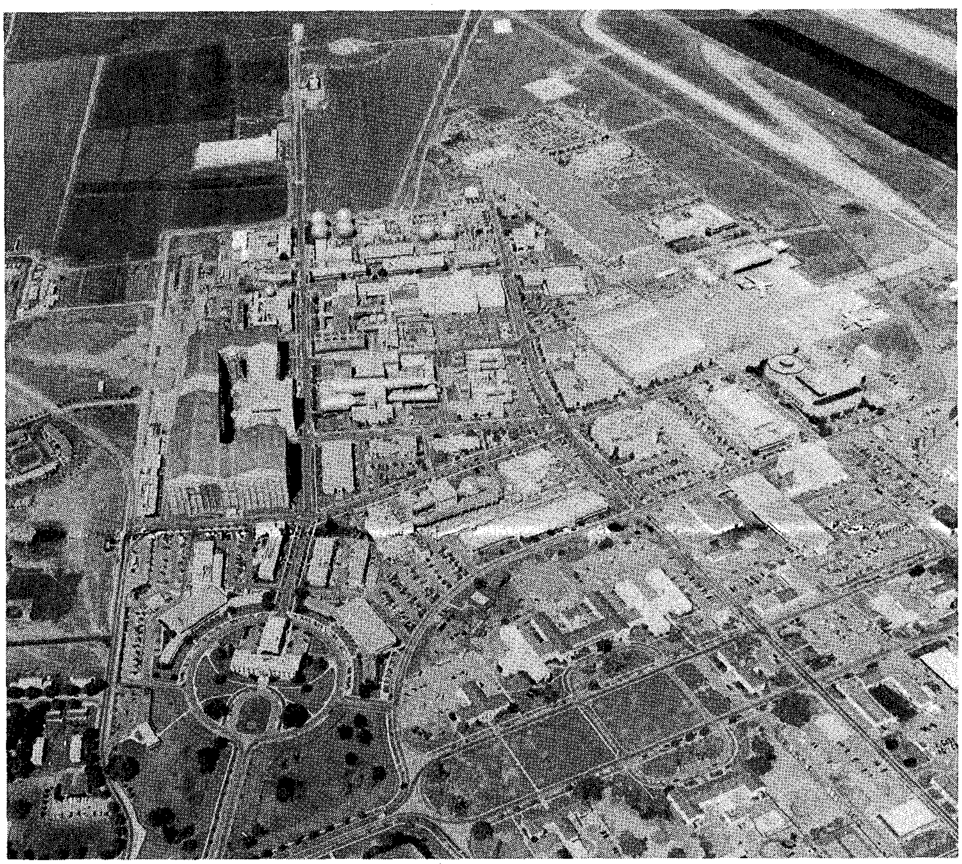


FIGURE 1: AERIAL VIEW OF NASA AMES RESEARCH CENTER

shares the runway facilities with us. Down in the lower corner of the picture, or the center lower part, is the Administration Building. As you go up from that, the large structure is the 40 by 80 Foot Wind Tunnel, which is a very large scale aerodynamic testing facility. We currently have a very exciting construction project underway to create an 80 by 120 foot test section that ties into that facility. It will be an important addition to our rotorcraft and VSTOL testing capability.

The Unitary Plan Wind Tunnel is to the upper right of the 40 by 80. It is a high speed complex of three wind tunnels with a Mach number range from subsonic speeds to Mach 3.5, and is identified as a National Aeronautical Facility There are three test sections: an 11 Foot transonic test section, 9 x 7, and 8 x 7 foot test sections for supersconic testing. They are sized so you can take a common model through the complete range of Mach numbers, if that is desired.

Also in the high-speed category are a 12 Foot Pressure Wind Tunnel, a 14 Foot Transonic Wind Tunnel, a 6 x 6 Supersconic Wind Tunnel, and a 3-1/2 Foot Hypersonic Wind Tunnel. The 3-1/2 foot has a Mach number capability in excess of 10.

The Human Factors research facilities are located near the aircraft hangers. Tied in closely with the human factors and flight control activities are a very unique set of piloted flight simulators, also located near the airplane hangers.

Ames, over the last several years, has been quite active in the design and development of proof of concept research aircraft. These aircraft are used to prove various aerodynamic concepts and to fly advanced systems. You will see two examples of these later today: the Tilt Rotor Research aircraft and the Quiet Shorthaul Research Aircraft. You will hear more about them in the following presentations.

The workforce at the Center is a little over 3,000: about 1,600 NASA permanent civil service employees, and the balance is made up of about 200 Army employees located at the Center, a large support service contractor staff, a number of visiting university researchers and temporary student help.

Now we'll get into the program content. The program is basically made up of three elements: 1) a fundamental research and technology program; 2) a vehicle specific technology program; and, 3) support of other agencies and the industry. Figure 2 shows the fundamental R & T program's major elements. This is the program that provides the fundamental advances, both experimental and theoretical, that further the state of the art.

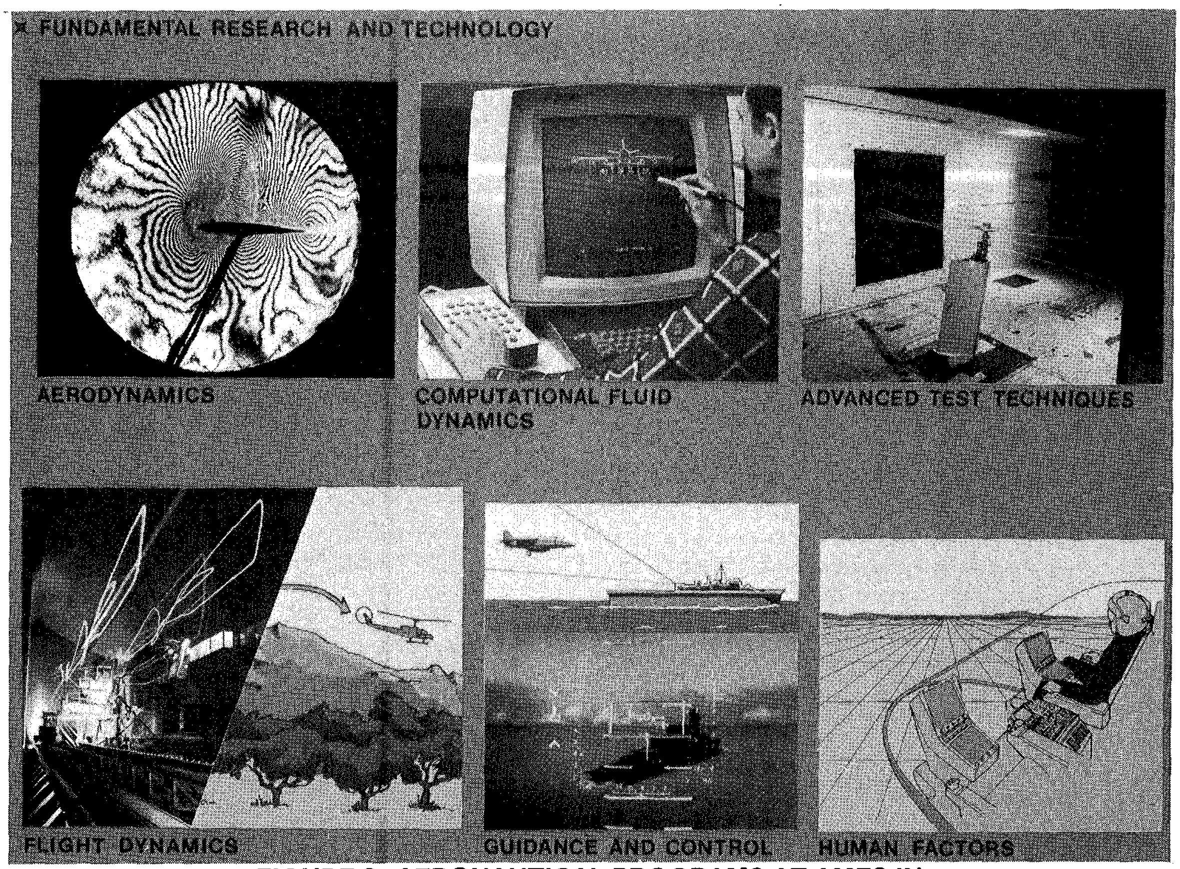


FIGURE 2: AERONAUTICAL PROGRAMS AT AMES IN FUNDAMENTAL RESEARCH AND TECHNOLOGY

The picture labelled aerodynamics is an end view of an airfoil being tested in one of our high speed wind tunnels. That's a laser hologram picture used by our aerodynamicists to visualize the flow. Those fringe lines are lines of constant density and allow the aerodynamicists to see where the shock is located on some of these optimally designed airfoils, where separation occurs, and by oscillating the airfoils, to look at the effects of dynamics on those characteristics.

The aerodynamics work, both theoretical and experimental, is closely tied with the computational fluid dynamics activity. There have been large increases in computing power in recent years leading to major advances in the ability to compute complex flows. Last Friday, Ames shut down the famous Illiac IV super computer. We are replacing it with a Class 6 Cray 1-S computer system and hope to successfully advocate the development and aquisition of what's called a Numerical Aerodynamic Simulator (NAS). The NAS will give us a very significant capability to compute the more complex flows, utilizing the Navier-Stokes equations which appear essential to the solution of complex viscous flow problems.

Advanced test techniques is an important element of any R & T based program. The third picture in Figure 2 shows velocimeter being used to define the flow near a rotor blade in one of our small wind tunnels, the 7 x 10 Foot Wind Tunnel. Laser velocimeters are a non-intrusive flow measurement device... very important certainly, for defining the flow around a spinning rotor blade. In this particular case, it is being used to define the trajectory of the vortex shed from that blade, and what the tendency is for the vortex to impact on the following blade. That is an important characteristic to understand because it influences the blade performance, the blade loading, and the noise generated by the rotor.

Ames has had a very talented group of individuals working on the development of laser instrumentation for use in our wind tunnels and has pioneered in that area for the last six to eight years. We have just recently put on line a new three dimensional laser velocimeter and have used that successfully in a jet-in-crossflow experiment (lower left portion of Figure 2). That's the first time that we're aware of that a 3-D system has been used.

In flight dynamics, piloted simulators are used together with theoretical analysis, to define handling qualities design criteria for new classes of aircraft. The second portion of the lower left illustration in Figure 2 portrays a helicopter flying a terrain-following, or map-of-the-earth mission, which is a very demanding task. A major part of the flight dynamics program is a rotorcraft flight dynamics element with both civil and military components. The civil work, for example, has some tasks that are cooperative with the FAA in defining stability criteria for their use in the preparation of airworthiness standards for single pilot IFR operations. We also are working closely with the Army to look at advanced control concepts, advanced displays and advanced controllers for improving the agility and flight control precision of rotorcraft.

The task illustrated for guidance and control in Figure 2 shows a VSTOL aircraft making an approach to a small ship at sea. The objective is to define guidance and control concepts to enable such operations in adverse weather conditions. This is a task that is of very keen interest to the Navy at the current time. The illustration below is a picture of the visual scene in one of our piloted simulators during the final approach to the ship (model). Superimposed on the scene is the head-up display symbology, which allows the pilot to make the approach without looking down at the instrument panel. He has all of the important flight parameters portrayed directly in front of him. Such work is typically done theoretically at first to define a guidance concept and then it is evaluated in piloted simulation as a followup.

Human factors is an activity that is aimed at further improving the safety of the air transportation system, through an understanding of the interaction of the pilot with the aircraft. The last illustration in Figure 2 portrays one of the goals of the helicopter human factors program, that of de-cluttering the cockpit,...simplifying the controls, simplifying the displays, increasing the pilot's visibility, and thereby reducing the work load.

The upper portion of Figure 3 portrays the vehicle specific technology activities. In vehicle specific technology, Ames is charged primarily with working in the short-haul aircraft area, with emphasis on helicopter technology and powered-lift aircraft technology. In helicopter technology, a large part of our work is aimed at advanced concepts, both rotorcraft vehicle concepts and advanced rotor system concepts. The Tilt Rotor Research Aircraft is a good example of an advanced rotorcraft concept. Shown in the upper left of Figure 3 is a picture of the X-Wing vehicle. This shows a large-scale model in the 40 by 80 Foot Wind Tunnel. The X-Wing is a rotorcraft concept with high-speed potential. A concept being developed by the Defense Advanced Research Projects Agency, it was tested in the 40 by 80 about a year and a half ago to look at the problems of starting and stopping that rotor in forward flight. Conceptually, the rotor operates as a conventional rotor for vertical takeoff and landing. And then as forward speed is attained, the rotor is stopped and the rotor system acts as fixed swept wings for high speed flight. The tests were quite successful and that development is continuing.

Next to the X-Wing is a picture of the Rotor Systems Research Aircraft. Two of these aircraft were built at Sikorsky for NASA and the Army. They were built specifically for the purpose of testing advanced rotor system concepts. They are very highly instrumented so that one can isolate the loads from the rotor system, from the hub, the auxilliary engines, the wing, the tail, and examine the contribution from each of those elements. The wing can be varied in incidence in flight to load the rotor system in various ways. The aircraft has been termed by some people as a flying wind tunnel, which illustrates its purpose.

The picture illustrating powered lift technology shows the Quiet Shorthaul Research Aircraft making a final approach to landing on the carrier U.S.S. Kitty Hawk. That was a set of tests done about a year ago off San Diego.

The QSRA is a transport-sized aircraft which uses upper surface blowing to enhance its low speed operating characteristics. In those tests, it was able to land and take off from the Kitty Hawk without use of an arresting gear or catapult, and without respotting on the deck for takeoff. The lower pictures in Figure 3 illustrate other agency and industry support. We have a lot of requests and subsequent involvement in joint programs or support activities with other government agencies, such as the Army, the Navy, the Air Force, the FAA, the National Transportation Safety Board, and others.

The lower lefthand picture in Figure 3 shows a large-scale model of a future STOL (Short Takeoff and Landing) fighter concept. This was tested in the 40 by 80, also quite recently. The picture in the righthand corner shows a helicopter landing on an off-shore oil rig pad in the Gulf of Mexico. This was an experiment conducted jointly with the FAA to look at guidance and navigation concepts for IFR operations to remote sites. That work produced data used by the FAA in defining terminal instrument procedures and air space requirements. NASA is using the results of that work to define future system concepts for increasing the capability for such operations.

Some of the current major program thrusts at Ames are listed below:

- Advanced Rotorcraft and Rotor Systems Concepts
- Rotorcraft All-Weather Capability
- Rotorcraft Noise Reduction
- Powered-Lift Aircraft Aerodynamics
- Aeronautical Human Factors

I've already mentioned advanced rotorcraft and rotor systems concepts. The last picture in Figure 3 illustrated some of the remote site aspects of the rotorcraft all weather research activities. There is a second element looking at the operation of rotorcraft in high density terminal areas, and looking at the Air Traffic Control interfaces. Most of that work is also conducted in conjunction with the FAA. The real thrust is to increase the productivity of rotorcraft by allowing them to operate in all-weather conditions and not haveing to operate as a fixed-wing aircraft, but to take advantage of their helicopter-type capabilities.

Noise reduction is a very important thrust. At the current time we have a limited effort underway. We are trying to augment that activity because of the notice of proposed rule-making that the FAA has come out with which would impose more stringent noise requirements on the industry. The industry has responded by saying that the predictive capability is not in place to allow them to design new helicopters with the assurance that they need. And so we are trying to augment the data base, improve the fundamental understanding, and develop improved predictive and design codes.

Figure 4 summarizes some recent accomplishments at Ames. For the sake of time, I will not discuss these in detail, but will let the next two speakers and their presentations provide examples of accomplishments to come out of Ames. Thank you.

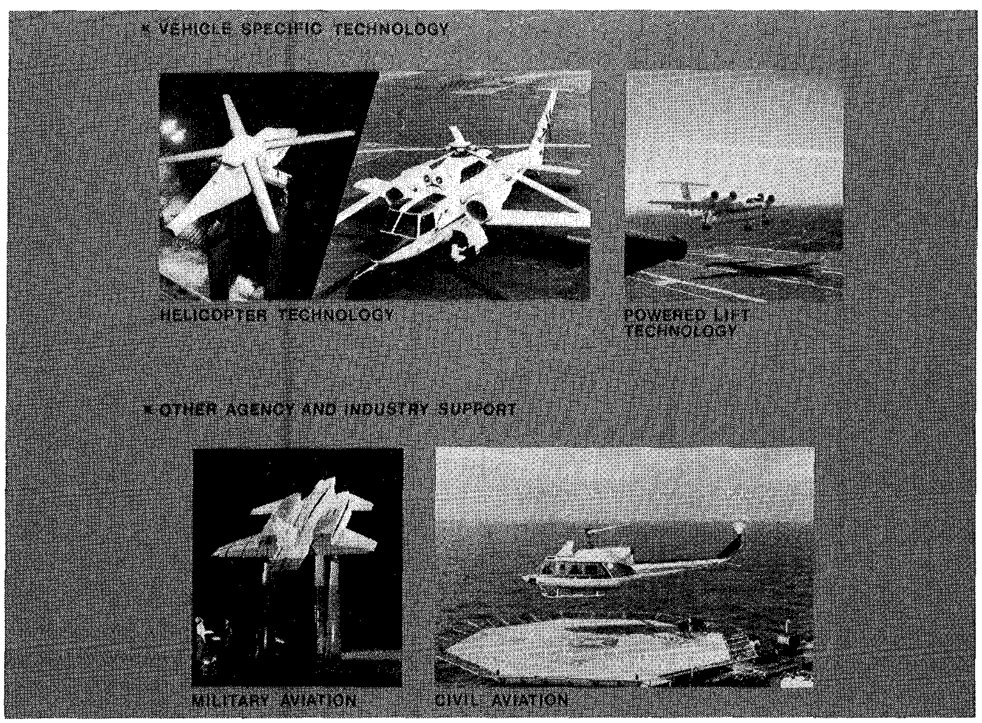


FIGURE 3: APPLIED AERONAUTICAL PROGRAMS AT AMES

FIGURE 4: MAJOR RECENT ACCOMPLISHMENTS AT AMES

- THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA) SUCCESSFULLY COMPLETED CARRIER LANDING AND TAKEOFF EVALUATION ON THE USS KITTY HAWK
- TILT ROTOR RESEARCH AIRCRAFT MADE FULL CONVERSION FROM HELICOPTER TO AIRPLANE MODE AND ACHIEVED CRUISE SPEED OF 300 knots
- HIGH RESOLUTION THREE DIMENSIONAL LASER VELOCIMETER WAS DEVELOPED AND SUCCESSFULLY DEMONSTRATED IN A STUDY OF THE AERODYNAMICS OF A JET IN A CROSS FLOW
- SEVERAL MODELS REPRESENTATIVE OF FUTURE V/STOL FIGHTER ATTACK AIRCRAFT WERE TESTED IN THE AMES HIGH SPEED WIND TUNNELS
- SEVERAL ADVANCED ROTORCRAFT AND VTOL CONCEPTS WERE TESTED IN THE 40- BY 80-foot WIND TUNNEL, INCLUDING THE ADVANCING BLADE CONCEPT, THE TWIN-NACELLE VTOL CONCEPT, AND THE BEARINGLESS MAIN ROTOR
- UH-1H HELICOPTER EQUIPPED WITH ADVANCED DIGITAL FLIGHT SYSTEM WAS USED AS A VARIABLE STABILITY HELICOPTER IN A NAP-OF-THE-EARTH HELICOPTER FLYING QUALITIES INVESTIGATION AND IN EXPERIMENTS TO DETERMINE STABILITY REQUIREMENTS AND CERTIFICATION CRITERIA FOR HELICOPTER OPERATIONS
- PRACTICAL FUEL-EFFICIENT OPTIMAL FLIGHT PROFILE ALGORITHMS DEVELOPED AT AMES ARE NOW BEING IMPLEMENTED BY THE AIRLINES

THE QUIET SHORT-HAUL RESEARCH AIRCRAFT

John A. Cochrane, Manager
Quiet Short-Haul Research Aircraft Office
NASA Ames Research Center

The Quiet Short-Haul Research Aircraft (QSRA) was developed by the NASA Ames Research Center as a flight facility for research in terminal area operations. The aircraft is strictly a research aircraft with the mission of developing data for the U.S. aerospace industry and the various government agencies responsible for certification and regulation of aircraft. The QSRA is not a prototype of any aircraft and although it has the approximate size and performance level of several military and civil aircraft, it should not be viewed as being representative of any specific aircraft application. The research aircraft was developed under a very limited budget and is, therefore, limited to low speed operation, which is the focus of the research for which the airplane was designed. The landing gear is not retractable, the leading edge flaps are fixed, and the fuselage is designed for low speed. These factors limit the top speed to 190 knots and would not be accepted in the design of an operational airplane. However, the propulsive-lift wing on the QSRA is designed to be representative of a wing capable of efficient cruise at a Mach number of 0.74 which is the equivalent of approximately 500 miles per hour at altitude.

The most important feature of the QSRA is the propulsive-lift system which provides the lift required for short field operations at low community noise levels. This system consists of four high bypass ratio, geared turbofan engines mounted so that the engine exhaust flows across the upper surface of the wing. This technique is known as upper surface blowing. Large specially shaped but relatively simple flaps behind each engine, control the direction of the flow for each phase of flight. For takeoff and cruise, the flaps are retracted and the flow is directed parallel to the direction of flight. For approach and landing, the flaps are deflected 50° causing the flow to be directed downward so as to convert part of the engine thrust into lift. A significant amount of lift is also generated even when the flow is not deflected due to the pumping action of the flow across the upper surface of the wing. An important feature of this method of generating lift is the fact that the above-the-wing location of the engines provides shielding of engine exhaust noise. This is one of several factors which result in low community noise levels for this technology.

A study by the Boeing Commercial Airplane Company, reported in Reference 1, showed that a 95 passenger short-haul transport based on this technology could operate out of 2500 foot runway (based on FAA commercial standards) with a combined takeoff and landing 90 EPNdB footprint area of 2.7 square miles. This is about one seventh the footprint area of an equivalent conventional jet transport. An important consideration not apparent in this statistic is that the exceptional maneuverability of an airplane based on this technology would permit maneuvering to avoid noise sensitive areas while still retaining acceptable safety margins. For example, a circling departure has been demonstrated with the QSRA where a circle approximately 3000 feet in diameter is flown while gaining 3000 feet of altitude. The time weighting factor used to calculate EPNdB causes the footprint area to be larger than a straight out departure because the airplane remains directly over the airport for approximately two minutes while climbing to 3000 feet. Nevertheless, the 90 EPNdB contour is a circle less than two miles in diameter which is well within the boundaries of most airports. The point here is to concentrate the noise over the airport rather than infringe on the surrounding community.

The over-the-wing location of the engines and the maneuverability of the airplane based on QSRA technology have been discussed as means of minimizing noise. Other factors are the high bypass ratio fan engines which are inherently quiet and noise suppression material which is installed in the fan inlet and exhaust ducts. These are state-of-the-art features which can be incorporated in any class of aircraft.

A common misconception regarding short takeoff and landing (STOL) aircraft is that they require high values of thrust to weight ratio (large engines) and, therefore, are not efficient. Analytical studies and flight research with the QSRA has shown that significant improvements in takeoff and landing performance can be achieved even at thrust to weight ratios and wing loadings comparable to those used in current conventional aircraft. For example, using a thrust to weight ratio of 0.30, the takeoff field length would be reduced from approximately 4000 feet to 3000 feet based on FAR Part 25 criteria. This capability can be used to operate from conventional airfields with greater safety margins or to operate from airfields with shorter runways. Another important alternative is to operate from equal runway lengths but with a greater payload, thus increasing productivity. This research shows that airplanes incorporating this technology can be made *more* efficient that conventionally configured airplanes, which is directly contrary to the common perception of propulsive-lift aircraft.

In the foregoing paragraphs the capabilities of the quiet propulsive-lift technology incorporated in the QSRA have been discussed. The following paragraphs will discuss potential applications of this technology. Reference was made earlier to a 95 passenger short-haul transport which was studied by Boeing in Reference 1. This type aircraft is one of the most likely civil applications of this technology. Such an aircraft would have a design range of 500 nautical miles with reserves and with 95 passengers. It would be capable of operating out of an FAR field length of 2500 feet. A reduction in the passenger load to 60 would permit a range of approximately 1200 nautical miles. Alternatively, an increase in gross weight and an increase in runway length to 2900 feet would permit a range of 1100 nautical miles with the full 95 passenger load. Economic studies have shown that by taking advantage of the capabilities of this type aircraft, direct operating costs can be lower than current generation short-haul aircraft.

The study reported in Reference 1 also considered the application of QSRA technology to the business jet class of aircraft. Clearly, the business jet operator has the greatest need to operate from short runways at low noise levels. The study showed that a small four engine business jet using QSRA technology could operate from a 2100 foot runway (based on FAA criteria for commercial transport category jet aircraft) with seven passengers and a crew of two. Cruise speed at altitude would be approximately 500 miles per hour and the range based on NBAA IFR criteria would be 1400 nautical miles. The 90 EPNdB combined takeoff and landing footprint area would be only 1.4 square miles.

Military applications of this technology range from tactical transport aircraft for the Air Force to carrier-based airplanes for the Navy. During the summer of 1980, the QSRA demonstrated the ability of an aircraft incorporating this technology to make repeated unarrested landings and free deck takeoffs from an aircraft carrier at sea.

It has been commonly believed that high performance propulsive-lift aircraft are difficult to fly. One of the flight experiments completed with the QSRA during 1980 was a program in which 25 pilots, representing a broad cross-section of the aeronautical community, engaged in a flight evaluation program with the QSRA. The pilots were from the military services, the airlines, and from other government agencies. They participated in the program in groups of three. Each group received a full day of briefing on the technology and the techniques used to fly the QSRA. This was followed by a day of flying in which each pilot flew in the left seat (pilot in command position) of the QSRA with one of the NASA project pilots in the right seat. The flights were about an hour and a half long and the non-flying pilots observed the performance of the flying pilot. The flight started with "airwork" to demonstrate the flight characteristics of the QSRA. This was followed by landings and takeoffs which gradually transitioned from conventional approach flight paths and approach speeds to steep (6° to 7½°) STOL approaches. The next day was devoted to debriefing the first day's flying and briefing the second (and last) day of flying. On the second day of flying, landing and takoff performance was examined with an engine inoperative and with various failure modes of the stability augmentation system. By the end of the third flying hour in the QSRA each of the guest pilots flew at least one steep, STOL approach with an engine inoperative and with the stability augmentation system inoperative. This provided a clear demonstration that an airplane with this technology does not require unusual piloting skills.

Future research planned for the QSRA is focused on development of controls, displays, and stability augmentation systems which will permit full exploitation of the potential of this technology. When that phase is complete, research will be conducted to determine landing field length criteria for civil aircraft operations. Advanced guidance and navigation schemes will also be investigated as a part of the research program. Concurrent with this flight research program, flight experiments proposed by outside organizations will be accommodated whenever possible. The ultimate objective is to develop the design data, certification criteria, and other parameters needed to bring this technology into operational use.

THE TILT ROTOR RESEARCH AIRCRAFT (XV-15) PROGRAM

John P. Magee, Manager
Tilt Rotor Aircraft Office
NASA Ames Research Center

My purpose in this presentation is to introduce you to the tilt rotor concept and our XV-15 aircraft. We are all familiar with the advantages of the fixed-wing aircraft. These aircraft provide a long-range, high speed means of transportation without which our current economy could not function. The major disadvantage of the fixed-wing aircraft is the relatively inflexible operating requirements in the terminal area and the real estate involved. Aircraft noise is also a problem when airports are situated in highly populated areas.

The helicopter was the first successful vertical takeoff and landing machine which has shown itself to be a work horse in many situations where vertical operation is a necessity. There is a growing acceptance of rotor-craft in the public sector and increased utilization of this means of transportation. A considerable effort has been expended to improve the operating characteristics of the helicopter in terms of noise and vibration suppression, better fuel economy, and longer range. These efforts have met with some success, and better machines are now available in the market place.

In the tilt rotor program, we tried a radical approach to try to achieve the best qualities of both of these modes of transportation in one aircraft.

The XV-15 tilt rotor aircraft was built by Bell Helicopter Textron under contract to NASA and the U.S. Army as the final step in proving the viability of this concept. The aircraft is shown in Figure 1 and will serve to illustrate the configuration concept as well as some important facts about our aircraft. In hover, the aircraft is lifted by the two wing tip mounted rotors with the nacelles in the vertical position. In this flight mode, the vehicle is a twin rotor helicopter and is controlled by rotor cyclic and collective controls. The aircraft can fly as a helicopter or tilt the nacelle to the propeller mode and operate as a fixed-wing twin turboprop airplane. It is also possible to stop the conversion at any intermediate angle and fly continuously or reconvert. The rotors are powered by two modified T-53 engines, and the power train includes a cross shaft located in the wing, to allow for the engine failure case and still retain power to both rotors.

The tilt rotor idea is not a new one. A small prototype aircraft was built by Transcendental Corp. of Pennsylvania in the 1950s; however, this aircraft crashed and ended the program. The XV-3, shown in Figure 2 was built in about the same timeframe by Bell Helicopter Company in a program with the U.S. Air Force, Army, and NASA. This vehicle demonstrated the feasibility of conversion from helicopter to airplane flight but suffered from a number of technical difficulties that prevented development of the concept. Over the last 20 years, a considerable amount of analytical and design technology work was done by Bell, Boeing, and U.S. Government agencies in the areas of

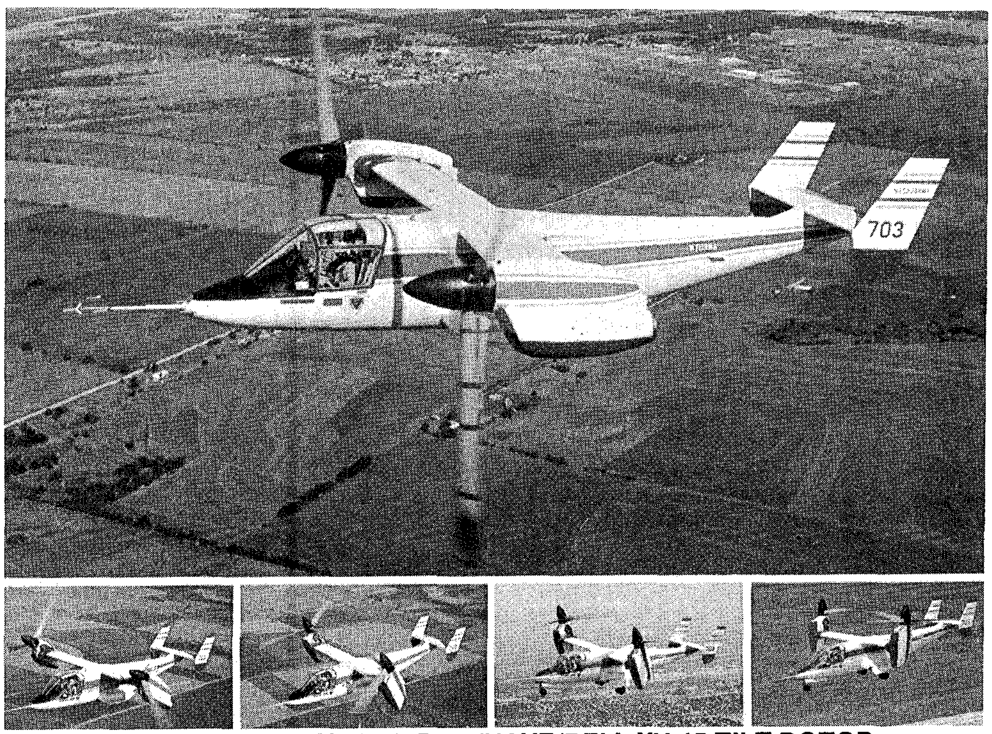


FIGURE 1: THE NASA/ARMY/NAVE/BELL XV-15 TILT ROTOR

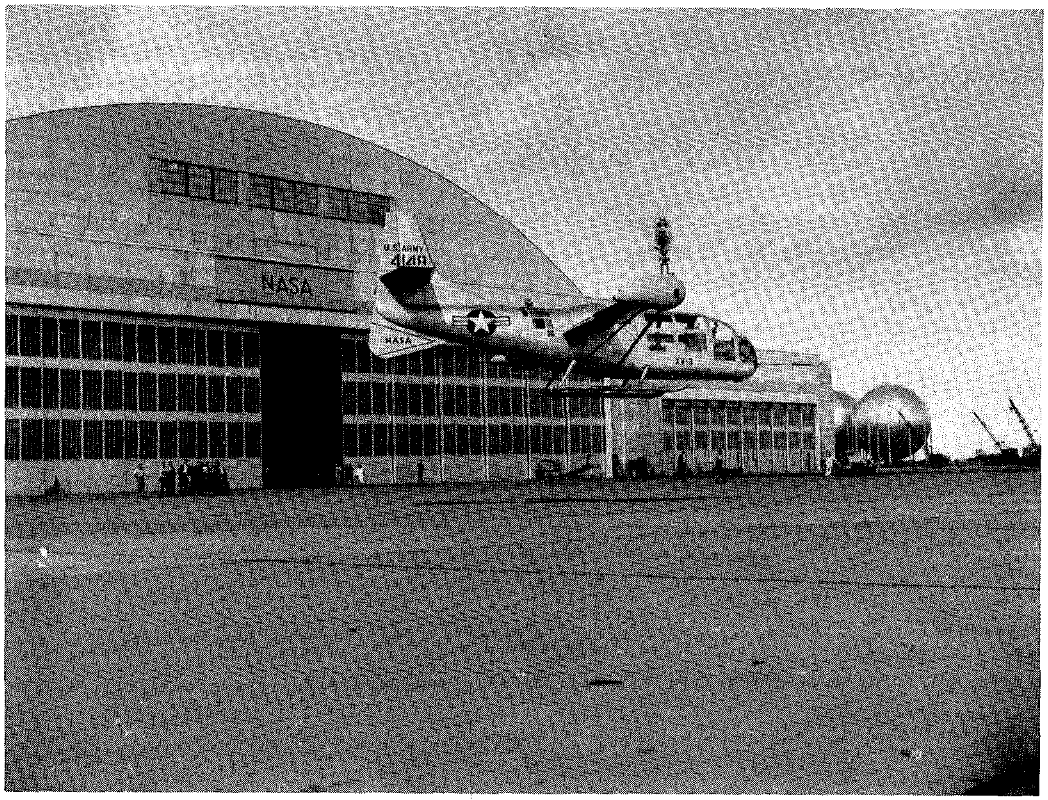


FIGURE 2: THE NASA/ARMY/AIR FORCE/BELL XV-3

aeroelastics, control, and performance. The present XV-15 program is the proof-of-concept; that is, the demonstration that the technical challenge has been met, and the concept is ready for development in the military/civil marketplace.

One question must be posed. Why was the tilt rotor idea pursued over this lengthy period of time? To understand the potential of the concept which was the driving factor, we must consider some basic facts. Figure 3 shows lifting efficiency in hover in terms of lbs. lift per HP installed as a function of the aircraft disc loading. Disc loading is defined as the gross weight on the aircraft divided by the area of the lifting disc or discs. For a helicopter, the disc loading is the gross weight divided by rotor swept area and typically falls into the range of 5 to 10 lbs./ft.^{2}. The helicopter is a very efficient lifting device and can typically lift 7 or 8 lbs. for every HP available.

For a VTOL aircraft lifted by jet thrust, the disc loading is very high since the area of the lifting jet is very small. A vectored thrust aircraft like the Harrier would fall in the 2,000 to 3,000 lbs./ft.^{2} disc loading range and is capable of lifting only approximately 1/2 lb. per installed HP.

The tilt rotor would typically be designed at about 13 lbs./ft.^{2} disc loading and has a lifting efficiency that rivals the helicopter.

The efficiency of the aircraft in vertical lift is only one side of the design problem. Figure 4 shows a comparison of power available and power required in forward flight for four of the vehicle types. In order to compare the aircraft on the same chart, the vertical axis shows HP divided by HP required to hover such that all the aircraft start at 1.0 at zero speed. As the helicopter increases speed, the power needed to fly decreases as a result of translational lift and then increases again as the aircraft drag becomes predominent. The propulsive capability of the rotor eventually is impaired by retreating blade stall and advancing blade mach number effects. When the power needed to fly equals the power available from the engine, the top speed of the aircraft has been reached.

When the tilt rotor converts to a fixed-wing airplane, it has better drag characteristics than a helicopter, and the rotor in the propeller mode retains its propulsive capability to higher airspeeds enabling the aircraft to penetrate to higher speeds of the order of 300+ knots.

Only the tilt rotor and tilt wing concepts provide the same speed range as the twin turboprop fixed-wing aircraft.

A tilt wing has higher disc loading and more power installed, and can fly faster, but suffers a lift efficiency penalty as shown on the previous figure.

A tilt rotor provides a good balance of lifting efficiency and propulsive efficiency.

The tilt rotor has about the same installed power as the same size helicopter and therefore burns about the same amount of fuel per hour. By virtue of the greatly increased speed of the tilt rotor, the range covered in that hour is almost doubled, which translates to a lower fuel consumption and less block time for a specific job, which in turn reduces operating cost. Figure 5 shows the range per lb. of fuel for the XV-15 compared with a Bell 214ST helicopter and illustrates the advantage to the tilt rotor. Figure 6 shows fuel flow in lbs./hr. calculated for the XV-15 as a fuction of airspeed and nacelle incidence. In helicopter mode, N=90°, the fuel flow curve has the same shape as the power curve decreasing initially with airspeed and then increasing again. Nacelle tilt causes the curves to step across the chart until the fuel efficient airplane mode is reached. Clearly, there are several combinations of nacelle incidence and airspeed at which minimum fuel flow is obtained, which allows a large degree of flexibility of operation. For example, in special purpose operations in an air search in wooded terrain, low speeds are necessary, or in a similar search over water where large areas are to be covered, higher speeds can be used. In both cases, almost minimum fuel usage is available maximizing utilization and on-station time.

Figure 7 shows the altitude-velocity envelope of three aircraft; the C-130 fixed-wing aircraft, the HH-53C helicopter, and the XV-15 tilt rotor aircraft. Clearly, the tilt rotor can perform over both of the other vehicles' operating envelope. Consider a rescue operation at sea. First, we launch a fixed-wing aircraft like a C-130 to find the rescue site and then disparch a helicopter like the HH-35C to effect the rescue. The tilt rotor could do both jobs and greatly increase the mission efficiency and reduce response time.

Figure 8 shows the progress made in exploring the altitude-velocity flight envelope of the aircraft. To date, the aircraft is performing as predicted, and a maximum speed of approximately 300 knots true airspeed is available at 15,000 ft. density altitude. The aircraft has been flown to 18,500 ft. density altiture at a speed in excess of 290 knots.

Figure 9 shows the progress of flight test work to date in exploring the conversion flight envelope. At a nacelle angle of 90°, the tilt rotor is in helicopter operation. At zero nacelle angle, the tilt rotor is in airplane mode. The conversion corridor is wide and easy to negotiate. Normal procedure is to fly in helicopter mode to approximately 60 knots and then execute a continuous conversion to airplane mode at about 130 to 140 knots. The aircraft can fly continuously at any intermediate angle, and a conversion can be stopped and reconversion executed at any point. In addition to the points shown on the chart, we have flown the aircraft down to stall speed in airplane mode and also with nacelle incidence of 30°. The stall behavior is conventional and easily handled.

In short, the performance that was anticipated for this concept is proving to be a reality, and the XV-15 is a convincing demonstration that the technical challenge has been met.

In the civilian aviation world, high performance, long range, low fuel usage, and low costs are critical parameters in a successful vehicle; however, public acceptance of the aircraft depends on other factors, (e.g., noise and vibration).

Figure 10 shows noise levels in PndB at 500 ft. for many of today's helicopters in hover/takeoff. The chart shows that as aircraft size increases, the noise levels increase. The XV-15 is shown to be at the bottom edge of the band and is a quiet aircraft when operating as a helicopter. When the aircraft converts to airplane mode and reduces the pro/rotor RPM, the noise levels are extremely low.

The vibration levels shown in Figure 11 are measured data from the XV-15 pilot station. In helicopter mode, the vibration levels are similar to helicopter values and increase with airspeed. As the aircraft converts, the data show reduced vibration at a specific airspeed or the ability to penetrate to higher speeds with the same levels. In the airplane mode, measured vibration levels of the order of 0.05 g's are shown which provides a comfortable envi-nment during the major portion of the operating time of the vehicle.

In this discussion, I have shown that the tilt rotor is a high performance, flexible vehicle which provides extremely good fuel economy. In addition, its low noise characteristics should make it a "good neighbor" from the airport acceptance standpoint, and it has the potential for a ride quality consistent with accepted twin turboprop standards.

One obvious civilian application of this technology is in the oil rig service industry. Figure 12 shows a comparison of a tilt rotor, a helicopter, and a ship operating in this role. The speed of the tilt rotor is shown here as 280 knots compared with the helicopter, 130 knots, and a ship at 15 knots. The tilt rotor speed advantage provides a mission block time of 22 minutes for this 100 nautical mile mission compared with 45 minutes for the helicopter, and uses only 48 gallons of fuel compared with 81 gallons for the helicopter.

The operating advantages hold true, of course, regardless of the destination since this same comparison can be drawn between city pairs for intercity transportation or in executive transport roles.

A comparison of intercity transportation modes is shown between New York and Washington in Figure 13. This comparison assumes that the heliports could be available within five miles of the customer, whereas the airports are about 15 miles out of the city.

The tilt rotor is shown to be faster, quieter and more fuel efficient than any of the airborne alternaives.

Figure 14 shows the comparative productivity of a tilt rotor and a similar size helicopter in a 12 hour cargo operation with different radii of operation. As the radius of operation increases, the tilt rotor productivity advantage becomes larger since the advantages of speed and fuel economy predominate.

The XV-15 has been labeled by the editor of "Armed Forces Journal" as "the quiet star of the 1981 Paris Air Show", following our successful demonstration there this year. We believe that this technology has a great future in the aviation world, and we in the NASA/Army project are encouraging the military and civil aviation user communities to take advantage of the knowledge and experience produced by the XV-15 program to bring tilt rotor technology into operational reality within the next decade.

FIGURE 3: LIFTING EFFICIENCY COMPARISON OF VARIOUS AIRCRAFT

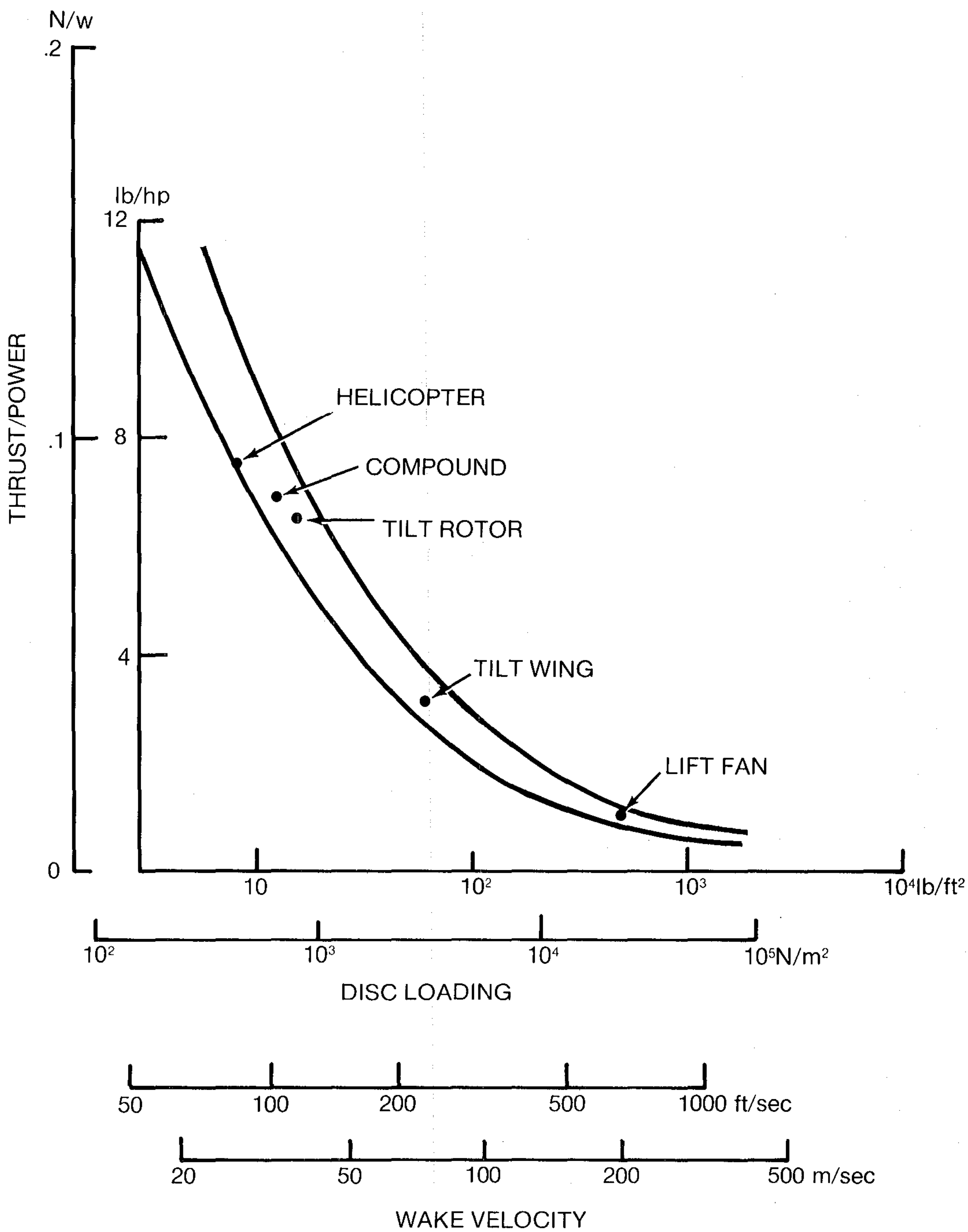


FIGURE 4: POWER REQUIRED COMPARISON

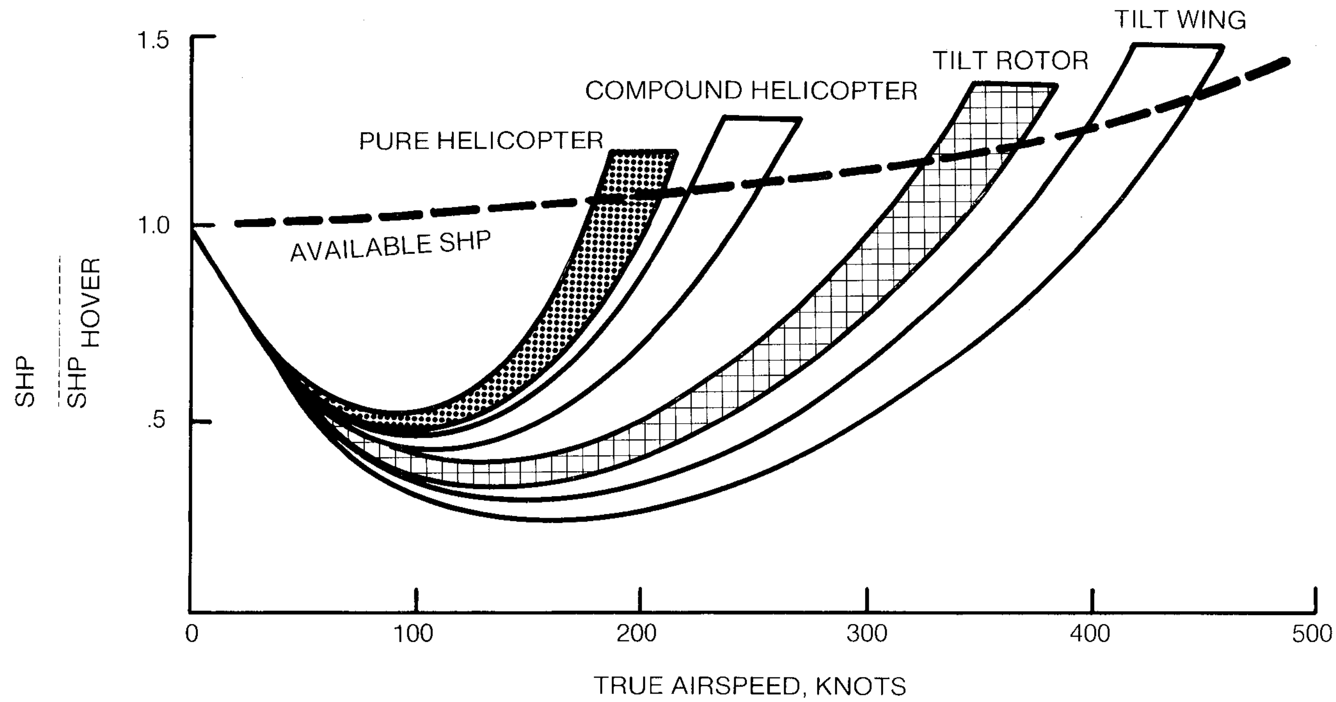


FIGURE 5: RANGE COMPARISON PERFORMANCE OF TILT ROTOR & BELL T14ST HELICOPTER

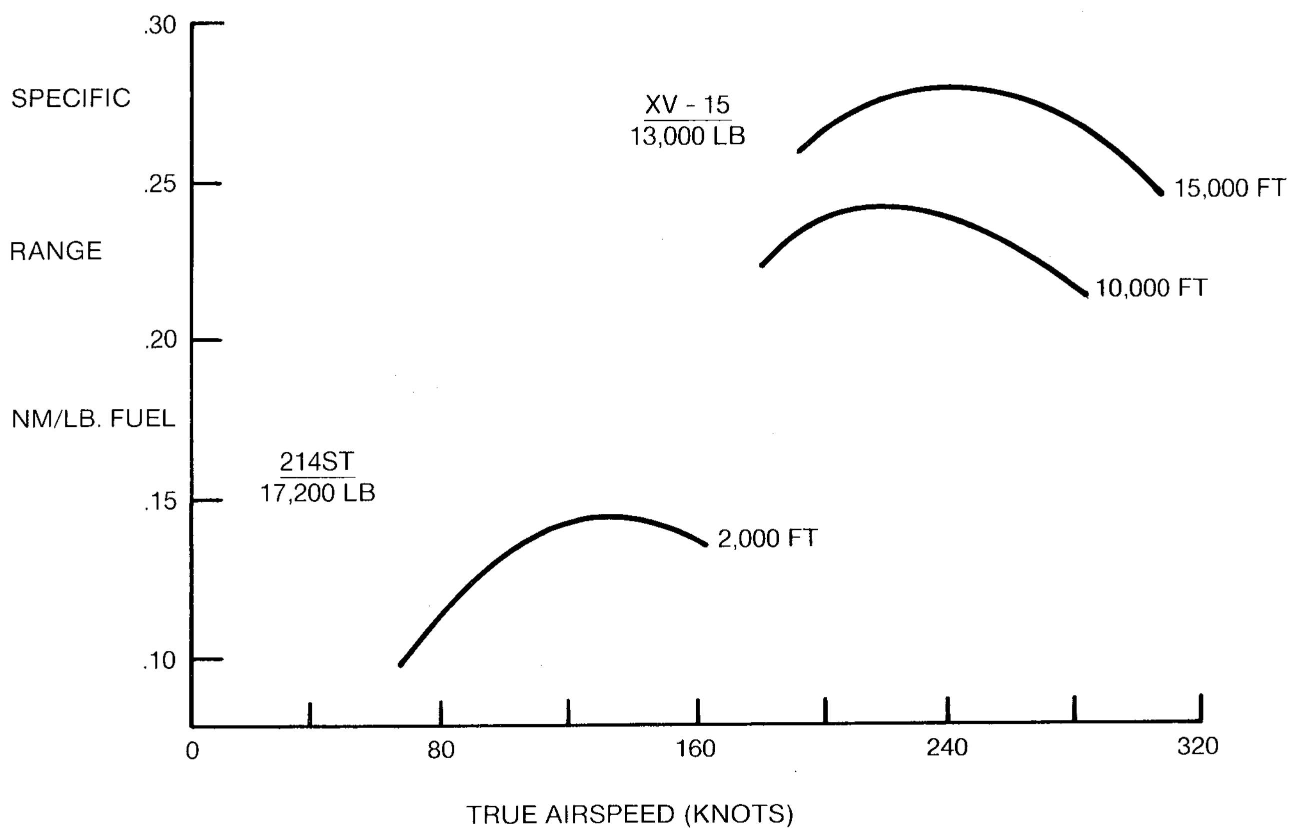


FIGURE 6: MINIMUM FUEL FLOW LOITER

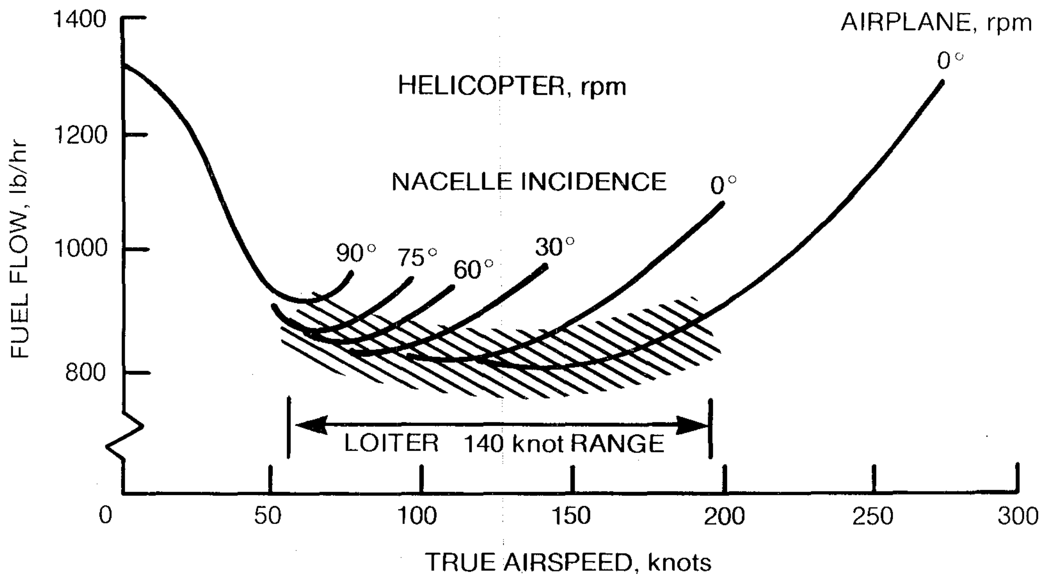


FIGURE 7: ALTITUDE-VELOCITY ENVELOPE COMPARISON

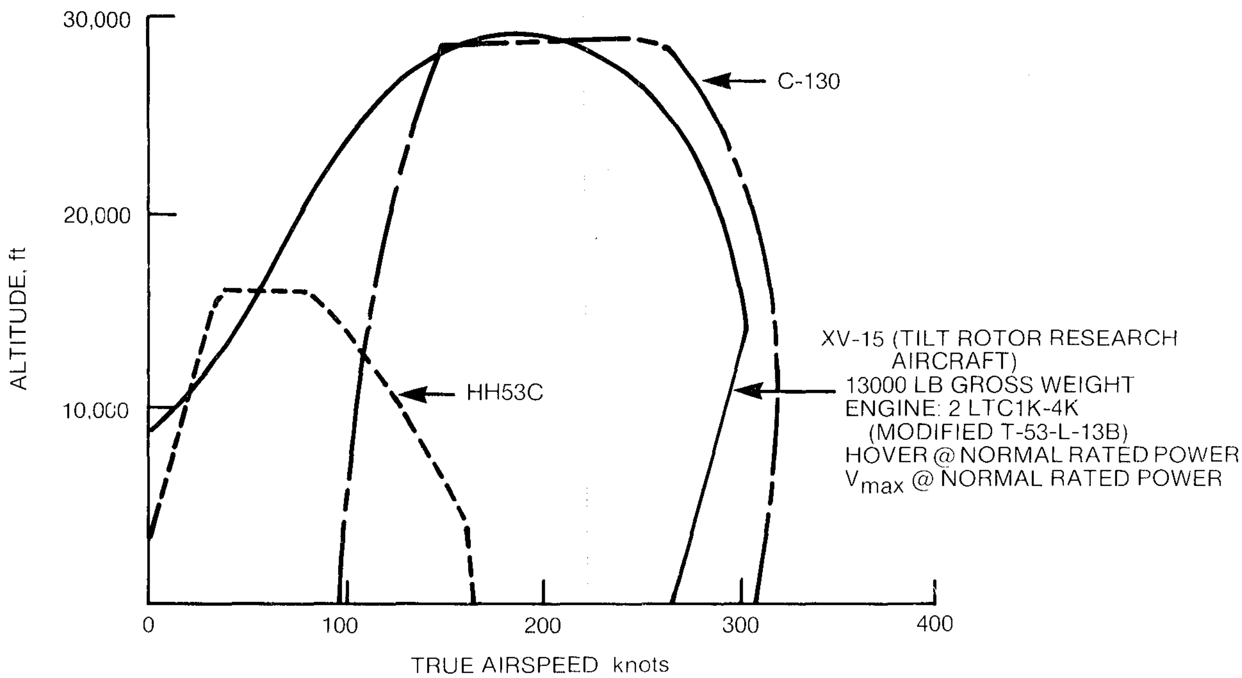


FIGURE 8: XV-15 FLIGHT ENVELOPE

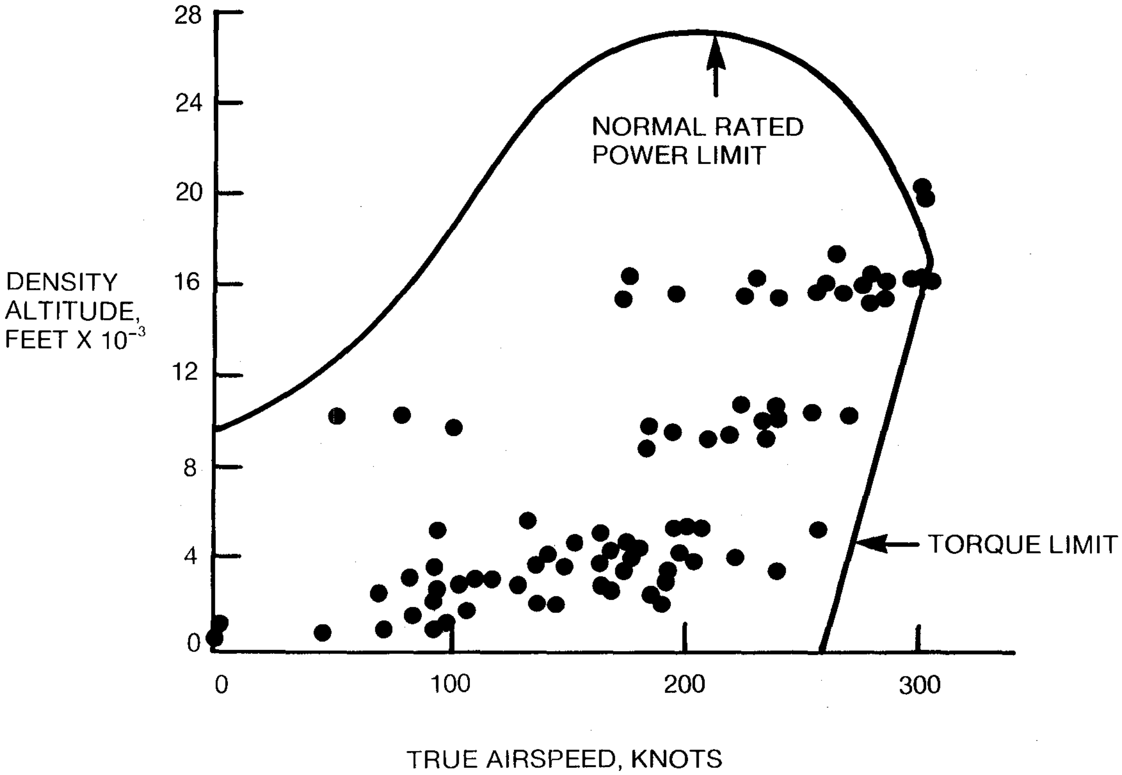


FIGURE 9: CURRENT CONVERSION ENVELOPE VS. DESIGN

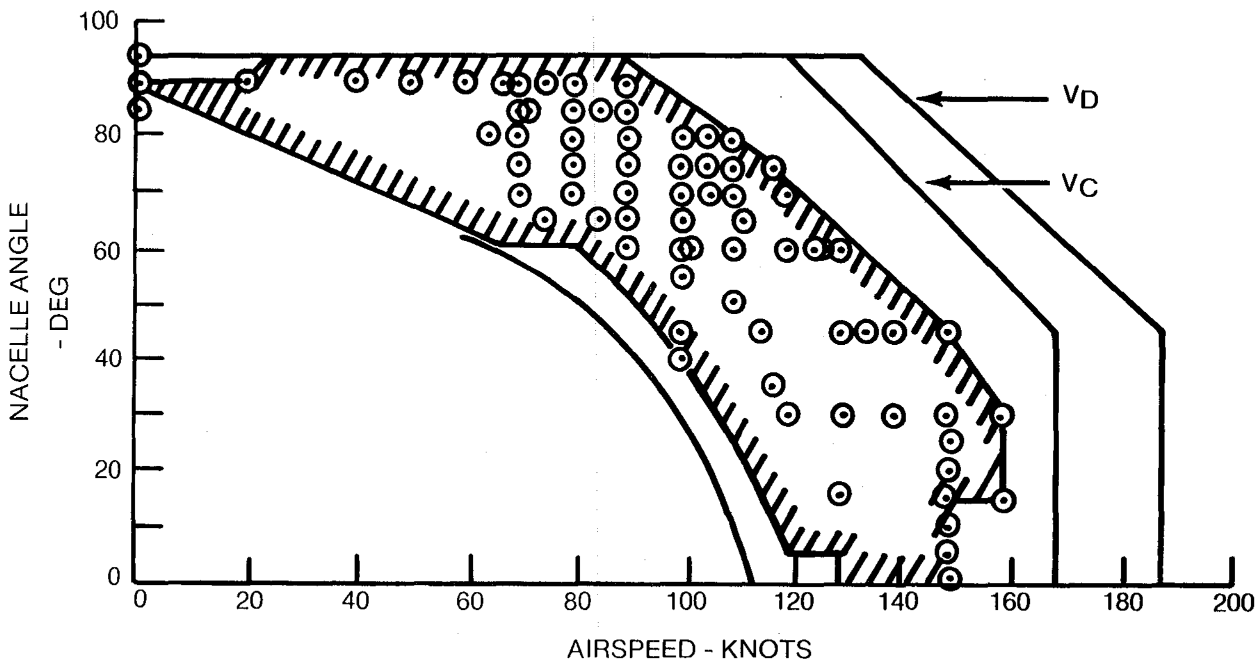


FIGURE 10: ROTORCRAFT HOVER NOISE LEVELS

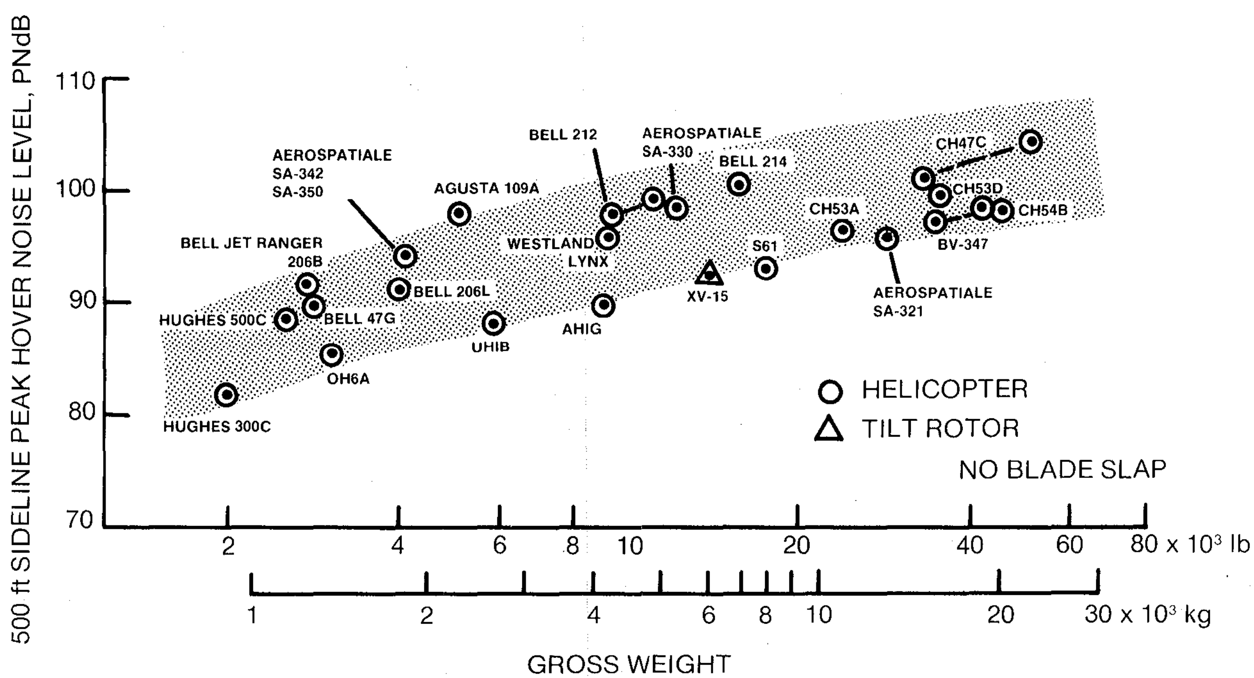


FIGURE 11: XV-15 CREW STATION VIBRATION LEVELS LEVEL FLIGHT

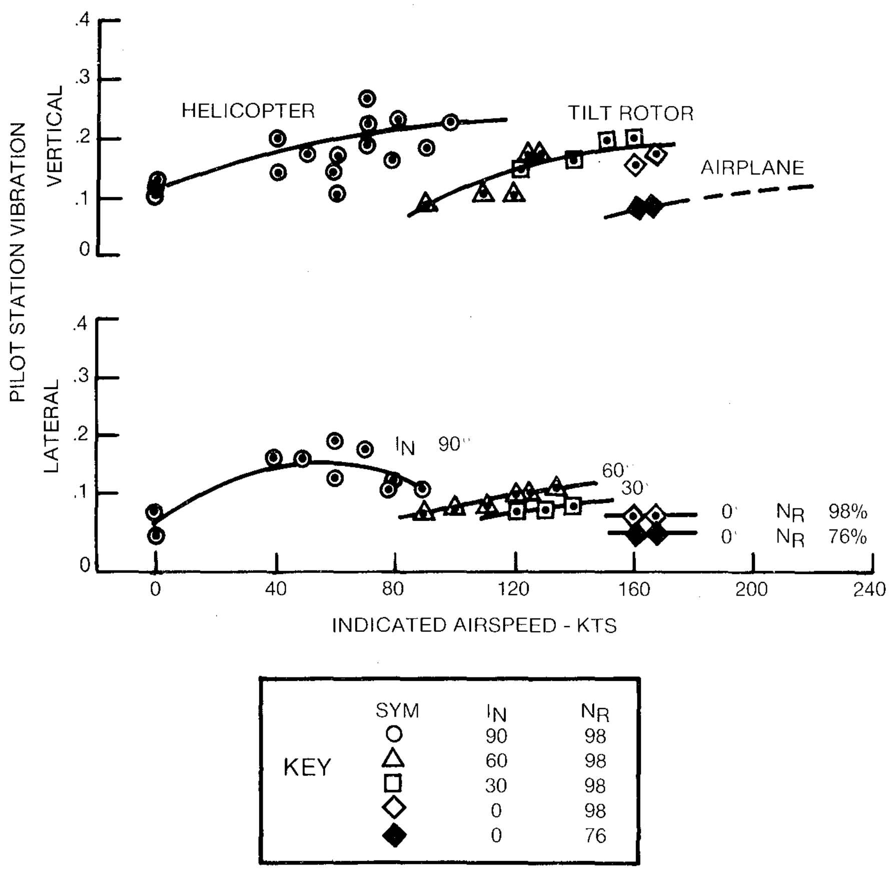


FIGURE 12: PERFORMANCE COMPARISON FOR OFF-SHORE OIL SUPPORT

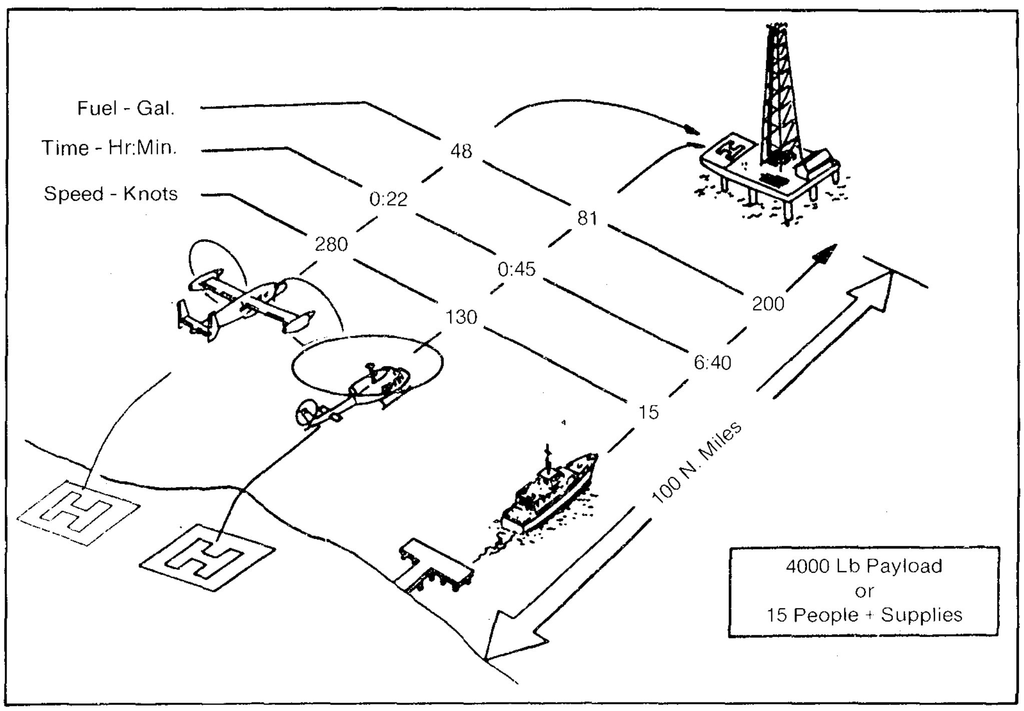


FIGURE 13: PERFORMANCE COMPARISON FOR INTER CITY TRANSPORTATION

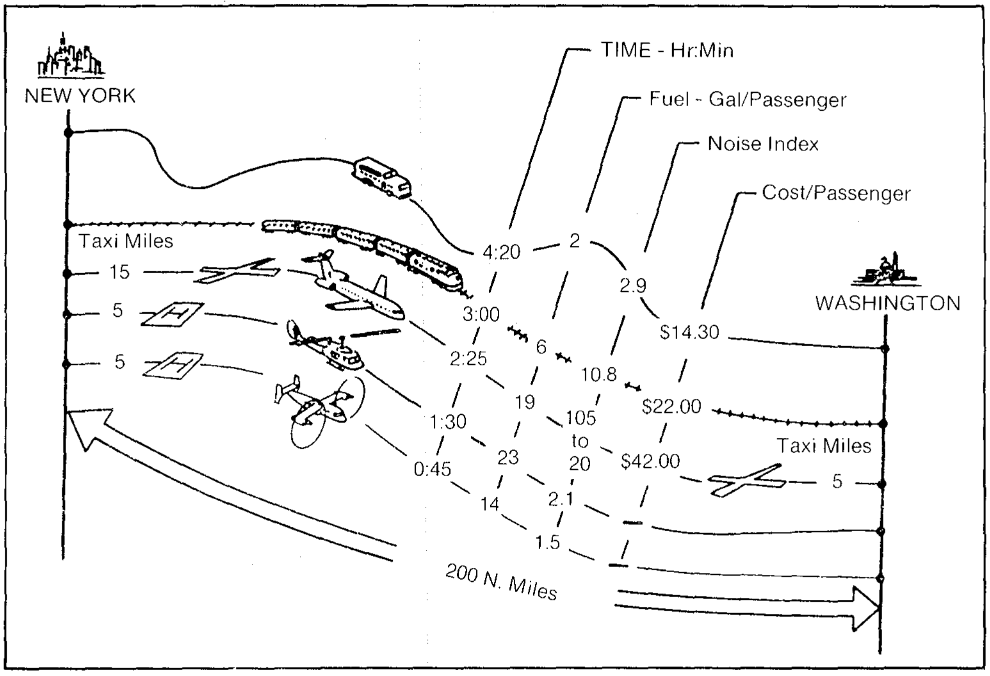
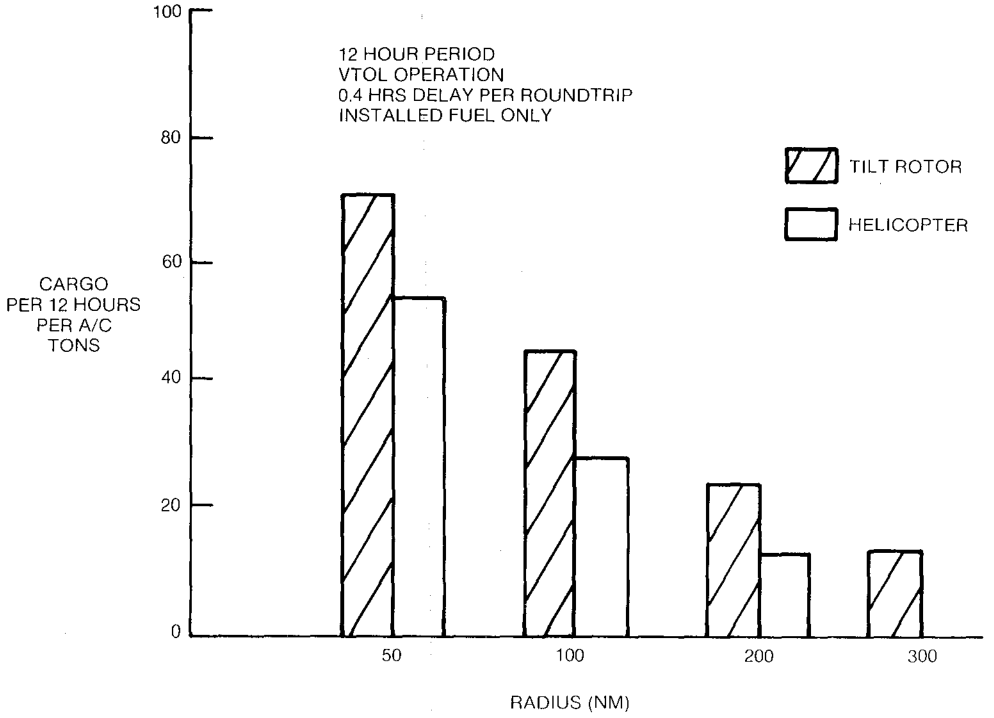


FIGURE 14: CARGO PRODUCTIVITY COMPARISON FOR DIFFERENT RADII OF OPERATION



REMARKS BY PUBLIC OFFICIALS

The Honorable Norman Mineta
House Aviation Subcommittee
Committee on Public Works and Transportation
Congressman, Thirteenth District, California

I am very pleased to be here today at this Conference on Planning for Rotorcraft and Commuter Air Transportation. The issues you are discussing in your meetings and workshops are some of the most significant confronting aviation in this country. How these issues are resolved will in large part set the course of future aviation progress in this country.

Progress in aviation in this country has been a result of a partnership between private industry and government. This partnership exists in all aspects of aviation—manufacturing, research, and planning and capital development. I believe for this progress to continue, this partnership between industry and government must also continue, and nowhere is that more evident than in the planning and development of adequate airport facilities. An early aviation pioneer and enthusiast once made the claim that "An airplane can do almost anything that a bird can do, except build its own nest." That vital nest-building requires a close cooperative effort among local, state, and federal governments, commercial aviation and other user groups, and private consultants and contractors.

This country will be experiencing tremendous growth in aviation activity over the next decade. The Federal Aviation Administration forecasts that air carrier enplanements will climb 61% by 1990, while commuter carrier enplanements are expected to grow by 170%. General aviation activity, including rotary wing aircraft, is also expected to increase dramatically.

A great deal of research, planning, and capital improvement must be accomplished for this growth to be accommodated, and that is the challenge both the private and public sectors now face.

My concern today is that the public sector in the current climate of budget cutting will not meet its responsibilities and as a result the costs to aviation and to the nation as a whole will be very high.

We all, of course, support efficiencies in government. We want to eliminate waste and create a system whereby the public sector lives within its means. But it is my belief that budget cuts are in some areas *not* cost effective and that they result in higher costs in the long-run through reductions in productivity. We need to be very careful that by accomplishing some short-term dollar savings we avoid doing irreparable harm to the basic infrastructure of this country.

One of the targets of the Reagan budget program has been transportation in general and aviation in particular. What can we expect *or not expect* under the Reagan program for aviation?

The federal government has had a significant role in the funding of airport planning and airport and airway capital improvements. It is a role that I and other members of the Subcommittee on Aviation support, and if it were only up to us, it is a role that we would like to see continue and grow.

In March of this year, I and a majority of the Aviation Subcommittee members introduced a bill to reauthorize the Airport and Airway Improvement Program (commonly known as the ADAP program) for the next 5 years. When we introduced this bill we recognized that there were significant needs in the aviation system and we tried to tailor a bill that would meet these needs while recognizing that we had to be as austere as possible in light of our belief, as well as the President's, in paring down the budget.

I would like to describe to you some of the ideas for airport planning in that original bill and how those proposals are treated under President Reagan's approach. In the original bill we made a number of what I believe to be improvements, in the manner in which airport planning was funded by the federal government.

Planning has always been a significant part of the ADAP program. A separate Planning Grant Program has been in place since 1970 and has usually received $10-15 million per year to fund airport master and system plans.

This year we set out to strengthen the role of planning. First of all, the Planning Grant Program was made an integral part of the ADAP program rather than a separate authorization, and we gave greater emphasis to *system* planning by setting aside $34 million over the next 5 years just for *system* planning grants to planning agencies of local governments and airport authorities. One of the major constraints on aviation has been and will continue to be a lack of overall or system planning within a community. Decisions on where to locate airports, whom they will serve, and what types of aircraft will fly where, are often the decisions that make or break growth and development of aviation in a particular community. The set-aside for system planning in the original bill was to ensure that this type of development was given adequate attention.

What happened after the Reagan cuts? In order to fit our bill to the Reagan funding levels, our Committee was required to cut this program back to a level of $10 million over the next 3 years. On a per year basis this represents a 50% reduction from what we felt was necessary. System Planning under President Reagan's program exists pretty much in name only. I believe that is regrettable because there are significant needs here. As a result we will have less planning, and there will be costs down the line due to mistakes and unforeseen consequences.

Another major program we introduced in March was what we called the Primary Hub Program. This represented a new concept in the ADAP program. In the metropolitan areas which encompassed the 60 largest airports, some funds would be available to undertake development agreed to by all the airports in a metropolitan area. What we contemplated here was a coordinated approach to the airport development of a community rather than just an airport-by-airport approach. In order for a hub to get this money, a system plan and an expenditure program had to be completed in which all public airport sponsors participated including commercial service airports, reliever airports, even privately owned public use airports could participate if they wished. A primary hub could have received up to $5 million for development within the hub. This was in addition to the other funds that went to specific airports under other types of apportionments.

When Congress got the President's budget figures for the ADAP program, we had no choice but to eliminate this new concept. There simply was not enough money to undertake new initiatives such as this. Again, I found this regrettable. A primary hub program in my opinion would have gone along way toward relieving the costs to local communities resulting from lack of planning, coordination, and cooperation.

I might also mention that another new program that we sponsored was the reliever heliport program. Heliports have always been eligible under ADAP but none have ever received funding. Helicopter operators contribute to the Trust Fund through fuel taxes, and we believed it was only fair that they receive development benefits in return. We mandated a modest program of $7.5 million over 5 years to demonstrate the significant contribution helicopters can make in the nation's air transportation system by relieving congestion at fixed-wing airports. However in order to meet the President's budget figures, this program, like others, had to be shelved. Again, I believe federal funding here could have made a real contribution to development and growth of rotorcraft transportation and air transportation in general.

Under the Reagan program, airport planning has been scaled back to a token level. It is my belief that to neglect planning is only to bring about higher costs and burdens, especially on local governments and communities, in the long-run. I only wish that in President Reagan's gallant effort to reduce the burden of government on the people, he had taken a longer view in areas such as airport planning.

The actual capital development and improvement programs for airports have fared no better. A recent FAA study indicated that capital development to expand the airport system to accommodate projected demand over the next 5 years would require over $8 billion. In contrast, the funding levels proposed in the Reagan budget, according to the same FAA study, would not even bring existing airports up to current design standards, much less expand the facilities to accommodate growth.

Furthermore, the administration has seized upon the idea that the largest and busiest of our nation's airports should not be eligible for any ADAP funding at all, an idea known as defederalization.

This idea would prevent most aviation users, who have paid user taxes on the promise that they would get needed capital improvement at the facilities they use, from ever having that benefit from the taxes they have paid. Defederalization assumes that the larger airports (and many of the not-so-large facilities, such as San Jose, Buffalo, Ashville, and Birmingham) will in the future be able to turn to the airlines for all capital improvement funds. These are, however, the same airlines that generally have great difficulty just trying to meet their own capital needs for aircraft. I just do not see the airlines in their present or future financial state as a ready source of increased funds to undertake the capital improvement needs of our nation's airports. If anything I see the airlines shying away from underwriting future airport capital development.

It has also been suggested that each airport might be given the authority to tax passengers directly to make up for ADAP funds lost because of defederalization. This however, raises enormous problems of non-standardized taxes all over the country, problems which would be avoided simply by retaining the current system of federally imposed and standardized taxes, which are then returned to airports for planning and development projects.

In short, as in the planning area, the approach of the administration to airport development is shortsighted and does not take account of long-term needs. It is a "no-growth" approach, which can be temporarily justified by the controls in air traffic which have been imposed due to the controller strike, but which in the long-run will leave us well behind the potential growth curve for aviation. It is my belief that for us to continue the kind of progress in aviation we have seen since its inception, government cannot shirk its role and responsibility, particularly in the areas of airport planning and development. Let's bear in mind that the partnership between private industry and government in the aviation field has been very successful, and that to destroy that partnership can only have dire consequences.

This fall we will be continuing the debate on such issues as airport planning programs, defederalization, and the extent of federal involvement in providing for airport development. I will be doing my best to see that the federal government continues to exercise its responsibilities toward airport development and airport planning. But I must say it's not going to be easy. We would certainly look forward to, and very much appreciate your support in this area.

Thank you very much.

The Honorable Judith Connor
Assistant Secretary for Policy and International Affairs
U.S. Department of Transportation

It is a pleasure to be here today to address such a distinguished group of experts in the field of air transportation. I hope that from my position as policy advisor to the Secretary of Transportation, I will be able to make a contribution to your forum which will, of course, not be technical in nature but will provide an overview of the Department's general policy perspective.

Outlook

Of, course, the good news in the commuter business is the growth that has been experienced in the market during the past several years and the projections for future growth. You know the numbers as well as I, and the fact that since 1979 commuter airline traffic has grown significantly faster than any other sector of the airline industry. Traffic growth in 1979 over 1978, measured by RPM's was 28% for commuters vs. 12% for the domestic trunks of 5%. Needless to say, a 12% growth in a period of a sluggish economy is even better than it looks. Commuter airlines today, more than 2½ years after the Airline Deregulation Act of 1978 was passed, serve more passengers (15 million, up 35%) in more cities (712), using more airplanes (nearly 1,400) than they did prior to the passage of the act. The outlook for the industry is equally as cheery. Commuter aircraft sales are forecast to average about 200 units worldwide annually for the next 5 years. The FAA estimates that over the next 20 years, U.S. commuters will purchase 2,400 light transport aircraft in the 11 to 44 seat category.

There are a number of reasons why we can conclude that the business is not only here to stay but also has a good opportunity to develop rapidly. It is our belief at the Department of Transportation that continued deregulation of the domestic airline industry will provide substantial opportunities for the commuter operator. In addition, as a result of the Deregulation Act, the commuters are actively involved in the Essential Service Program. The so-called 419 program is currently subsidizing 23 commuter carriers that are serving 39 points in the United States at an annual cost of $9.4 million. Commuters provide service to about 75% of the 319 cities eligible for essential air service transportation outside of Alaska. In Alaska, commuters provide the only service to almost all of the 22 points. The point is that there is a market for commuter operations. It appears to be an expanding market, particularly now that airline deregulation has permitted the "big guys" to assign their aircraft to the route on which they can be used most efficiently. In addition, since deregulation, the trunk carriers have become more acutely aware of the necessity to provide hub-and-spoke operations. If, as in many cases, they are unable to provide this type of system through their own operations, they will increasingly look to small operators to feed into their long-haul services. I expect that as the trunks further rationalize their route systems, we will see more and more of a dependency upon the feed that can be provided most efficiently by small aircraft operated by commuter carriers.

Manufacturing Opportunities

It seems that the bad news is that U.S. manufacturers are not particularly interested in exploiting this developing market. At least some quarters have criticized them for not looking at this market in a creative manner. In addition, we in the administration have been criticized for having a hand in the development of a system, (rapid deregulation) and of a program (the FAA's Loan Guarantee Program), which appear to be attracting manufacturers of foreign aircraft to the detriment of U.S. manufactured aircraft. Indeed, although Piper, Cessna, Beech, and Swearingen are U.S. manufacturers who are on top of the list for number of aircraft being flown in passenger operations during 1980, there is no question that the outlook for development of aircraft for the future suggests incursion of foreign manufacturers into the U.S. market. We all know that foreign manufacturers are concentrating on the 20-50 seat category aircraft which they believe will be the growth area for the commuter industry. British Aerospace, Embraer, Shorts Brothers, deHavilland, and Fokker are the primary players. All are producing aircraft in this category and are committed to improved developmental aircraft.

While our manufacturers are criticized for not getting into this new market, there are obvious reasons why foreign manufacturers are able to do so and U.S. manufacturers find the market less attractive. Europeans, Canadians, and Brazilians have cast their lot with the larger market for three primary reasons: (1) The potential for the worldwide market, which in total is projected to be twice the size of the U.S. market; (2) their limited production facilities fit the slow demand rates (these aircraft will be bought in lots of 1's and 2's with delivery dates strung out over as many years); and (3) they saw a hole in the market place which is not likely to be filled by U.S. manufacturers unless there are some breakthroughs. U.S. manufacturers, find the market unattractive for the following reasons: (1) the volume of demand, the fact that these orders come in dribs and drabs, and do not fit their production capabilities; (2) the cost of production would be spread over fewer units; therefore, overall profit potential is smaller; (3) they have directed their developmental, production, and marketing efforts towards dominating the general aviation market, a market considerably larger than for a commuter aircraft. (In comparision to the approximately 200 commuter aircraft purchased in 1980, U.S. manufacturers produced 11,800 general aviation aircraft valued at $2.5 billion. This market is also growing rapidily, with the General Aviation Manufacturers Association forecasting shipments of turboprop business aircraft at an increase of 14% in 1981); and finally (4) U.S. manufacturers do not find the arrangements either for their own facilities or for their prospective buyers to be particularly attractive.

Constraints on Developing the Market

Perhaps the biggest weakness I see in all evaluations and discussions of the commuter manufacturing market is that there is a tendency to discuss it as if it were a single market. In fact, like most markets it is heterogeneous, and the product must fit the needs of the consumer, in this case the operator. There is a tendency to talk about a "typical commuter flight." In fact, in preparation for the development of the speech, one of my staff members informed me that the "typical commuter flight" is 120 miles and is flown at low altitudes. However, this would hardly characterize the commuter operations for the Midwestern or mountain states where distances are long, passengers are fewer in number at any one point and higher altitude operations are necessary. Therefore, it is essential that we contemplate the possibility that there is no one "ideal" commuter aircraft. This prospect may indeed make it extremely unattractive for U.S. manufacturers to carve out a niche in the developing market. In addition, there are certain characteristics which must be built into any future commuter aircraft. We must start by recognizing that commuter operations are, for the most part, competitive with other modes. The short distance operations clearly compete with the automobile and intercity bus, both of which are becoming more fuel efficient. Even in the western states, where there is less congestion on the Interstate highways, commuter operations may have to compete against surface transportation modes. Thus, they must be cost competitive with other modes in a way which is not shared, for example, with transcontinental operations by wide body aircraft. In other words, where time and distance are major factors, surface modes cannot compete. But where time and distance are not obvious factors, surface modes *can* compete and commuter operations must offer fares which are low enough to attract passengers from these other modes.

Therefore, the "musts" for the production of commuter aircraft for the foreseeable future are cost, cost, cost. These aircraft must have low trip costs, efficient fuel consumption, low maintenance costs, and limited crew requirements. The maintenance aspect means not only that costs of maintenance must be kept low but that the maintenance itself be kept simple. Most commuter operators will not have a stable of skilled mechanics, and will not maintain pots of inventory for replacement parts. These operators simply are not well enough capitalized to maintain such overhead. In fact, we all know that commuter operators have limited access to capital markets, that they are often dependent on the financial support of local banks, who in turn rely on the credit ratings of the owners. In many cases, the owners are prominent local business men, and the financial stability of the operation rests upon the inclination of these owners to infuse capital into the airline when needed. The bottom line is that the availability of money for both capital purchases and expenses is extremely tenuous at best.

Conclusions

I am not telling any of you anything that you have not already heard. In addition, the commuter operators are well aware of these facts. The question is whether or not we are drawing the right conclusions from these facts. I would draw the following conclusion as being the single most important for you as planners and technologists: *As you try to develop your conceptual design for an aircraft, make sure that you do not build in capabilities which you do not need.* There should be no baubles on the Christmas tree. This may seem to be a simplistic conclusion and self-evident. However, I must relate a story which demonstrates how difficult it is for people who love aircraft to learn this lesson. I first entered government in 1971 and was employed by the Office of Economic Opportunity. At that time, President Nixon decided that he wanted to encourage the development of rural areas by providing greater access to them, in order to attempt to prevent what we believed to be a movement towards urban living. Since I had come out of the airline industry, I was given the assignment to determine what kinds of aircraft were available to provide access to smaller communities. Needless to say, the answer at that time was the same as it is today. There were limited numbers of appropriate types of aircraft. Several months after I joined the Federal government, I moved over to the Commerce Department and continued the project from there. Commerce was, of course, interested in the mission and numerous manufacturers came to call on the Secretary to determine what the needs might be and where there might be some available funding for manufacture of aircraft to serve small communities. The problem was that we had determined the aircraft needed only to be "efficient." As far as we were concerned, it could flap its wings and fly 10 feet off the ground or be peddled by the passengers as long as it was cheap. During the better part of a year, as I worked on this project, I never received a proposal that was for a *nonjet* aircraft. I found this incredible at the time (despite the fact that jets were viewed to be the "efficient" engine) and continue to do so. My point in telling this story is that I continue to see similar followers in documents I read today.

There is discussion about pressurizing compartments, when I question whether or not pressurized compartments are needed in all instances; there continues to be a mystique regarding short takeoff and landing capabilities, even if the aircraft is not, in and of itself, a STOL aircraft. While short takeoff and landing capabilities may be of interest in downtown airports, for the most part, I suspect these capabilities are not really necessary today or in the foreseeable investment related time period.

In sum, let us put aside our intrigue for aircraft and its capabilities and seriously evaluate how we can produce a product that is best suited for a specific market at the cheapest possible cost of production and operation. I am not saying we should not dream—I found this morning's sessions by NASA exciting and stimulating. But, let's not lose sight of pragmatism. The market *must* develop before we can hope for breakthroughs and the developments must use today's technology.

Thank you.

SESSION III:
COMMUNITY TRANSPORTATION PLANNING

Dorn C. McGrath, Jr., Chairman,
Department of Urban and Regional Planning,
The George Washington University

Some of the questions raised in both formal and informal sessions of the Conference in its first two days indicate a considerable degree of misunderstanding among aviation industry representatives concerning the work that local planners do and official roles that they play in the communities. This brief perspective is offered to help clear up some of the apparent confusion about local transportation planning professionals in the hope of improving communications among the conferees and enhancing the effect of the Conference as a whole.

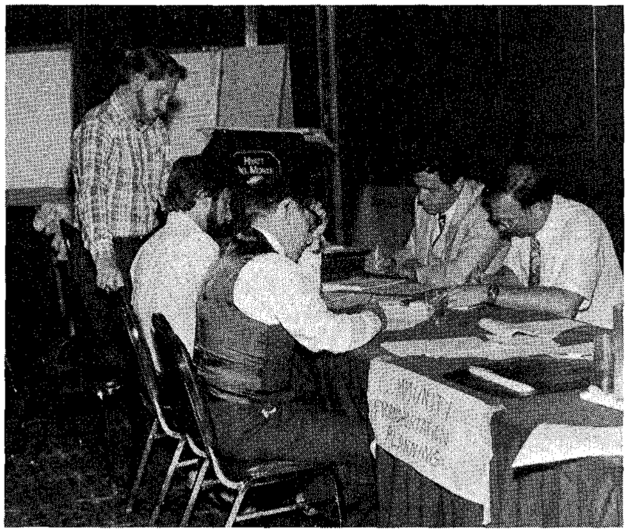
Local planners in this context refers primarily to the professionals who hold staff positions in the municipalities and metropolitan planning agencies in all of the 283 SMSAs across the U.S. These are the planners whose work is concerned with the transportation needs of about 75% of the U.S. population. The term local planner also refers to professionals in smaller cities, counties, and towns outside the SMSAs where rotorcraft and air commuter services are important but not yet major factors in the marketplace or in public policy. So defined, local planners account for about 2/3 of the 23,000 professionals mentioned regularly by speakers here as the membership of the APA.

It is important to note that the transportation planner is most often a staff specialist in the typical municipality or SMSA where several other types of planning activities account for most of the agency's workload. Thus, there are perhaps fewer than 2,000 planning professionals who actually hold the title of transportation planner, and several of the leaders of this group are among the Conference speakers, organizing committee, and attendees.

The local planner, including the transportation planner, serves primarily as a professional advisor to a Mayor, City Council, City Manager, or to a group of elected officials, according to the local pattern of government organization. The planner advises on public policy concerning the use of scarce resources, which almost always means land, the environment, time, and money.

Planners are, generally speaking, broadly educated, and they tend to be quite skeptical of quick fixes and aggressive technology, having been burned badly by urban freeway boosterism, premature advocacy of the disposal of toxic wastes by landfill, by over-enthusiastic promotion of the benefits of nuclear power, and by the unplanned introduction—by others—of jet aircraft into airports barely adequate for piston-engine planes. Picking up the pieces from these technological advances has been very difficult indeed for local planners and elected officials.

Now before the local planner comes the new generation of rotorcraft and air commuter services offering many promising, but unplanned, potentials and just as many problems. It would be enough to cope with these challenges alone, given the fact that much of the land needed for new airports has already gone into other uses. But the local planner has other urgent problems to confront. In almost every city, county, and town the planner hears from his boss, the Mayor, Council, Supervisors, et. al, that the *really* pressing problems, all aggravated by a lack of $$$, are in housing (for the poor, minorities, young couples, and the elderly); in non-airport-related economic development (non-airport jobs and tax base); in public transportation; in school-closings; in drug abuse and related crime; in health care; and even in regulating pornographic book stores and massage parlors. And the local planner is also the chief professional advisor to the local government on an endless parade of zoning change and land subdivision applications, year after year. Thus, in perspective, airports,



heliport, and aviation in general tend to fall somewhere around 10th or 12th on the typical list of local public priorities, even if the planner and Mayor are pilots themselves. Such is the priority among issues that the electorate demands.

There is a special sensitivity among many local planners and public officials where airports are concerned. This results in part from the fact that the FAA and the aviation industry in general withheld the technical tools and political support needed to make land use control around airports effective during the 1960s when it was urgently needed to protect airports from encroachment by housing and other noise-sensitive land development. The record shows that the CNR, the first of the land-use planning techniques to be based on open recognition of aircraft noise, particularly jet aircraft noise, was robbed of its credibility and effective application by its own sponsors, the FAA and DOD, from the time of its first publication in 1964 through 1970. Disparagement of the concept by industry, not only on the basis of often narrow technical considerations but also because the results obtained by the technique revealed in stark terms the misfit between jetports and their surrounding communities, prevented local planners from gaining political acceptance of the need for rigorous land use regulation in noise-exposed areas. Frequently local planners attempting to apply the CNR or NEF concepts could not obtain basic data from either the FAA or local airport operators, with the result that many localities and their airports were denied the benefits of preventive land use planning to protect basic aviation resources.

Fortunately, this aspect of local planning for aviation needs has been improved in recent years. Publication of AC 150/5050-6, *Airport-Land Use Compatibility Planning,* in late 1977 has done much to provide local planners with forthright state-of-the-art information about aircraft noise and usable guidelines for the use of local authority to regulate land use in airport environs. The 13 years of official equivocation on such issues, from 1964 through 1977, however, resulted in the urbanization of thousands of acres of airport-related lands that probably can never be regained for conversion to aviation use or to permit the expansion of airport operations with associated aircraft noise.

These comments are intended to provide perspective on some of the political reality of local transportation planning, especially as it involves aviation. They are offered to help the representatives of aviation here understand what may seem to be the over-cautious attitudes of their newfound colleagues in planning toward the next wave of advances in aviation technology and their potential applications.

THE TRANSPORTATION PLANNING ENVIRONMENT, STATUS AND PROJECTIONS

Willard Stockwell, Chief Planner
Metro Area Planning Department
Wichita, Kansas
Conference Co-chairman

I smile when people refer to me "being from Wichita.... I consider Denver my home; I lived there longer than I have in Wichita and it has taken some adjustment to start calling myself a Wichitan which is the way we refer to ourselves in Kansas. But having my Congressman, Dan Glickman, speak as he did yesterday with such pride, reminds me of what a great place it really is. I've quit covering my badge.

I can assure you if there is an aviation community in the United States, then, Wichita, Kansas is certainly it. I'd also like to mention how exciting the air show was yesterday. I want to give the credit this morning to both Bell Helicopter and Hughes helicopter for the use of their aircraft. For planners, like myself who have never even touched a helicopter let alone had an opportunity to ride in one, it was a very exciting afternoon. In addition to recognizing Bell and Hughes, credit also should go to Nick Ford, the Manager of the Monterey Airport and his staff, for the way that they assisted in the demonstration and air show. As you saw the airport was literally closed to commercial air craft during the flight of the experimental aircraft. Last, but certainly not least I would like to commend NASA. Having watched NASA perform on television and watching the flight of the Columbia and various other space-related events over the years, you can't help but be impressed with NASA. I think that all of us probably feel that way but I think it came home more yesterday actually being present and watching. Of course, we were watching a part of NASA that many of us have forgotten altogether, the aeronautical side. In fact, that abbreviation "NASA" is used so frequently that you forget that part of that term is aeronautical. I mean, the space side obviously has been the pizazz side, the one that everyone has identified with, but yesterday it was certainly the aeronautical research that was on display and it was very, very exciting. Certainly all the Conference participants that I talked with just thought it was great! It was especially inspiring yesterday morning to hear from Mr. Cochran of the QSRA Program and Mr. McGee, of the Tilt Rotor Program. Mr. Magee's enthusiasm for his work and what they have accomplished was thrilling to me. . .to know that we have people in the federal government that are as enthusiastic about their work as these people are. I would like to give NASA a hand now for their efforts. *(Applause)*

As we put this Conference together we felt that we ought to try to survey pre-Conference attitudes and opinions of the planners that were going to be involved at this Conference. The thought was that we wanted to find out what planners know about rotorcraft and commuter air transportation; the pre-Conference point of view. Most of the planners attending the Conference have a variety of backgrounds. Some work for port authorities and state DOTs, while others have been involved through the preparation of airport system plans for regions and metro areas. A few, as you well know by now, are from academic institutions and some others are transportation consultants. This planner's perspective that I prepared is broken into three parts. First, some brief comments on commuter air transportation, and second, land use controls for airports and third, the subject of rotorcraft.

First, on commuter air transportation we asked the planners to relate their impressions favorable or unfavorable as to the impact of the Airline Deregulation Act on their communities. In general there was a consensus that deregulation had resulted in improved air service and that the spin-offs were favorable to such as lower fares in some instances and improved business opportunities in some of the smaller communities. But certain problems remain, some of which could ultimately reduce passenger volumes if not adequately addressed by the commuter airline industry. Some of the more prominent concerns are as follows: generally, under the category of safety, and we had—it seemed to me that the transportation planners and planners responding had more concern on that than anything else. Some questions raised without answers that we are seeking at this Conference: Are the commuter aircraft as well maintained as the larger planes or the air carriers? Are the flight crews as well trained? Is instrumentation up to par as compared with the larger air carriers? Do commuters get proper attention by air traffic controllers? Under the subject of comfort, we obviously observe more in-cabin noise and vibration, more crowding; we wonder if that crowding situation will always exist, and, of course, much less pampering by cabin attendants, which I think we have all come to enjoy over the past 20 years of being carried in the larger aircraft.

Under the subject of accessibility, just the ease with which you use the commuter, we observe that in the larger hubs there is much more walking, that the commuters seem to be scattered in terms of the convenience to connecting flights, that you frequently are enplaning through the rain or snow . . . all of these things, I think, add to a difficulty in encouraging people to want to fly. In Wichita, Kansas we happen to be blessed with a great deal of good air service because, I think, of our aviation industry. We have thousands of people flying in from all over the world to take possession of a Cessna or a Beech or a Gates Learjet or Boeing executives going this way or that, we are served by, I think, five of the major carriers: United, TWA, Braniff, Central, and Frontier. But we also have a commuter operator that has been very prominent and very successful. I have had the occasion to get on the smaller commuter aircraft to make a flight to Kansas City and it is quite an experience to land in Parsons, Kansas. You feel that you are landing in the middle of a wheat field; you're not even convinced that there is any asphalt or concrete underneath you . . . certainly there is no fire equipment necessary in case of any kind of accident. So flying by commuter aircraft does cause greater concern to the people using it, and I think that these are some of the problems that we need to address.

We wonder, due to the lack of capacity at the larger hubs, if many commuter flights might be relegated to fringe airports with poor support facilities, thus necessitating additional transfers to reach the ultimate destinations. At the fringe airports we believe that the issue of safety will be more pronounced and that there will be a concern for the noise levels that might spill over on nearby residents. Usually at these fringe locations, housing developments are built right up to the edge of the runways and as you bring in higher performance commuter aircraft and start making more noise you also create neighborhood opposition.

Last, it was even mentioned that the loss of the big jets in some of the smaller towns was a blow to community pride. In summary, we believe that deregulation is working but we came to this Conference wanting answers to our questions on safety. We accept the discomforts of commuter air travel but we hope a new generation of commuter aircraft will address these concerns. As transportation planners, we will be assisting the communities we work in to coordinate the development of the increasing number of airports it will take to accommodate the forecasted growth in commuter air transportation.

On the subject of land use controls for airports, it should be said that, although zoning is the most widely used land use control, most planners advise against relying on zoning to protect airports from incompatible land uses. This technique of land use control is too easily overturned when faced with economic and political pressures. Some planners, however, report that zoning can be effective in rural or low density areas. In other words, where development pressure is greater, it appears to most of us that the only reliable protection is the purchase of adjoining lands, or at least the purchase of development rights. Unfortunately, because of the cost, this solution isn't feasible in many instances.

Other techniques of protecting airports are used with varying degrees of success and include subdivision regulations and establishment of avigation easements to prevent lawsuits. In fact, this is a technique that we have employed in Wichita, for something like eight years and it has been very successful. This technique limits building heights as well as documents existing and potential noise problems. Another technique is modification of building codes requiring insulation. We haven't tried this in Wichita and I don't expect that we will. We are realists. Anytime we start talking about changing building codes requiring insulation we are dealing with increasing the cost of housing and that just won't sell in these times of high housing costs.

Land banking is another technique but, again, it is expensive. One more method of protection is to use guide growth; i.e., to keep residental development or incompatible land uses out of the airport areas where you would have either hazards or noise problems through various postive means of attracting development into other areas.

To summarize, all good land use techniques involve purchase, one way or another, and it's the only reliable way to protect an airport from encroaching development.

On the subject of rotorcraft—I saved rotorcraft for last because it is the least familiar of the air transportation modes we are considering at this Conference. Let's face it, until yesterday virtually none of us planners had ever flown on helicopters. It was really an education.

We are familiar with the missions they perform so well and we see so much of that on television or in the movies. We accept that they are well suited for rescue, whether from the top of burning hotels, or from sinking ships, and that they aid in traffic enforcement and assist in other policing activities. Obviously they have saved countless lives when used in emergency transport of accident victims. And we acknowledge their adaptability to all transport situations like offshore oil platforms. We know they can effectively be used for various agricultural purposes like the recent and continuing episode with the Med-fly. It is also apparent that high level executives, not to mention our President, find helicopters suitable to certain transportation needs. For all of these reasons we know that helicopters are here to stay and we, as transportation planners, need to be more conscious of the need for public and private heliports and helistops and for realistic regulations concerning their development and use. It is clear that we will see more and more use of this marvelous flying machine as it handles transport situations that no other vehicle handles as well. But the question still remains, "Can the helicopter help us solve big city rush hour congestion?" I think not. We planners as a group are skeptical that the helicopter can make a significant impact on that staggering demand. We came to this Conference with open minds on this question and we hope the answers are available. I might add that most of us are convinced that the principal constraint to the use of helicopters as commuter vehicles is economic, not environmental and not public acceptance. We contend that if they can compete economically they will be used. The record is that they have not and we are asking can they? Has there been a lack of communication on this subject or were we as transportation planners just not listening? The fact that the transportation planners are largely unfamiliar with helicopters and their capabilities, points to the need for a greater effort on the part of the helicopter industry and the federal government to acquaint planners, policy-makers, and the public in general with the capability of this aircraft. We recommend that the industry, the government, and planners join together to demonstrate this rotorcraft capability. We and the American Planning Association would like to help. Thank you.

THE STATUS OF PLANNING FOR ROTORCRAFT AND COMMUTER AIR TRANSPORTATION

Dr. Joseph R. Stowers, President
System Design Concepts, Inc. (Sydec)

Our firm has been working with the Transportation Planning Division of the American Planning Association (APA) under contract to NASA, to provide Conference planning and support services, and to conduct one of the two major technical pre-Conference studies. Our final report has been submitted to NASA Ames Research Center and distributed to all Conference participants.[1] As the first of three presentations on the results of our study, my purpose is to provide a brief summary of our assessment of the state-of-the-art of planning in this field. Martin Huss and Ronald Bixby will then report in more depth on the results of the two principal technical components of our study:

- Results of a questionnaire and telephone interview survey of the most knowledgeable transportation planners who have been involved in some aspects of planning for rotorcraft and commuter air transportation
- A comparative review and preliminary assessment of helicopter ordinances in a small cross-section of representative cities and communities.

Our objectives in performing this assessment have been to (a) identify community planning needs in this field, and (b) to identify the criteria being used by planners in their current assessments of rotorcraft and commuter air transportation. The purposes of the study are to:

- Assist NASA in setting priorities for aircraft technological development during the 1980s in a manner most responsive to community needs and concerns
- Assist manufacturers in developing aircraft and other related equipment which will most effectively satisfy the emerging market for short-haul air transportation, as visualized by community planners
- Assist operators in better understanding the environmental issues and market conditions under which they seek to provide services
- Provide planners with reference material and guidance in planning for rotorcraft and commuter air transportation
- Establish a basis for communications between planners and tecnnoiogists in continuıng to work toward each of the above purposes[2].

At the outset we need to acknowledge that only a start has been made in achieving these purposes, and that this Conference should be recognized as a first major effort in a much needed new area of study and cooperative effort. NASA is to be complimented in recognizing this need at an early date in the young history of rotorcraft and commuter air transportation development.

Part of the difficulty in achieving the above stated purposes is inherent in establishing new communications channels among diverse professionals and interest groups—difficulties in overcoming peculiar jargon, as well as in learning to work with different institutional structures, networks of communication, and modes of operation.

Equally importantly, we had difficulty in assessing the state-of-the-art because the field is so embryonic. Relatively few people are involved in planning for rotorcraft and commuter air transportation, and what work is going on tends to be somewhat isolated and rudimentary by comparison with planning for other modes of transportation.

For these and other related reasons the results of the study may seem somewhat negative and simplistic because of the necessary focus on gaps in data and methodology, because of the fact that these early planning activities have so little tradition upon which to build, and because we choose to stress basics in our reporting in order to assure clear communication among diverse groups.

The primary tool for surveying the state-of-the-art was a detailed questionnaire administered to a selected sample of 55 transportation planners and others involved in planning for helicopters and commuter air transportation. The respondents were selected by following up all references to knowledgeable people in the field, beginning with contacts in all FAA regional offices and selected major regional planning agencies. The interview process necessarily involved a fair amount of pre-testing and refinement, and a substantial amount of telephone interviewing to clarify questions and responses and to use this process as a means of gathering additional information and technical materials. This process and its results are the principal focus of the paper which follows, by Martin Huss.

The survey was designed to provide information on all aspects of planning for rotorcraft and commuter air transportation, including the perceived importance of all issues, how various impacts and benefits should be measured, data and methodology needs, and research priorities. In

[1] *Planning for Rotorcraft and Commuter Aviation,* prepared by Transportation Planning Division of the American Planning Association and System Design Concepts, Inc.; August 1981. The other major pre-Conference technical study is a survey and assessment of current rotorcraft technology by the Helicopter Association International (HAI) and Vitro Laboratories, Inc. Several papers prepared for the rotorcraft session of this Conference are based on the findings of the HAI/Vitro study.

[1] In addition to the APA/Sydec report and the papers prepared by member of the APA participants at the Conference, one additional unpublished paper was prepared for distribution to all Conference participants as part of the pre-Conference synthesis to provide an initial basis for dialog in the workshops: "Outline of Issues: Prospective Conference Findings, Recommendations and Unresolved Questions" by Joe Stowers, August 25, 1981.

addition to background data on the respondents' experience, responsibilities, and agency functions, the survey asked for planners' perspectives in the following categories:

- Transportation planning data needs
- Marketing and economic analysis
- Facilities and operations planning
- Environmental and safety issues
- Potential impacts on communities' industrial base
- Existing transportation systems
- Quality of life.

The questionaire and interview survey process was supplemented by assembling and analyzing all available secondary information sources, including planning documents obtained through the contacts and through a literature search, and a special small scale survey of local ordinances with supplementary telephone interviews. In addition a special workshop was conducted in April, 1981 at the national APA Annual Convention in Boston. This workshop involved a preliminary report on results of this study and an effort to obtain all participants' responses to the most important elements of the survey questionnaire.

A major finding of the study is that planners are woefully lacking in basic data and reference material to guide them in planning for the short-haul air modes. Almost all of our activities underscored this problem, particularly as relates to helicopters, but to almost as great an extent for commuter aviation.

A significant proportion of the needed data, methods, and reference material already exists in one form or another, but are located in sources unknown to planners, or have not been assembled in a form readily usable by planners. Industry and technologists should cooperate with transportation planners in providing objective information and disseminating it in reference documents to community planners.

Planners expect to have access to unbiased data and reference sources. They need that type of material for the analysis they are expected to perform. It does little good to sell planners on the general benefits to be gained from helicopter and commuter services if they are not able to develop credible technical assessments in terms understood by elected officials and other community leaders. Planners need to be in a position to perform evaluations of particular proposals or development opportunities in an objective manner with the right kind of data and methods. Planners are accustomed to having these types of data, methods, and reference materials for other modes such as highways and mass transit.

The most needed types of data fall into three broad categories:

- *Demand and use data*—including statistics on origin and destination patterns, purpose and time of travel, modal split for particular market conditions, elasticities of demand with respect to fares and travel times, and other relationships that can be used in forecasting market responses to specific services
- *Technology data*—performance and cost measures for available aircraft including such items as door-to-door trip cost and travel time, cruise speed, costs per seat mile, capacity and payload, space requirements for landing and take-off, capital, operating, and maintenance costs per seat mile, and measures of actually achieved in-service vehicle utilization
- *Environmental and safety impact data*—primarily noise measures under different operating conditions and accident experience (fatalities, injuries, and property damage per passenger mile or per vehicle mile), so that comparisons can be made among modes.

Planners and industry should discuss these and related data needs in detail and seek to find ways to assemble this information in a form most useful for reference and application by planners in their communities. Some of the material that has been made available for this Conference By HAI, the Regional Airline Association (RAA)[3], and various manufacturers provides part of this information need. However, the information is selective and fragmentary. A significant amount of work is needed to pull together a more consistent, comprehensive set of reference material in a more usable form. Planners and industry should work together to achieve this.

The second major subject area which should be a priority for attention, based on our survey of planning practice, is the need integrating planning for short-haul air transportation with planning for other forms of air and ground transportation.

Our survey leads us to conclude that it is not much of an exaggeration to say that nobody really is responsible for system integration. We are at a stage, it seems, where air system planning is becoming much more complex at a time when the capacity to do the planning is diminishing. In the past, air transportation planning focused primarily on planning for a single type of transportation—long-haul commercial aviation. Now the diversity of modes in air transportation is getting much more complex and trends indicate that this diversity will become even more complex in the future. There are more problems in terms of ground access than there used to be. There are more problems in terms of the complexities of the terminals in dealing with the several modes.

To support my statement that nobody is really responsible for system integration, I would like to briefly run down the list of the different interest groups that are involved and ask you to consider their current and evolving roles in relation to these increasing problems and complexities:

- *Planners* do not even study the problem in school—most do not have courses on air transportation system planning in graduate planning programs.
- *NASA* has no planners in this field, and has no regular means of communicating its technology with many of the other groups that are involved, although an excellent start has been made with this Conference.

[1]Prior to the fall of 1981 RAA was known as the Commuter Airline Association of America (CAAA).

- With deregulation the *CAB* is backing out of this area entirely.
- *FAA* supports some planning activities and has produced some very useful reference materials, but it's role is rather passive and it is focused primarily on the air side of the problem.
- *The Department of Transportation* as a whole is tending to diminish its support for planning, particulary in terms of setting aside funds for planning and in terms of fostering air/ground integration. DOT used to put more emphasis on intermodal integration than it now does
- *Industry's* role in planning has been primarily sales-oriented prior to this Conference, although I sense a growing awareness among industry representatives here that planners can be useful allies in dealing with some of the community opposition they have encountered.

In summary I conclude that we have no organizational structure at present to provide a continuing forum in this field of air transportation, at either the national, state or local levels which brings all the interest groups together to promote an integrated planning effort.

What are the primary issues that have to be dealt with in this area of integrated urban air transportation system planning? I would put them in six categories.

The first is the organizational structure for continuing planning at the state or metropolitan level. We do not have anything like a norm. A few metropolitan areas and a few state areas have put together committee structures that bring the different interest groups together, but I do not think we have a description of what goes on or should be done by such groups to deal with the gaps we have identified. Such efforts are very *ad hoc*. Very few if any examples exist of organizational structures that deal with planning for all aspects of the air/ground transportation system as a whole.

The second category is the location of heliports on a system-wide basis in metropolitan areas. I would like to call your attention to the thoughtful analytical approach to this problem by Bob Winick in his paper to be presented in the rotorcraft session of this Conference. It is an original piece of work and makes a good start, I think, toward a methodology for systems planning for heliports.

The related third area is protection of existing airport environs to provide for projected growth on an areawide or statewide basis. Chris Brittle's paper, to be presented in the Commuter session of this Conference, does a good job of describing what the role of a regional planning agency should be in this area. The good work of the Metropolitan Transportation Commission should be repeated in urban areas throughout the country.

The fourth area is ground access—the provision not just of basic transportation modes, but specialized facilities in some cases, perhaps high occupancy lanes, or special services from airports to downtowns and other locations.

The fifth area is demand analysis and evaluation methods for use on an intermodal basis. We need to develop the necessary analytical relationships and the evaluation methods and get them into practice in states and urban areas around the country.

The final area is modal integration within the hubs themselves—planning for the provision of heliports or STOL facilities within hubs; the integration of those facilities with the major carriers' facilities, and the transfer arrangements within the hubs, both for people and for cargo movement.

Those six areas, I think, are the most important areas that need increasing attention as part of a more integrated planning process for air and ground transportation systems.

Finally, in conclusion, we need to discuss how we can deal with the problem of the lack of clear responsibility, the lack of a clear organizational structure for dealing with integrated planning. At the national level we need to find a better mechanism for communication and for getting some of these products out -- dealing with these issues on a more systematic basis. A variety of options exist, and perhaps several different directions are needed all at the same time. Existing organizations, such as APA, HAI, RAA, (formerly CAAA), and other organizations perhaps, can pay more attention to these planning needs within their own framework, but I'm frankly skeptical that we will get very far if we continue to deal with it on that kind of basis. I believe a need exists for some kind of group that brings these interests together on a regular continuing basis. Perhaps we just need to agree that we are going to have some forums of this type on an *ad hoc* basis next year; or six months from now. Whatever the solution, I am convinced that this Conference must find a mechanism to carry out the Resolves that you are going to develop, and it should be a strong continuing forum involving all the groups represented here today.

RESULTS OF NATIONAL SURVEY OF PLANNING FOR SHORT-HAUL AIRCRAFT

Martin Huss
Transportation Planner/Engineer
System Design Concepts, Inc.

Some of you have participated in our lengthy survey, but for the benefit of those of you who have not, the purpose of our survey was to provide information on planners' and consultants' perspectives on rotorcraft and commuter air planning. Basically what we were trying to do was to determine who the planners are who are involved with air transportation, either rotorcraft or commuter air, and what their perspectives are on those two areas of air transportation. We were hoping to determine the methodologies that are used, the data sources that are used, and various ways in which planners approach planning for these modes.

Many planners are not involved in air transportation, and of the planners who are, most have not had a whole lot of experience in either commuter air or rotorcraft, and there is not enough of an awareness of the problems of these modes.

The survey itself was quite lengthy. It was a fifteen page questionnaire with six major sections. The first section was designed to get a profile of the respondents themselves to enable us to correlate some of our results with the type of positions and the amount of experience, size of community, of the individual respondents, etc. However, we were not really able to do that to a large degree. The sample size was small—we had 55 respondents—and in trying to subdivide those respondents into smaller categories in a matrix we find one or two or three people in any given cell of the matrix and cannot statistically come up with any conclusions. However, some trends were detected, as discussed later.

The second section of the survey dealt with current and future missions for rotorcraft and commuter air. The next three sections of the questionnaire covered 46 issues involving general categories of planning data needs, marketing and economic analysis, facilities and operational planning, environmental and safety issues, impacts on communities' industrial base and quality of life in general in communities as related to air transportation. The last group of questions on the survey asked planners for recommendations for researchers, manufacturers, and operators. Much useful information was derived from those recommendations.

There was also ample space on the questionnaire for write-in comments on each issue and each question, and space for writing in additional issues and questions. So, in one sense it was quite open-ended and in another sense it was quite specific. Telephone conversations supplemented the written responses.

In terms of selecting respondents, this was not meant to be a general opinion survey but a perspective of a preselected set of planners who are engaged in various aspects of rotorcraft and commuter air planning. Out of hundreds of planners contacted, 55 were selected who were able to respond to at least some part of the questionnaire. Table 1 shows the geographic distribution and type of agencies which the respondents represent. Planners at different levels of focus (local, regional, federal, consulting, research) all had different perspectives. Overall, on an average basis for the 55 respondents, about 10 to 15% of their experience was related to commuter air or rotorcraft planning.

Table 2 shows the missions for rotorcraft and commuter air which respondents see now, and project for 1990. Public Service—police, fire, and rescue—is perceived as the most important use for helicopters at the present and also in the future. Business/corporate use is in the second position, now and in 1990. Most of the rankings do not change. However, public transportation—which includes the business district and airport access categories moves modestly from a sixth ranking to a fifth ranking, but in terms of the percentage responses, it increases from 29% to 47%. Thus, there is an indication that, in terms of planners' perspectives, the use of rotorcraft for public transportation is the mission that would grow the most and gain importance.

For the same question, for commuter air missions, the ranking changes, but not radically. Public transportation, which was ranked second in 1980, is projected to a point where it is about equal to business and corporate in 1990. The cargo and goods movement function is also perceived to increase in relative importance for commuter aircraft missions.

In addition to getting answers to the various questions, respondents were also asked to rate each of the 46 questions and issues that the three main sections of the questionnaire dealt with, in order to determine which were the most important. The ratings went from minus one (very unimportant) to plus two (very important). Thus, the highest score would have been a 2.0.

Table 3 shows the fourteen most important issues. The issues of airport and heliport location, planning data and adequacy of data are ranked at the top. Noise and noise measurement parameters are high up; transportation service factors which generally deal with the interaction between services, community economic base and transportation activities of the community, environmental impact, are fairly high, and legal/regulatory, defining markets, ground access to airports, community intrusion (the intrusion of the community on the airport and the intrusion of flights over the community), air traffic congestion, and safety are all important. Obviously, there are many other issues, but in terms of the ranking these are the most important.

On the question of airport and heliport locations, ground access and safety were the most important two considerations. Responses to other questions stressed these concerns as well. The question of ground access to heliports within a central business district as well as to airports in outlying areas was extremely important. And issues of safety, particularly for rotorcraft over urban areas, is extremely important. Other issues that were important, such as noise, proximity to users, cost of construction, etc., appeared in responses to a number of different questions. Need for more, or better, planning data, origin/destination data, and marketing data (which was one of the most frequent "Other" responses filled in) were shown to be quite important. The knowledge of what the market is, who would use these services, the various missions for rotorcraft and commuter air is something that planners are not quite sure of. They need data as to who would use the system, what fares the market would bear, what the economic operating costs would be, price elasticities, market and pricing information, as well as origin/destination data—who are the users, where are they traveling from, what type of trip purposes do they have, what time of day do they travel, how often do they travel, etc.

Also of importance to planners are noise data and safety. About 75% of the respondents felt that rotorcraft and small aircraft safety was perceived by the public as being much worse than actuality, and that this is a major issue in terms of getting people to accept and use these services. Not only the riding public but also the decision makers are affected by the public's negative perception.

To conclude, an overview of all of the responses, and recommendations, the overall concerns are being able to determine markets, being able to develop forecasts for rotorcraft users and commuter air, improving the ride quality and weather stability and safety of the vehicles, designing more efficient vehicles in terms of sizing a vehicle so that the load factors are appropriate, developing vehicles that require less maintenance, using management techniques to reduce operating costs, quantifying the cost/-benefits of economics and quality of life (not just direct benefits of revenue from their riders, but indirect benefits to a community), reducing rotorcraft noise emissions, increasing ridership through marketing techniques and education of the public as to the state-of-the-art of vehicles (which we planners are now more aware of, partly due to the impressive demonstrations provided by NASA), and educating the public as to safety and public benefits that are potentially available. And, finally, we must continue the dialogue among planners, operators, manufacturers, researchers, and public officials—and obviously that is one of the reasons that we're all here—not with a one-time conference or even an annual conference, but through a mechanism that can put into motion a continuing interaction so that planners can go back to their communities and continue getting more information and data for the planning process.

TABLE 1: DISTRIBUTION OF SURVEY SAMPLE BY AGENCY TYPE AND REGION

	REGION									
Agency Type	Northwest	West/ Southwest	Central/ N. Central	Great Lakes	South	Northeast/ New England	Alaska	Hawaii	**Total Respondents**	**Percent of Respondents**
FAA	1	3	1	2	2	2	1	1	13	24%
Consultant/ University	1		1		4	4			10	18%
State DOT or Aeronautics Division	1	2		4	2	1	1		11	20%
Port Authority		1			1	1			3	5%
MPO, RPC or COG		4	1	3	2	5			15	27%
City Agency		1		1					2	4%
County Agency		1							1	2%
Total Respondents	3	12	3	10	11	13	2	1	55	100%
Percent of Respondents	5%	22%	5%	18%	20%	24%	4%	2%	100%	

TABLE 2: RELATIVE IMPORTANCE OF MISSIONS

Missions	Rotorcraft				Fixed Wing Commuter			
	1980		1990		1980		1990	
	Percent Responding	Rank	Percent Responding	Rank	Percent Responding	Rank	Percent Responding	Rank
Public Transportation (CBD-CBD, CBD-airport, airport-airport, other)	29	6	47	5	73	2	76	1
Public Service (police, fire, rescue, etc.)	89	1	93	1	9	6	16	4
Business/Corporate	60	2	75	2	76	1	76	1
Cargo, Goods Movement	24	7	33	7	38	3	51	2
Construction	58	3	64	3	5	8	7	6
Energy Exploration	49	4	60	4	16	4	18	3
Forestry	33	5	44	6	11	5	7	6
Other	24	7	25	8	7	7	9	5

TABLE 3: THE 14 MOST IMPORTANT ROTORCRAFT AND FIXED-WING COMMUTER AIRCRAFT PLANNING ISSUES[1]

Question	Topic	Relative Importance	Mean Rating
CIII.1	Airport/Heliport location	1	1.8
CI.1	Planning data	2	1.7
CI.2	Adequacy of planning data	3	1.5
EI.1	Transportation Service Factors	3	1.5
DI.1	Noise measurement parameters	3	1.5
DI.3	Far-field noise	3	1.5
EII.4	Environmental Impact	4	1.4
DIV.1	Vehicle Performance	4	1.4
CIII.4	Legal/Regulatory data	5	1.3
CI.3	Defining markets	5	1.3
CII.1	Ground access	5	1.3
DI.7	Community intrusion	5	1.3
CII.2	Air traffic congestion	6	1.2
DII.1	Safety statistics	7	1.0

[1]Out of 46 questions which had rating boxes, only 4 were considered **very important** (+2) by 50% or more of the respondents, and 11 were rated +2 by 40% or more. Those 11 questions are listed, as well as three which received the highest percentage of +1s (somewhat important), for a total of 14. The questions are ranked in descending order, based on the mean ratings, excluding those who left a rating box blank.

RESPONSIVE TECHNOLOGY RECOMMENDATIONS

Lawrence Dallam, Director
Transportation Planning
Twin Cities Metropolitan Council

The accomplishments in the area of rotor and commuter aircraft technology are very impressive in their own right—but are outstanding when compared with ground transportation modes. What you lack (and what they have) is an effective constituency—an advocacy group—a group of people and organizations not associated with NASA, FAA, HAI, RAA, etc. that (could) benefit from your technology—but who are unaware of what these benefits are (and could be).

Consider highway transportation where the situation is almost exactly the opposite. The auto and truck propulsion (and sound) technology has not essentially changed for over fifty years—yet there is a diverse and very effective constituency of cities, counties, states, corporations, developers, truckers, and chamber of commerce that advocate the maintenance and expansion of the highway system. It should therefore not be surprising to learn that one of the U.S.D.O.T.'s three major priority missions is the completion of the Interstate highway system—or that street maintenance, repair, and construction is a major item in a city budget.

Another member of the highway transportation constituency is *the planner.* The planner may see things differently than the builder/operator—and many times be advocating a different solution or configuration, but the planner is nevertheless a vocal advocate of highway transportation because it provides benefits in many areas of social and political concern.

This is not the case in air transportation. There are very few aviation planners or planners that know something about aviation on the staffs of city, county, and metropolitan agencies. Most urban and regional planners stand somewhere on the continuum between complete indifference to aviation—and vocal opposition. If they are advocates, they usually are advocating *containment* or *separation* of aviation from the urban and suburban environment.

The aviation industry in general, and airport owners/operators in particular, have actively discouraged the involvement of planners in the planning, development, and operation of airports. This is understandable considering that planners have generally viewed engineers as "unrefined clods" with tunnel vision—dedicated to the unceasing expansion of their "technology toys," which if unchecked (by planners) will rape the environment and ruin society; whereas engineers generally view planners as "societal mutations" that speak in big words and long sentences—that say nothing—with no vision at all (just look at all the plans gathering dust on forgotten shelves) and who *create* problems rather than solve them. (As a civil engineer for 15 years and a transportation planner the past 11, I've been on both sides and felt the impact of both accusations).

The aviation industry has not communicated its technology and problems to the local policy-makers early in the decision-making process. It is difficult to convince elected officials of the benefits and virtues of locating a heliport or extending a runway in a community—when it's time to vote and there are organized citizen groups saying NO!

In response to this situation it may be helpful to further look at the highway transportation analogy. During the major expansion of the highway system in the '50s and '60s, planning was done by the engineers—in an atmosphere of public demand and acceptance. In the late sixties the public mood changed as a result of urban sprawl and noise and air pollution, and enough people said "enough"—so the National Environmental Protection Act was passed and Environmental Impact Statements (EIS) required in order to bring a highway project to construction. Also, a new transportation planning process was mandated, and planning shifted to comprehensive metropolitan agencies. Transportation planning was required to be a continuing, *comprehensive* process done cooperatively by planners and engineers. Congress set aside funds for planning agencies to carry out this mandate. Land transportation planners miraculously multiplied to meet the need (and the funds)—and planning agencies and highway agencies have since evolved from adversaries in the beginning, to an uneasy truce, and now to partners in many cases. An example of this partnership exists in the Twin Cities between the Minnesota Department of Transportation (Mn/DOT) and the Metropolitan Council. The Council as the regional transportation planners were asked by the Commissioner of Mn/DOT to help resolve two very controversial, uncompleted Interstate freeway segments—one in Minneapolis and one in St. Paul. In one case the Council was to recommend the preferred alternative for the final EIS, and actually prepare the EIS in the other. Transferring (in effect) the decision-making process to a more open and (perceived) unbaised forum has led to a successful resolution in one case and such is expected in the other. This is but one example of successful partnerships that exist in the country between planning and highway agencies.

For whatever reason, the aviation industry and the Federal Aviation Administration chose not to be a part of this federal planning process. Consequently, there are no aviation planning funds earmarked on a continuing basis for planning agencies—and therefore few aviation planners (if any) on their staffs and few aviation issues on their agendas.

There should be more joint, cooperative planning between the planners and operators at the system plan level, the master plan level, and the local planning and zoning level. The private sector should be a partner in this planning—the manufacturers, suppliers, and operators. They should be involved throughout the entire process—become members of advisory committees and task forces in order to raise issues and concerns *and solutions* to the policy-makers. In the 1978 revision to the airports system plan in the Twin Cities, helicopter issues were not mentioned. No one identified a need for heliports (no advocates) and consequently the plan is silent about heliports. This was also the case when we did our highway system plan. The role of rotor and fixed-wing aircraft in the urban transportation system is not identified—and that is a deficiency in my opinion.

I believe rotor and fixed-wing aircraft could play a significant role in urban transportation—and could provide solutions to problems in ways that are not now clear. We won't find out this role until we form some sort of partnership and involve each other in each others' affairs. We need to begin the sometimes painful process of developing understanding and trust. It can only happen through two-way communication and involvement.

I strongly believe this type of partnership could lead to an effective constituency that would advocate the development of your technology for the mutual benefit of our society and the aircraft industry.

OVERCOMING OBSTACLES TO HELIPORTS AND COMMUTER AIRPORTS

John Glover
Transportation Planning Supervisor
Port of Oakland

I. What are heliports and commuter airports?

As a general definition, they are any air transportation terminus served by helicopters or by commuter aircraft. Commuter airports include a spectrum ranging from small, isolated airstrips in rural areas to major air carrier airports, and potentially include virtually every existing general aviation airport. They can also include new airports designed and intended specifically for commuter aircraft operations, particularly in dense urban areas. Heliports include all other airports, plus all the rooftops, ocean platforms, parking lots, mountain sides, and other landing sites that helicopters alone can reach.

As a practical matter, the two extremes of the spectrum I have just described are probably not of too much concern in discussing obstacles to airport use or development. The truly rural airports generally don't meet the kind of intense opposition that is directed at airports in inhabited areas, since most obstacles to airports are directly a result of their having neighbors. Major air carrier airports, at the other extreme, have problems of such magnitude already that the introduction or expansion of helicopter or commuter aircraft operations won't make things much worse (with one major exception, the integration of commuter operations with air carrier activity in areas with airspace capacity constraints).

So the airports we're talking about are the existing small airports, serving the "Piper Cubs" and the Twin Beeches (and maybe a couple of DC-9s or 737s), built on the outskirts of town 20 or 50 years ago and now located right between the civic center and the Hyatt Hotel as the town has grown into a city around them. And they are the planner's dream of urban STOL landing strips on the river front; or the multi-purpose transportation hub complexes with tilt rotors landing on the roof, parking for 3000 cars, buses on the main floor and rapid transit in the basement. And, of course, the helipad on the roof over the board room. All have the important point that they are being used, or considered, or planned, as terminus points for commuter aircraft and/or helicopter service.

II. What are the obstacles?

Airports have been compared to the town garbage dump, though the analogy is not really an accurate one. Everybody agrees that there needs to be a garbage dump in town—they just want it to be located next to somebody else's back yard. The inaccuracy of the analogy to airports is that while nobody wants them next door either, not everyone agrees that there even needs to be an airport. Let's take a look at why they are so unpopular.

The first, and most obvious, reason is noise. Aircraft have the annoying habit of announcing their presence with growling or roaring exhaust, droning or buzzing propellers, whining turbines, and slapping rotors. Since they are overhead, and unshielded, their noise affects a much larger area than an equivalent noise level from traffic, industry, or other ground-based sources. The historical development of aircraft, and particularly business or corporate aircraft flown from general aviation fields, has caused some powerful image problems that recent technological advances are still hard-pressed to overcome. At about the same time that the booming growth of many communities was beginning to engulf municipal airports in a sea of single family houses, an inventor and aircraft designer named Bill Lear was pushing corporate aviation into the jet age. The Lear Jet was the ultimate corporate status symbol—it was sleek, sexy, fast, expensive, and almost unbelievably loud. Homeowners who signed mortgages for their piece of the American Dream in suburbs growing up around municipal airports began to feel that they had bought a nightmare instead, as business flying took off. Businesses that couldn't afford a Lear Jet flew a light or medium twin, generating twice the noise of the "piper cub" that the realtor had assured was the only user of the airport nearby (if he admitted to its existence). Or perhaps a turboprop, combining the noisiest features of both propeller and jet. The 1960s and early '70s set the stage for an avalanche of political and legal attacks on airport noise that may not yet have reached a peak. As we are learning in this Conference, technical solutions to the aircraft noise problem are available, and many are in fact already on the market. But the reputation that airports acquired in the last two decades as unacceptably noisy neighbors is still very much with us.

The next major obstacle that I want to discuss is safety. There is a widespread lack of understanding on the part of the general public about the physics and mechanics of flight. This lack of understanding is accompanied by a general lack of confidence in flying machines, as you can verify by counting the white knuckles on the passengers of any airliner preparing to take off. And airline travel has by and large been accepted by the public, particularly as airliners have gotten bigger and bigger. There seems to be something about size that inspires confidence; many people who use the airlines regularly would never set foot in a "little airplane"—a designation that seems to apply to anything with propellers, unless it has at least four of them. This fear goes double, or triple, for helicopters. At least an airplane has wings to hold it up, like a bird, so its ability to fly seems somehow justifiable; helicopters have, as it were, no visible means of support, but seem to hold themselves up principally by the production of tremendous amounts of noise and vibration.

For the public in general these fears about the ability of small aircraft to stay up in the sky is not a matter of serious daily concern. But for those living under the approach and departure paths to an airport the feeling of insecurity can approach a siege mentality. Simple logic dictates that if enough of these dubious contrivances fly over the house, sooner or later one is going to drop in uninvited. And if (as rarely happens) an aircraft actually does fall out of the sky, the fear becomes panic, the airport changes from an annoyance to a public menace, and its neighbors organize to shut it down. Aircraft accidents, even small ones, make news, and the overall result is a general predisposition to regard airports as undesirable neighbors from a safety standpoint in addition to the noise problem.

The third major obstacle is the public perception of the value of the airport to the community. There is a prevailing sentiment that airports are less an essential public service than a playground for the rich and foolhardy. Along with the widespread fear, particularly of small aircraft, is a certain predisposition to regard them as frivolous, unnecessary, and wasteful of scarce resources. The need for general aviation, business, and corporate aviation, and to a great extent even public commuter aviation, has not been effectively demonstrated to a majority of the public. Because the benefits to the community of aviation services beyond the air carrier system are not apparent, the imposition of noise and safety impacts (and other secondary impacts) by small airport users is regarded as unjustified and unfair.

The fourth and final major obstacle is economics. Airports (I am excluding heliports here) require large amounts of property, and impose restrictions on land use beyond the boundaries of their airfields. Particularly in urban areas where land values are high and competition for space is intense, the vast open spaces of an airfield may seem inappropriate and wasteful. Even the STOL aircraft we are learning about here require runways and clear areas measured in city blocks; unless tremendous utilization is achieved, a true urban airport would be difficult to justify economically as a land use. Most, if not all, existing downtown airports were built before the downtown got there; and all too often, in spite of very high levels of aviation use (or perhaps in part because of it) there are constant pressures to convert the airfield to other more intensive and "appropriate" land uses. I think it is probably impossible at present to build a new urban airport, even limited to STOL aircraft, primarily because of this economic pressure on urban land.

A second area of economic concern needs to be mentioned. An airport, as an objectionable neighbor, will reduce property values for certain kinds of land uses. Unless prospective airport neighbors expect to profit from the business or traffic generated by the airport, their reaction to it is going to be negative to the extent that it does them financial harm.

We are going to hear this afternoon about the need for legal and institutional controls to guide and foster heliport and commuter airport development, so I'll just touch on the subject briefly. Most existing zoning controls and other ordinances center, once again, on concerns for safety and noise control. New York City doesn't allow heliports on top of buildings because helicopters, or parts of them, have a tendency to fall onto passersby in the street below. Strict operating curfews result from complaints about being kept awake by aircraft noise. The problem with these kinds of controls is that once started they seem to acquire a life of their own; regulations tend to be enforced because they are there, whether or not they continue to be (or ever were) reasonable. Again, past problems and bad reputations are difficult to live down. These restrictions reflect widely varying opinions on how best to protect the public welfare. While New York City doesn't allow heliports on rooftops, Denver allows them only on rooftops; Los Angeles has no location standards at all, but heliport approval is nearly impossible to obtain there. The prevailing opinion again seems to be that heliports are a public nuisance to be controlled rather than a public service to be accommodated within the framework.

Fear of expansion of either an existing airport or a planned one can be a difficult problem to deal with. Many people have lived around an airport long enough to see it grow from a small pleasure aviation strip to a bustling business airport, from occasional overflights to continuous operations. As I mentioned earlier, these shifts have been accompanied by dramatic increases in noise and safety concerns, and have led to a "foot-in-the-door" syndrome: Any airport is assumed to be destined to become a bigger airport. Airport neighbors (or prospective neighbors) may oppose not the airport that is proposed, but the airport they think will ultimately result. They are afraid, again, of noise, of safety, and also of traffic impacts, decline in property values, and other impacts that they may feel are not apparent yet but will appear as the airport inescapably grows.

Airports also have a proclivity to become political footballs. They appear with monotonous regularity as election issues, often with candidates vying to achieve the most visible anti-airport stance. The basic issues, again, are noise, safety, and airport value to the community. Politicians take anti-airport stands because they perceive that position as a popular one—one that puts them on the side of the people, opposing privilege and public subsidy of the wealthy. The benefits of the airport are nebulous; the adverse impacts are very apparent.

III. How do we overcome these obstacles?

There are two basic ways to approach solutions to these problems. The first is to recognize that there are legitimate concerns expressed by airport neighbors, and to try to do something about them. The second is to recognize that the value of an airport is regional in nature, and to try to protect it as a regional resource. In practice a combination of these approaches will almost always be necessary—make the airport as easy to live with as possible; and then protect it from those who are still unhappy with it for one reason or another.

Much of the technical information presented at this Conference deals with the first approach. Quieter aircraft are better neighbors. Safer aircraft make people less nervous. Aircraft that takeoff on shorter runways, or climb and approach steeper, take less valuable real estate. Giant strides have been made in the last five years or so in noise reduction; new generation business jets are often quieter than small twin-engine propeller aircraft, and rotor technology has produced significantly quieter helicopters. Safety improvements are constantly being made, including more reliable powerplants, improved landing aids, aircraft communications, collision avoidance systems, and so on. As I said before, airports have a reputation to live down; technology is providing a lot of the tools needed to change that negative image, by improving the aircraft that use them.

Airports must also be willing to accept some constraints from the community, where serious compatibility problems can be mitigated in this way. By imposing limitations on the weight of aircraft that can use an airport, or on the noise level they are allowed to produce, the airport can eliminate the most objectionable users and demonstrate an understanding of community concerns. Establishment of curfews can reduce or eliminate noise during sensitive evening and nighttime hours. A word of caution: these restictions must be carefully worked out to avoid running afoul of federal regulations governing air commerce. There is also the danger of imposing restrictions that comprise the value of the airport by over-limiting its use.

Another response to legitimate concerns about the airport as a neighbor is to keep the neighbors from getting too close. There are three ways to protect airports from incompatible surrounding development. The first is the basic planning tool of zoning. This provides a legislative framework for controlling development around an airport, but it depends upon the zoning authority's interest in protecting, rather than abating, the airport. It is generally more valuable if the area surrounding the airport is under the zoning control of the city that owns the airport; all too often an airport causes negative impacts on property in another city, outside the zoning jurisdiction of the airport operator. (As an example, Oakland spent over one million dollars and a year and a half trying, only partly successfully, to prevent residential development adjacent to its air carrier jet runway in the city of Alameda.) Zoning is, of course, subject to political manipulation, and may be less effective in providing long-term protection than the next two measures.

The second means of protecting the airport's neighbors is less subject to political tides, but is much more expensive. This is the purchase of property around the airport for use in ways that are compatible with the airport. This provides permanent and essentially certain control; it is probably practical only for areas close to the airfield over which other forms of control are unavailable. It is possible to purchase property and then resell it with deed restrictions limiting its use.

The third method begins to cross the line between protecting the airport's neighbors from airport impacts and protecting the airport from the neighbors. This is the acquisition of property easements granting noise rights, overflight rights, and other concessions. These easements are a way of compensating airport neighbors for the inconvenience of living next door. If properly prepared, they also provide legal protection to the airport. Another way to use easements is to exact them as a condition of development rights under zoning laws; combining zoning restrictions with easements can provide protection to the airport and still allow land uses nearby that might otherwise be incompatible. There is a clear danger in this approach, though: the easement does not make a land use compatible, it only makes it legally acceptable, and only until a sharp attorney finds his way around the language of the easement. If you are contemplating this approach, use it very carefully.

The most important way to protect the airport from its neighbors is to place them in the minority. Of the thousands of people that use a typical small airport, relatively few live near it. Yet it provides a valuable service that will be lost if local pressure closes it down (or prevents it from being built in the first place). If you can demonstrate the benefit to the community that the airport provides, as a source of jobs, tax revenue, recreation, and of course, transportation services, and demonstrate it effectively enough, you can perhaps make the anti-airport political stance less popular and point out that local problems created by the airport are overshadowed by its value to the community as a whole.

The new technology presented at this Conference is giving us participants a good look at some ways to overcome obstacles to heliports and airports. The airport neighbors with the noise and safety concerns need to know that these advances are coming. They need to see the demonstrations of quiet jets and helicopters, and to be assured that this technology is not impractical scientific doodling but solid, marketable engineering fact that is going to replace the current aircraft that make the airport next door so difficult to live with.

Finally, as I mentioned at the beginning of this paper, the backbone of the commuter airport system is, and will continue to be, the existing general aviation airports. These airports are succumbing to economic and environmental pressures all over the country. If there is to be a viable commuter air service system, you as planners must protect the airports in your communities. Without them such a system cannot exist.

A ROTORCRAFT OPERATOR'S PERSPECTIVE AND COMMENTS

Lt. Robert Morrison
Aero Bureau Commander
Huntington Beach, CA Police Department

What is a guy like me doing at a meeting like this? I must admit that since I have been to this meeting, going to the luncheons, and participating in the workshops, I have had a lot of fun because I introduce myself, and the person I am talking to says, "Hi there, I'm Joe Blow; I'm from ABC Planning Corporation and you're Bob Morrison, Huntington Beach Police Department!!? Nice weather we've been having here lately."

I'd like to say that my substitution for Mr. John Anderson may present a little bit different perspective, and some of the things that have been presented at the meeting thus far give you an idea of what the role of public service aircraft is in your community. A typical aircraft that we started out with as far back as 15 years ago, very aptly could be described as the Volkswagon of helicopters, and many of them are still flying today. We fly a variety of equipment of all different sizes, capabilities, and speeds. In Los Angeles County in 1976, 983 search and rescue flights occurred. Of these 983 victims, 177 were critical victims. A survey I did in 1978 shows that in the state of California there were 30 public service agencies which included the Border Patrol, the local sheriffs, city police, Highway Patrol, Drug Enforcement Administration, etc. Because of the close proximity of Las Vegas, Neveda, we include their operation, bringing the total to thirty-one, and we flew 89,000 hours in 1978. We comprise one-sixth of the total fleet of helicopters that are operating in the United States and one-third of the flight hours. These are sobering figures here but they can all be justified and substantiated.

Unfortunately, the airways are not always used for commuter air travel or helicopter travel; they are sometimes used for devious and self-serving means. Sometimes aircraft accidently fall out of the sky. An airplane crashed less than a half-mile from the heliport in the City of Huntington Beach about six years ago. The cargo that spilled out of the doors was bales of marijuana.

Sometimes we drop in on you at the most unexpected times. We don't always plan for a lot of the events that occur. But people have a habit and a way of getting themselves stuck in predicaments that they didn't necessarily plan on. Here is an example of planning. The Ontario Motor Speedway in Ontario, California was designed and built for racing cars. When they built the place they didn't have the foggiest idea that it would be used for the Cal Jam II with 30,000 people jammed in one location for two and a half days. They had births. They had deaths. They had everything that went on in between. (Laughter). Seagulls flying overhead of the smoke rising out of there were known to spin-out and crash. (Laughter). Another unplanned event goes back a little bit in time—a man climbed to the top of the tower at the University of Austin, barricaded himself up there, and killed about 18 people with sniper fire—a totally unplanned event in an urban community.

We have had training excercises in San Bernadino County in a joint operation between San Bernadino County, the Los Angeles County Sheriffs, and the Los Angeles Police Department with a kind of air/ground team. We work in conjunction with the officers on the ground. A patrol officer, or you or I driving by a vacant field, look out the window and see—a vacant field. The helicopter flying overhead notices a dead body in the middle of the field. Arrests that otherwise could not be made are made as a result of this air/ground surveillance.

This is what I would propose that you, the planners, take back to your community. From my perspective, every city hall and every community hospital should have a heliport sitting on top of it. The people who were having the time of their lives at the MGM Hotel in Las Vegas last year never dreamed that they were going to go for a helicopter ride that morning. But over 320 people had a ride of their lives that morning and over 320 people had a ride that saved their lives. My message to the planners at this session which is titled Community Transportation Planning is very simple. Plan on it and hopefully it won't happen. Thank you very much.

SESSION IV: REGULATORY PERSPECTIVES

Jean Ross Howard, Chairman
Director, Helicopter Activities
Aerospace Industries Association of America

Good morning, I'm Jean Ross Howard, Director of Helicopter Activities, in the Office of Public Affairs, Aerospace Industries Association in Washington, D.C.

The AIA is the national trade association of companies in the United States engaged in research, development, and manufacture of Aerospace Systems, including helicopters, manned and unmanned aircraft, missiles, space launch vehicles, and spacecraft and propulsion, guidance, and control units for all the foregoing.

I very much appreciate being invited to participate in this Conference on the two fastest growing segments of aviation—rotorcraft and commuter airlines. Thank you, Bill Stockwell, for including me.

I'd like to add my thanks to NASA for the impressive flight demonstrations of the XV-15 and the QSRA—future technology is here. And thanks to Bell Helicopter Textron and Hughes helicopters for providing first flights for so many of the attendees. Now they can share our appreciation for the versatile helicopter and recognize the need for more public heliports.

Yesterday, Alan Steven and Tom Stuelpnagel gave excellent reports on the current status of the commuter airlines and rotorcraft.

Thanks to Federal Express, I have copies of the 1981 AIA Directory of Heliports and can report the latest heliport data. There are now 3,985 heliports in the United States, Canada, and Puerto Rico, an increase of nearly 16% over the 1977 total of 3,432.

The greatest increase has been in the hospital heliports. There are now 905 of these life-saving facilities, a 28% increase over the 699 reported in 1977, an astronomical increase over the 1965 total of 34.

The bad news is this: of the 3,985 heliports listed, only 348 are public use facilities, down from the 1977 total of 417.

There are 3,637 heliports for private or prior permission use compared to 3,016 in 1977. This increase reflects not only greater utilization of the helicopter, but also the growing variety of business use and destinations. Today, there are heliports at banks, breweries, shopping centers, vineyards, race tracks, stadiums, publishing companies, newspapers, TV and radio stations, assembly plants, convention centers, museums, inns, hotels, motels, departments stores, city halls, utility, insurance, steel construction and mining companies, cosmetic firms, prisons, farms, and the White House.

The need for more public heliports is critical. City center ground level or rooftop facilities are essential to permit the point-to-point transportation above ground traffic and below airlines traffic which only the helicopter can provide. These urban heliports can serve as reliever airports for the growing fleet of business helicopters.

Without public heliports, metropolitan areas today lack a balanced and complete transportation system. Heliports should be part of any public use building built today. Chicago and Los Angeles City ordinances require rooftop emergency helicopter landing areas on high rise buildings. Recent high rise fires have tragically and dramatically demonstrated that these 50-feet rooftop clear zones can save lives—when the only way out is up.

The Directory of Heliports was published jointly by Aerospace Industries Association and Aviation Week & Space Technology, 1221 Avenue of the Americas, New York, New York. There are order forms on the table at the back of the room, together with complimentary copies of the 1981 AIA Directory of VTOL Aircraft and the AIA, HAI, NBAA brochure "Positive Planning For Heliport Approval;" please change the FAA Form number to 7480 on the first page.

This morning the subject for our Panel of Experts is Regulator Perspectives.

Regulations or lack of regulations can be critical in the development of rotorcraft and commuter airline transportation. For example, in states such as California and New Jersey, helicopters must be licensed. while in some cities like Washington, D.C. there are no zoning regulations for heliports and no public heliports.

We have a slight deviant in our program. . .James Lightsey was unable to come at the last moment, and at the last moment we found a good friend and a neighbor of mine, the Mayor of Alexandria, Virginia, Chuck Beatley, a former United Airlines captain, is now owner of Virginia's Warrenton Airport and Warrenton's Soaring Center. He's a member of the Northern Virginia Transportation Commission, the Virginia Aviation Commission and the Washington Metropolitan Transit Authority. Chuck we're happy you could join us.

HELIPORTS AND COMMUTER AIRPORTS IN PERSPECTIVE

James V. Mottley, Chief
National Planning Division
Federal Aviation Administration

Much is being said about advanced aircraft technology, and the potential growth in commuter and rotorcraft air transportation. In traveling to and from Monterey and watching the NASA Ames demonstration, we have witnessed the potential of modern aircraft for short-haul transportation. The XV 15 (tilt rotor research aircraft) and the Quiet Short-Haul Research Aircraft (QSRA) are so new and impressive that we might wonder how long it will be until they receive public acceptance. Yet, one of the most remarkable aspects of the aviation industry is the rapid acceptance that innovations receive. This openness to new ideas is a characteristic of rapidly growing industries and aviation is certainly growing rapidly.

Over the past ten years, enplanements increased from 170 million passengers in the early 1970s to 324 million in 1980, and almost 500 million annual enplanements are forecast by 1990—in other words, an increase in the next ten years of about 150 million enplaning passengers over what the system is carrying today.

Our civil aircraft fleet is also expected to increase dramatically, with the addition of 100 thousand new general aviation aircraft, 370 new large air carrier aircraft, 1,500 new commuter aircraft, and 4,400 rotorcraft by 1990.

The primary purpose of this Conference is to discuss the future of rotorcraft and commuter aircraft and learn how they might influence future community and regional transportation systems. A key consideration is the availability of landing areas to accommodate these aircraft. We must keep in mind that the development of new and improved landing facilities is as important as the development of aircraft themselves because adequate airports are essential to air transportation.

Local and state governments have the primary responsibility for the establishment of landing areas throughout the nation. Government officials and planners—many of them members of the American Planning Association—play an important part leading to the success or failure or efforts to provide these facilities. If timely provisions are not made in the overall community planning process, including the preparation and revision of zoning ordinances, it will be difficult if not impossible to improve existing landing areas and establish new ones. In the case of rotorcraft, additional public use heliports may be exactly what is needed.

In the late 1960s, scheduled service in Chicago, New York, San Francisco-Oakland, and Los Angeles demonstrated the public acceptance of helicopters. A number of heliports were established specifically for use by these carriers. However, the earlier technology and helicopter operations were vulnerable to competition from other modes of transportation, so scheduled passenger service was gradually suspended. The same level of intracity public air carrier service has not been reestablished since, but the potential is still there and it could be developed by using the latest helicopter technology. Today, the main need, particularly in the metropolitan areas, is for the establishment of an adequate system of public use heliports to serve corporate and air taxi operations. It is quite possible that with such facilities, air taxi operations would develop into regularly scheduled service.

Within the FAA, we are monitoring helicopter activity levels and forecasts to determine the need for public use heliports. We have records as of December 1980 on over 2,300 heliports, including those located on airports. Approximately eight percent of these heliports are open to the general public. Such landing areas can generally be used by all types of users including emergency helicopter service, corporations, air taxi operators, and individuals. The private use heliports, which make up 92 percent of the total, are generally privately owned and not available for public use. If the private use heliports were available for public use and met adequate design standards, many metropolitan areas might have an adequate system of heliports today.

To give a few examples, we identified and plotted the heliports within a 30-nautical mile radius of the Central Business District (CBD) for several of the largest metropolitan areas. We found that Atlanta has 70 heliports, Boston 68, Chicago 83, and Los Angeles 143—again these are all within 30 nautical miles of the CBD. Many of these heliports are located along major arterial highways and rivers. It may be that these collections of predominantly private use heliports could comprise the framework for the public use heliport systems of the future.

A question that often arises is how to determine the need and establish the location for a public use heliport? We believe that these issues are best addressed in the heliport segment of the local, regional, or state air transportation plan. However, the FAA does have some guidelines for national use. For the purpose of developing the National Airport System Plan—The NASP—we consider a public use heliport to be warranted if (1) there are 800 total itinerant operations (an average of slightly over two operations per day), or four based helicopters, or where the heliport is served by air taxi which has a minimum of 400 annual itinerate operations, (2) the heliport meets commuter service criteria (i.e., receives regular service from one or more registered commuter air carriers and has enplanements of 2,500 or more passengers in the previous year, (3) the point is, or was served by a CAB certificated air carrier, and (4) preferably such heliports are included in an acceptable regional, metropolitan, or state aviation system plan if one exists.

The considerations in locating a heliport site are the more difficult to define. Our Heliport Design Guide (Advisory Circular 150/5390-1B) covers the physical dimensions of the landing area and the requirement for obstruction free access and egress routes. In addition, the nature of surrounding land uses and the proximity to the origin and destination points for trips must be considered when evaluating potential sites. These considerations are best handled by local planners on a case-by-case basis.

Before I discuss the status of commuter airports, I would like to mention to those of you who are not familiar with the NASP, that it is a compilation of development needs at approximately 3,600 landing areas which comprise our basic national system of airports. These are the public airports and heliports which are eligible for federal planning and development grants. In other words, to be eligible to receive federal grant funds, a location must be included in the plan. I might add that since the passage of the Airport and Airway Development Act of 1970, airport system planning has also been eligible under the FAA's grant program. In fact, in the last few years, forty-five (45) states and approximately thirty (30) metropolitan areas have prepared system plans and many have undertaken continuous aviation system planning. In addition, many airports have received grants for the preparation of detailed master plans. From the Aviation Trust Fund, over the last ten years, approximately $95 million in grants have gone into aviation planning.

Turning to the system of airports served by the commuter air carriers, we find that these carriers operate at a wide spectrum of airports—from the largest hub locations such as Chicago O'Hare to smaller communities such as Page, Arizona.

As most of you know, commuter airlines are operators of either rotorcraft or fixed-wing aircraft with 60 seats or less, which perform at least five round trips per week between two or more points and publish flight schedules which specify the time, days of the week and places between which such flights are performed, or transport mail by air, pursuant to contract with the United Postal Service. Since they operate the smaller air carrier aircraft they are granted exemption by the CAB from the requirement to obtain a certificate of public convenience and necessity. They must, however, register with the CAB, file fares and schedules and carry prescribed liability insurance.

The history of the commuter, and its relationship to airport development, includes several significant factors that contributed to the growth of this segment of the aviation industry. The first began with the introduction of turboprop and commercial jet aircraft in the late 1950s and early 1960s. These large new aircraft displaced the older, piston driven aircraft in the airline fleets, requiring longer runways and more enplanements to maintain service to smaller communities. Where passenger service was marginal but there was a need for air mail service, a federal subsidy was provided to the air carrier. Even so, airline service to small communities was often infrequent or inconvenient. In cases where Air Mail service was not essential and enplanements were low, service was suspended or deleted. Enterprising businessmen began providing air service to the communities, using light aircraft on a scheduled basis. The CAB recognized that these air carriers were operating smaller aircraft and exempted them from the certification procedures required for larger air carriers. The smaller air carriers were permitted to operate under less severe economic regulation. Public acceptance and reliance on this service resulted in growth to the point that the Congress specifically acknowledged its special airport needs. The 1976 amendments of the Airport and Airway Development Act established a special funding category for landing areas served by commuters. Another significant event came shortly thereafter, with the passage of the Airline Deregulation Act of 1978. Deregulation provided flexibility for service changes by the certificated air carriers, allowing them to adjust their markets their markets. The route structures. This accelerated the reduction or loss of service by use of the larger aircraft at low activity points, providing the commuters with an opportunity to expand significance of this discussion is that these two factors left airports in the communities serviced by the commuters, for the most part, with airports adequate to continue or initiate their operations.

It is interesting to note that, consistent with the Airline Deregulation Act of 1978, the CAB will no longer certificate air carriers after January 1, 1982. This will tend to blur the distinction between the various types of air carrier and commuter scheduled services. Legislation is being considered by the Congress that would combine the present commuter service and air carrier airport classifications into a single new airport category—the Commercial Service Airport.

Some 286 commuter airlines serve 816 airports, of which 145 are classified as commuter service airports. The remainder are either air carrier locations, or have less than 2,500 enplanements and are classified as reliever or general aviation airports.

Commuters are often identified with small cities, but the typical commuter market is a pair of cities—one quite large, the other quite small. Looking at the top 25 passenger markets, virtually all involve a large or medium hub. An exception is the Philadelphia/Washington market which involves two large hubs. The largest commuter market is between St. Thomas and San Juan. This is also a unique market, which generates enough passengers to support a certificated air carrier but, because the trip is very short and the runway length at St. Thomas is limited, a commuter is able to dominate the situation.

No matter what parts of the commuter industry are examined, it is obvious that they must provide reliable service in order to succeed.

Service interruptions due to adverse weather must be kept to a minimun. With this in mind, the FAA recently reviewed the instrumentation at airports served by commuters. The conclusion was that most airports are already very well equipped, but some additional facilities are warranted, particularly at low activity airports. The FAA has responded to this need by lowering the commuter activity levels needed to qualify for precision instrument landing systems, and by giving these facilities a high priority for future programs. This action will help the development of commuter service, particularly in small communities.

When all is said and done, the rotorcraft and commuter industries have one thing in common, they are very dependent on adequate landing areas provided by local governments. So I challenge the planning community to be aware of the potential growth of these industries and the benefits they may yield, and to ensure that the need for airports and heliports is considered in the comprehensive planning process. This is the bottom line, the FAA's supportive role is important, but it cannot substitute for local initiative and "grass roots" support for airport planning and development.

Thank you for giving the opportunity to address you today.

THE NEED FOR A MODEL LOCAL ORDINANCE

Ronald Bixby
Director of Planning
System Design Concepts, Inc.

The purpose of my remarks is to identify some of the reasons why a model heliport ordinance would be a useful tool for community planners and local public officials. This finding is based on a comparison of existing heliport ordinances in 5 urban areas which was conducted as part of the APA/Sydec report prepared for this Conference entitled, "Planning For Rotorcraft And Commuter Aviation." I will briefly cover 3 points: 1) background on why the assessment of heliport ordinances was conducted; 2) the various types and major provisions of existing ordinances; and 3) benefits of a model heliport ordinance.

The impetus for a comparison of heliport ordinances came from a survey of 55 community planners involved in rotorcraft and fixed-wing commuter aviation which was conducted in advance of the Conference. We found that in talking to planners from areas where new heliport proposals were being made, there was often a knee-jerk reaction on the part of public officials to respond by adopting a new local ordinance. Most planners felt ill prepared to advise public officials concerning the appropriateness of such an ordinance, or its technical provisions. The result was often denial of the proposal, or an unnecessarily long and restrictive local approval process. At the April 1981 Boston APA conference workshop on helicopters and commuter aircraft, we found that planners considered new heliport ordinances to be a significant problem with few readily available answers. Some planners were conducting surveys of their own to obtain information on this topic.

As a result of this interest, it was decided to examine some of the major provisions and issues associated with a sample of existing heliport ordinances, including New York, Chicago, Houston, L.A., and Denver, as well as several ordinances from smaller suburban and rural areas. Our methodology included initial review of the ordinances available from these areas, followed by phone conversations with planners and others regarding their content and issues. I want to emphasize that no attempt was made to assess the reasonableness of these ordinances, due to limited resources.

Figure 1 shows the two basic types of local heliport ordinances. One can be described as "piecemeal." That is, specific helicopter or heliport provisions might be added to existing sections of different municipal regulations, such as a zoning ordinance, building code or fire code. Another type of ordinance could be characterized as "comprehensive," combining all or most of the relevant helicopter/heliport provisions in one section of a municipal code. Most cities, particularly the smaller ones, have no helicopter provisions. Only two of the five urban area ordinances reviewed could be described as comprehensive.

There are at least nine major provisions which are often contained in heliport ordinances. None of the ordinances that we looked at contained all of the provisions identified in Figure 1, and the level of detail associated with each provision varies considerably. For example, there is wide variation in the terminology and the classification schemes that exist from one ordinance to another. Some ordinances are based on the size of the helicopter or its operations. Others use classification schemes based on the use of the facility, such as a public or private facility or the number and type of support facilities that a heliport might have. Such nonstandard terms as "helistop" or "helipad" contribute to the confusion.

Some ordinances require a permit from only one municipal department. Others require permits from a broad range of municipal agencies such as fire departments, police departments, building departments, zoning agencies, and so forth. Approvals are sometimes required at both the municipal level and at the state level, resulting in two, often duplicative, levels of procedure. A wide range of practices exist for permit fees, including no fees, flat fees, or graduated fees according to facility classification. Approval periods vary. Some ordinances have specific periods for approving an application of up to sixty days, while others have no specified time. Many ordinances have provisions for a temporary permit which can be granted after only five days.

One of the amazing things about the ordinances we reviewed was the variation in requirements for application content. There is little agreement on what information is sufficient in order to grant a permit. At least 10 major requirements were identified, including proof of financial responsibility, site plan, operations plan, statement of public need, structures report, compliance report, and documentation of insurance. The danger is that in an effort to be both thorough and responsible, new ordinances will require permit applications which are unnecessarily detailed, time consuming, and costly.

An important provision in some ordinances is emergency rooftop access. Most ordinances don't have such a provision. Some make this provision voluntary, especially for clear areas. I've talked to several officials who would like to adopt this provision in their ordinance, but they can't resolve the issue of who is in charge of the rooftop of a highrise building during an emergency: the fire department, police department, or the emergency rescue team. Please refer to our Conference report for a description of the remaining major provisions, including periodic inspections, revocation of permits, and penalities for violation of an ordinance.

FIGURE 1: TYPICAL MAJOR PROVISIONS AND TECHNICAL STANDARD CATEGORIES FOR LOCAL HELICOPTER FACILITY ORDINANCES

Type of Ordinance	Provisions	Technical Standards
PIECEMEAL - Provisions added to various ordinances including:	Facility Classification	Layout, Design, and Construction
• zoning	Permit Requirements	Location
• fire code	Permit Fee Schedules	Hours of Operation
• building code	Approval Periods	Insurance
• franchises	Required Application Content	Insurance
COMPREHENSIVE - A single integrated ordinance causing all aspects of heliport regulation	Emergency Rooftop Access Requirement	Safety
	Periodic Inspections	Environmental
	Revocation Procedure	
	Penalties for Violation of Ordinance	
Source: Compiled by Sydec from ordinances collected from several cities		

Figure 1 shows also that there are at least six different categories of technical standards contained in existing heliport ordinances. These include layout design and construction of heliport facilities, locational criteria, hours of operation, insurance, safety, and environmental concerns. Without getting into the specifics of each of these categories, let me summarize some of the findings. Number and type of standards vary greatly among the ordinances we reviewed. Technical standards included both qualitative and quantitative criteria. In some instances standards are based on guidelines provided by the FAA, HAI, National Fire Protection Association, State Aeronautics Boards, and other groups.

Most technical standards in existing ordinances do not reflect changing aircraft performance and technology, and therefore "lock in" the characteristics of the facility. For example, Figure 2 shows two types of minimum landing area design criteria. One is based on the gross weight of the aircraft combined with specific geometric dimensions. The other is based on the use of the facility, such as private small, private large, public large and factors which reflect the dimensions of the aircraft. The later technical standard is designed to account for the future changes in size and operations of helicopters.

The results of the comparison of helicopter ordinances suggest that some guideline, possibly a model ordinance, is needed by community planners and public officials. Guidelines should address several important issues. First, are helicopter ordinances necessary at all? Certainly not in all communities and not under all circumstances. If they aren't necessary or needed, what are the alternative mechanisms that can be used to protect the public and to respond to the concerns of public officials? Second, what level of government is responsible for local heliport regulation? Currently, heliport authorization is a split responsibility between the state and local areas and sometimes

FIGURE 2: HELICOPTER MINIMUM LANDING AREA CRITERIA

Facility Classification	Aircraft Weight Standard		Facility Use/Aircraft Size Standard	
	Gross Weight	Minimum Landing Area	Use	Minimum Landing Area
Class I	Up to 6,000 lbs.	Ground level: 75 feet x 75 feet Elevated: 40 feet x 40 feet with additional 18 feet perimeter safety area.	private (small)	1.5 times helicopter length, plus ¼ helicopter length for perimeter safety area.
Class II	6,000 lbs. to 12,000 lbs.	Ground level: 100 feet x 100 feet Elevated: 50 feet x 50 feet with additional 25 feet perimeter safety area.	private (large)	1.5 to 2.0 times helicopter length, plus ¼ helicopter length for perimeter safety area.
Class III	12,500 to 20,000 lbs.	Same as above.	public (large)	1.5 to 2.0 times helicopter length, plus ½ helicopter length for perimeter safety area.

Source: Compiled by Sydec from ordinances collected from several cities.

results in confusion and unnecessary procedure and delay. Third, what kind of ordinance is appropriate for different size areas in different parts of the country, and what are reasonable technical standards?

In conclusion, a model local helicopter ordinance and guidelines for its use and application would have immediate benefits and application throughout the country. It would assist community planners and elected officials in determining if, when, and where a helicopter ordinance might be necessary. A model ordinance would describe reasonable provisions and technical standards to protect the public interest and promote commonality in the ordinances being adopted by different local jurisdictions. Finally, a model ordinance would help to shorten and simplify the local review and approval process that heliport developers face with almost every new proposal.

REGULATORY CONSIDERATIONS

Jack Thompson
Aviation Representative (Heliport Planning)
Ohio Department of Transportation

Thank you, Jean. My purpose this morning is to present a brief overview of the regulatory environment that is common for all types of aviation transportation planning. However, I am going to address it the light of heliport planning, even though it is equally applicable to conventional take-off/landing facilities and also Stol landing facilities. Now, the approach I am going to take since most of this information is almost second nature to most of the aviation types we have in the audience — essentially a shopping list and cookbook approach to the planners in the audience — and in order to maintain the acute level of alertness that I perceive in the audience I will try to make it as brief as possible because it is fairly dry information.

There are essentially, of course, three levels of regulatory action on the federal, state and local levels. I would like to look at each one of those briefly, first looking at the actual bureaucracy or authority that handles these functions on each level and then the regulatory bases and then a few points that might be of interest to the planners in their efforts to gain heliport approval. First, on the federal level, the United States Department of Transportation, which is a Cabinet-level office that was established in 1966 during the Johnson Administration, leads and coordinates all federal government transportation programs and recommends policy and needed legislation to the President and the Congress. Basically it functions to develop the national transportation systems and to conduct research programs to advance safety in transportation. And, additionally, the DOT serves to encourage cooperation within the private sector of the transportation industry. All these functions are handled within the DOT by various sub-bureau or bureaus relating to specific modes of transportation, such as highways, railways, waterways, mass transit, and, of course, air. Which brings me to the case in point, the Federal Aviation Administration. Now the FAA, and with all due reference to the Future Farmers of America, it is the FAA and not the latter—the FAA promotes and regulates air safety, governs use of federal airspace and it performs this function by developing, installing, maintaining and operating air traffic control systems and the necessary navigational facilities that are associated with the ATC systems. Also, it continually conducts research and development programs in the interest of improving those systems, as well as other functions, such as certification of aircraft and equipment and their modifications for air worthiness and safety as well as pilots, air crew and maintenance personnel for their knowledge, proficiency and medical qualifications. Additionally, the FAA supervises the publication of aeronautical charts, instructional materials and reports, including the advisory circulars—now at this point I would like to emphasize the importance of advisory circulars in my presentation but I would like to tell you about them in more detail later. Now like any self-respecting federal bureaucracy the FAA organization is composed of a myriad of offices and associate administrators, all reporting to the administrator and, of course, located in Washington, D.C. However, as initial points of contact for the heliport planner, the FAA has various regional offices located throughout the country to handle its field operations. Recently, in the interest of cost reduction and efficiency, FAA Administrator Helms had made a proposal to consolidate the eleven existing regional offices into six that encompassed the same area of—just hoping to increase the efficiency by consolidating much of the same functions that are held by the smaller regional offices as they exist today. Evidently that program has reached kind of a snag but it is in the works and will probably come about. These six proposed regional offices are located in Anchorage, Alaska; Atlanta, Georgia; Boston, Massachusetts; Seattle, Washington; Fort Worth, Texas; and Kansas City, Missouri. I mention that just to give you an idea of where you might want to go initially to gain your support and information from the FAA in your efforts in any particular area.

Each regional office in turn maintains—well, of course, many different field offices located throughout its area of operation. The two that are most germane to your function as a heliport planner would be the airport district or field offices, also known as the ADOs, and the general aviation district offices, known as GADOs. These are usually located in major population centers within the regional area or in areas of high aviation activity. These offices serve as a grassroots level interface of the FAA with local aviation community airport and heliport planners and the general public. The airport district offices are outlying units or extensions of the regional airports divisions. They advise and assist the public agencies and their agents with the submission of project requests for establishing, improving, equipping and financing airports and heliports under the ADAP Program which has been mentioned previously, and they also provide advisory services to the owners and operators of both public and private airports and heliports regarding the operation and maintenance of their facilities. The GADOs—General Aviation District Office—conduct those air safety programs relating to certification, inspection, surveillance of general aviation operators, agencies and related airmen, aircraft air worthiness, air taxi operators, aerial applicators and rotorcraft external load operators, and conduct inspections of general aviation flight operations and maintenance to ensure compliance with safety requirements.

The statutory basis for these federal offices that I have just outlined, the Transportation Act of 1966 which is also known as Public Law 89-670 under Title 49 of the United States code-Transporation. Now this forms the statutory basis for all of U.S. law relating to transportation. This act, among other things, specifically transferred the functions, powers and duties of the old Federal Aviation Agency, which had been an independent agency since 1958 to the Secretary of Transportation and created the Federal Aviation Administration within the DOT to handle these functions. The FAA receives its statutory charter, then, from the Federal Aviation Agency, which I mentioned earlier, and established the legal basis for the Federal Aviation Regulations, also known as FAR's, which are codified under Title 14, Code of Federal Regulations, Aeronautics and Space, Chapters 0 through 199. The FAR Part 157 is of particular interest to help our planners as it deals with the requirement for Notice of Construction and activation of airports and heliports to the FAA. Now, the Advisory Circulars that I mentioned earlier are, as the name implies, advisory in nature only and unless they're incorporated into a regulation by reference, the contents of an Advisory Circular are not binding to the public. . .on the public. However, since the FAR's are issued by the Federal Aviation Administration, and in a numbered subject system corresponding to related FAR's the tendency is to accept the contents as legal gospel. . .that's not the case and I wanted to make that very clear to the planners that might be working with these Advisory Circulars. They are advisory in nature only—keep that in mind. In the draft study, the Appendix section which has been distributed to everybody. . .in Appendix D, the first category lists a series of Advisory Circulars that would be of interest and importance to heliport planning. A piece of Federal legislation that has been significant or has had a significant effect on airport planning is the Airport and Airways Development Act of 1970, Public Law 91-258, which has been mentioned earlier as the basis for the Airport Development Aid Program known as ADAP, that Jim was mentioning earlier. The FAA developed the ADAP program to carry out the provisions of that Act, which authorizes grants of federal funds to sponsors of airport development in order to bring about establishment of a nationwide system of public airports adequate to meet the present and future needs of civil aeronautics. The Airport Act of 1970, however, contained no specific provisions for heliports, although the 96th Congress did propose some heliport legislation last year as part of ADAP renewal—unfortunately the ADAP program was allowed to expire in September of '80 leaving the FAA with no legislative authority to grant funds, which still exist in the Aviation Trust Fund, by the way, as Congressman Mineta related to us the other day at lunch, for heliport development.

So much for federal involvement in heliport regulations. State authorities—most states have a Department of Transportation analgous to the Federal DOT in functional organization in scope. These manage state transportation systems and levy various taxes related to transportation in order to provide funding for their programs. The State DOT's also serve as an interface with the Federal DOT then, to coordinate and administer joint funding of transportation projects. As a general rule, those states with the DOT have some form of aviation division or aeronautics commission with an organization similar to the FAA in function on the state level. However, its usually to a far lesser degree of complexity. . .some states having an aviation commission with a staff of maybe 1 or 2 or 3 perhaps. In others, they're considerably larger. Also, in lieu of the division of the DOT, some states also operate independent aeronautics commissions which are made up of board members throughout the state that have some type of affiliation with the aviation industry in one way or another. I would urge heliport planners and proponents of heliport construction to contact the appropriate state agency in the area that they want to work in—again I refer to the second category B in the Appendix for a list of their addresses and phone numbers. The state laws and regulations that support these state agencys—the supremecy clause of the Constitution states that the Constitution and the laws of the United States shall be the supreme law of the land. Aviation is so much under federal regulation that we tend to see federal law as always supreme, thereby pre-emptive over state law and indeed some federal law does take precedence over state laws such as regulating air carriers, aircraft owners, supersonic flight, etc. States' rights are jealously guarded by the states and the Constitution specifically declares that rights not held by the Federal government shall rever to the various states, therefore, many states have their own aviation codes, regulations, etc. These laws usually have some sort of provision for the creation of authority of an aeronautics commission mentioned earlier and they also provide the statutory basis for the state aviation rules and regulations, again analagous to the FAR's. About three-fifths of the states rely wholly on the Federal Aviation Regulations to enforce their laws. Some, as I mentioned, also have their own laws. The laws in each state generally tend to be fairly flexible and seem to be imposed mainly in the interest of aviation development and safety and, therefore, they're relatively easy to work in. Again, on the state level, it's roughly analagous, like I said, to the federal. However, when we get into the local area, there's such a myriad of offices, zoning boards, etc.—it's very difficult to present any type of list or even a general guide in which to work when you are trying to make your heliport proposal go through. The only thing I would recommend that you would try to coordinate all efforts in gaining heliport proposal on a state, federal and local levels in order to. . .well, first off in the interest of efficiency and secondly to avoid surprises and annoyed civic officials.

I would also like to mention that there are also some one-regulatory associations that are also listed in the Appendix that provided technical criteria and standards such as the NFPA—the National Fire Protection Association and the various interested groups such as the Helicopter Association International, the National Business Association, etc. These people can be of invaluable help to the heliport planner as sources of information and finally, I would also like to mention that there has been a recent proliferation of interested groups of helicopter pilots in regional areas that have formed associations and these people can also be counted on to provide interested, enthusiastic help in developing heliports. Thank you.

CAB ESSENTIAL AIR SERVICE PROGRAM

The Honorable Charles E. Beatley, Jr.
Mayor
City of Alexandria, Virginia

Good morning. I really can't speak in the same vein as James Lightsey of CAB, the person I'm substituting for because my background is really quite different, but I would like to say that I am very impressed by the variety of people that we have here. I've never seen such a diverse group of people under one tent and obviously aimed in very similar directions related to each other. It reminds me, since we've all been speaking with different viewpoints, it reminds me of the joke about the two hunters who were out in their duck blind—this is a typical Virginia story—and that the one hunter had his favorite dog Old Blue, and he would shoot a duck and Old Blue would go out and bring the duck back in with a nice soft mouth on him, and as Old Blue brought back the duck, he came back walking on top of the water. He did that three times and the proud owner finally turned to his friend who had never seen Old Blue before, and he said "I wonder if you notice anything unusual about Old Blue?" His friend scratched his head and said, "Well, come to think about it, he can't swim". So, we all see things through different eyeballs and I think that's the thing that's important here today. . .we have to understand, I guess, we come from different backgrounds and maybe in this cross-pollination effect, we will pick up something from each other that will be very beneficial.

I think in regard to regulations I have to set the stage for what I see of some things happening first. I think the future of regulations may well be different from what some others of you visualize. An FAA person will have a different view, and a state DOT secretary will have a different view, but we do know that we have to have a review for short-haul aviation in all our communities and as times are very crritical right now, such a study for review does show a tremendous diversity in transportation needs among communities, of different sizes and regional locations. From east to west you can see those needs so differently. The needs have been recently changing in response to deregulation. . .fuel price increases and the general economic and land development trends and the technological developments also. So I think we really should look at where we are today before we start talking about regulating. I think some of our regulation efforts will be directed more effectively and it may turn into more promotional than regulatory. I think we should note this one fact alone. . that the basic airline industry, including all commuter and rotorcraft are really inter-dependent on because if 70 percent of our present commuters, for example, rely on interline exhanges at hubs, whether they're large, medium or mini-hubs, what happens in this bigger airline industry really does concern us at the lowest level.

The airline industry, the big industry, the large jet industry is in the throes of a tremendous revolution. . .I suspect that probably several years ago we ended an era but didn't know it, and that was whenever there was some recognition of the tremendous impact of the monumental changes in the price of fuel, which became the sizeable expense item in the large carrier business. It became a tremendous proportion of the total expense picture of the big airlines. . .I think this jet set era of which we think of, of worldwide cheap fares and high trip frequencies and really plush service. . .I think it has undoubtedly come to an end. There will probably be plush services, but they will probably be flown by corporate jets and others.

I suspect something drastic is in the picture right now. It started, I'm sure you recognize, with the major OPEC raises, and then I think deregulation and PATCO just triggered off this adjustment that is now in its beginnings. We're going through a very agonizing time. I guess we know that the first victim would be, of course, the SST. The Concorde's demise is obvious, but gives an exaggerated picture of the adjustment that's going to have to take place. The Concorde uses two and a half times as much fuel as a convention big jet per seat mile. Pan American and Braniff have both been trying to sell equipment to meet payrolls, if you can believe this. The Concorde played a role in Braniff—it was a foolish venture for them as much as we like the technological aspects of the SST, I think that Pan American is also partly on the ropes as a result of some of the competition which came about through Concorde, indirectly, even though they weren't an operator of the Concorde.

In any case, what we've got is a situation where costs of present services require high prices in the market. Here is where the opportunity is, though. Because at the very bottom level, it's obvious that the 737s the DC 9s and others are being rapidly phased out of the smaller city markets. Deregulation has theoretically brought this about. But it's really the economics behind the big jet that's doing this, and so the commuters that are coming into the picture and hopefully in the future rotorcraft, which are commuters too, will have this special opportunity at the very bottom of the totem pole. I suspect that the commuters themselves will have opportunities bigger than just the scope of what it would look like right now. I can see where long-haul operations will probably be the big jets; I can see that some of your medium, at least a substantial amount of your medium and your short-haul jets that are flown by trunk line carriers can't be flown with the present equipment they're operating over a long period of time. I would predict that ten years from now you'll see some massive adjustments here. I think this is where the opportunity for commuters probably lies. Commuters may well be into the larger short-haul trunk line areas just as they've always tended to expand that way anyway. So, back to regulations.

I think our role in regard to regulations should be one of thinking in terms of how we put this thing together. There should be maybe a third of our effort placed in regulatory efforts. Such efforts should have some missionary aspects to it in which we're promotional. . .we're protective and being helpful. We should be thinking in terms of helping get this system, this tremendous adjustment that's around the corner, accomplished in some orderly way, with a minimum of disruption.

I'm afraid we're going to have some bankruptcies and things which will disrupt present operations. The system may well be interrupted and if we're dependent on the hubs for our lowest level, which is our subject here today, I think we're going to have to be concerned about this health of the larger group. In Virginia I'm concerned about this especially because we have a number of small cities that fed into hubs. We at the Virginia Aviation Commission are doing our best at implementing whatever resource we have, whether its ADAP funds or promotional activities which we're involved in in regard to Dulles and National, and so forth. We're doing our best in our own way to make sure that we don't have an over-regulation problem.

I am concerned about the talk concerning airports consuming land and having. . .an effect on development. However, I'm going to speak as a Mayor now, and I will say that when we talk about this subject, the thing that warms my heart the most is economic develpment. Frankly, I think that most people don't understand this and they may have some reactive position in regard to noise and other regulatory efforts when they really should be thinking about their economic develpment and finding the necessary compromise that allows the development.

In Alexandria, Virginia our tax base back in 1970 was about 950 millions. By 1980, it became 3.2 billion. A substantial amount of credit I ascribe to Metro, which is a form of transportation. In addition, I ascribe a good bit of credit to National Airport and Dulles Airport. I think Dulles would serve us better if we had the total complement of trips we could have in a better planned situation. But we're very sensitive about regulating.

At the local level of course, we can only get involved in environmental considerations, and I've attempted, if you will, to blunt the environmental criticism and concentrate on the economic aspects of the benefit of moving future growth from National to Dulles and get the hub set up there again like it used to be years ago at National. There is no real hub in the Washington metropolitan area at this time. It is a really totally unplanned operation. It is a "grown-like-topsy" situation and I have great apprehension about how things will go—I just want to keep National Airport in the picture and I want the friendly environment that my local citizens want, some of whom would like to shoot it dead. I fight the battle of showing them that there are some very special benefits to our City. Alexandria just recently got the American Trucking Association, and these people have corporate airplanes. I'd like to think that in addition to shuttles and those uses of National, that we have a corporate and business operation able to benefit my City as well. So, we're very gentle about our regulations at the local level, taking the City as a whole.

Well, I guess my time is about up. . .I'd be happy to get involved in a question and answer period, but we'll do that later. I'd just like to say though, that among other things that are obvious here today. . .that rotorcraft people should be especially prominent in this. You really have to have more than just your city council and your boards of supervisors on your side. The acceptance of the general public, the taxpayers and the voters is necessary. If there is a failure and a breakdown at the council level, I would say it is very likely because your voters are uninformed, uneducated in regard to your special mode. This is especially true of rotorcraft. In my 15 years of public office, I've had only two incidences of rotorcraft application in that whole period of time, so it shows it's not a big subject in my City. I guess what I'm saying, though, is that we shouldn't have expectations for things that are not here yet in regard to public acceptance without our going out and working for it. We need to be missionaries and sell our product. . .build the fire that brings some economic activity that gets in front of the regulatory boards. At the present time I don't have anything to regulate in regard to rotorcraft in Alexandria.

REMARKS BY LOCAL OFFICIALS

CHAIRMAN: *Robert Richadson, Executive Director, Helicopter Associaton International*

(Mr. Richardson introduced the three speakers, two of whose papers are included here.)

LOCAL GOVERNMENTAL ENVIRONMENT

Clifford W. Graves
Chief Administrative Officer
San Diego County

My perspective at this Conference Session is that of a local appointed official, operating at the central management and policy level of a fairly large and sophisticated jurisdiction. The qualification is necessary because one shouldn't generalize about local governments or local officials. There are thousands of units of local government and tens of thousands of local officials in this country, and no two are exactly alike.

Nevertheless, local government officials share a few common characteristics when it comes to the issues of helicopters and commuter air transportation. It's important for planners, federal officials and the industry to understand these characteristics, if they want to work constructively with local governments.

The first characteristic is that to the local government official, air transportation in general and helicopters and commuter air transportation in particular, constitute a very minor issue. In most jurisdictions, airport operation is a relatively minor function. In San Diego County for example, we own five general aviation airports, yet our airport organization is one division within one of 31 County departments. Most of my Board's and my time and energy are devoted to fiscal management, criminal justice issues, social and health services, solid and liquid waste, and other such matters. While our airports are well run and, overall, operate in the black, they do not capture our attention very often.

While our County, like most local governments, does exercise land use regulatory authority, air transportation as a land use issue is a highly localized problem which does not crop up frequently. A proposal to expand an airport, change its service level, or develop the land in its vicinity may generate controversy for a brief period over a small area. But San Diego County, with a population approaching 2 million, encompasses some forty-five hundred square miles and contains 16 cities; our airports have little direct impact on our official responsibilities.

Therefore, don't be surprised if your City Council, County Board, City Manager and County Administrator aren't too excited about the potential of helicopter and commuter air transportation. Rightly or wrongly, it doesn't play a major role in their scheme of things.

The second thing to remember is that local officials, especially elected officials, are facing very tough choices these days. You're well aware that the resources available to government are diminishing while the demands for government services and intervention are on the rise. This dilemma, highly publicized at the federal level, is really felt most sharply at the local level. My Board members and their counterparts around the country are making some very painful choices between capital investment and operation needs, between public works and social service requirements, and between continuing all services at a reduced level and eliminating some to protect others. In the regulatory realm, they find themselves between very strong community preservation and environmental interests on the one hand, and business and developmental interests on the other. As local resources decline, these pressures intensify.

As a result, local officials are asking very tough questions to everyone who comes before them. The intensity of the debate demands that claims or promises not be accepted as they may have been in the past. Today's local officials require facts and hard analysis.

For example, my County has had mixed experience with commuter service at our airports. In San Diego County, companies come in, make great plans, operate for a while and then disappear. We have seen no discernible effect of increased commuter air service on traffic congestion in general or around major airports; nor has their presence had much effect on industrial location.

We have seen impressive industrial development in the vicinity of the County's two major airports. But the County has enjoyed a high level of industrial development in recent years anyway. How much airport investment is needed to stimulate industrial development?

As another example, helicopters now provide limited but important law enforcement and emergency medical services in our County. Nevertheless, their use has been criticized by many persons and groups because of noise and safety hazards; there is some evidence to suggest that the original freedom given to helicopter operation is being abused by organizations who treat helicopters as a kind of toy.

Finally, because of diminishing resources, local officials must cut back some popular services; the prime candidates for cuts are those services that are operated at local discretion. Most of the services my County delivers are required by state or federal law, and many of these are funded by state or federal dollars. These dollars have generally remained constant while locally generated dollars have diminished in real terms. Therefore, local officials are reluctant to invest their diminishing local dollars in new activities or programs.

Local Government's Roles

Local governments are both users of helicopters and regulators of their activity. San Diego County, for example, is a $700 million-plus business with 12,000 employees serving a 4500 square mile territory. Helicopters play a relatively minor part in our operations now: our Sheriff owns 3 helicopters (one or two might be operational at any given time). A case could be made that the County should expand its use of helicopters to move people and material around its territory. If someone presented that case, I would take a hard look at it. As noted above, however, it's not a high priority for me nor for most of my counterparts. And so far, no one has developed that claim.

In summary, San Diego County's experience and attitude toward helicopters and air transportation is neutral.

Most conflicts at the local level involving helicopters and commuter air transportation stem from a local government's regulatory (police power) responsibilities. Cities and counties regulate land use on and around airports and heliports (among other places). Any authority to regulate attracts conflict: airports are not unique.

As a regulator, my Board must be convinced that policies encouraging the expansion of helicopter use and commuter air service will provide genuine public benefits. These benefits must outweigh the costs, environmental and otherwise. Local officials are sensitive to the concerns over noise, safety, and traffic that surround aviation issues. They must be able to balance those concerns with hard information on behalf of expansion. In San Diego at least, the broad policy debate has yet to take place.

The County is attempting to protect existing County airports from encroachment. We are doing very well at that. (I might add parenthetically for those of you who have flown into San Diego, Lindbergh Field, our region's principal commercial airport, is not owned by the County of San Diego.) We're further attempting to insure the capability of these airports to expand. By and large, this is working fairly well.

The Intergovernmental Problem

There is one large problem in San Diego which should interest you, because we share it with most other metropolitan regions: intergovernmental planning and programming. San Diego County contains 16 cities within its borders. Two County-owned airports are within the limits of cities. Two major airports are owned by one city in San Diego County—the City of San Diego. The principal airport in San Diego County—Lindbergh Field—is owned by the San Diego Port Authority, an independent agency. Except for the Port Authority, airports enjoy no special priority among the local units of government.

There is no cooperative process for aviation planning in San Diego County. The approach encouraged by the Federal Government—councils of government—does no work in our case; there are too many uninterested players. The COG includes all of the cities and covers only one County, and most of these cities have no significant interest in aviation. It's possible to establish *ad hoc* mechanisms to deal with specific time-limited problems, but this doesn't work for long-term projects.

San Diego is an important County, but nonetheless only one of 58 in the State of California. We get no useful planning assistance from the State Government. While I've made much about the general neutrality of local officials, I believe that the absence of a viable intergovernmental mechanism by which interested local officials can collaborate on long-term planning and programming may be the biggest stumbling block to full utilization of emerging technology in aviation.

As a minimum, three areas need to be addressed on an intergovernmental basis: (1) long-range planning for airports and heliports; (2) cooperation in land use controls on and around airports; and (3) standardized negotiating procedures, so that all jurisdictions in a given area have the same policies and approach to dealing with commuter airlines, helicopter operators, and others in the regional interest.

Conclusion

Let me summarize my main points. First, in this area of aviation technology, don't expect local officials to take the initiative—they have other things to do. At the same time, you'll find little hostility to aviation issues among local officials. Therefore, they are open to facts, possibilities, and offers of cooperation. But so far, at least in jurisdictions with which I'm familiar, the case for systematically expanding helicopter and commuter air transportation has yet to be made.

Second, the biggest mechanical obstacle to a systematic metropolitan approach to planning and coordinating for helicopter and commuter air transportation is intergovernmental: few metropolitan areas have effective mechanisms for collaboration among interested organizations.

While you conferees can do little about the first (except to recognize it in planning, product development, and marketing); you can have an impact on the second.

Lawrence Dahms
Executive Director
Metropolitan Transportation Commission (Berkeley, CA)

As I understand the pre-Conference materials which have been distributed, three objectives have been set out for us as participants:

A. The suppliers of technology—that is the researchers, manufacturers, and operators—are to inform planners about what is available—the aircraft, their capabilities, and the opportunities they provide.
B. The planners are to inform the suppliers as to what their information needs are in order to do a more effective job of evaluating these opportunities in our communities and to more effectively work with them in implementing improved rotorcraft and commuter facilities and services.
C. All Conference participants are being invited to help establish a process of continuing exchange of informaton.

These objectives imply two underlying assumptions which deserve to be recognized and given some explicit attention in our discussions at this Conference:

First is the assumption that rotorcraft and commuter aircraft technology are currently underutilized in comparison with what an objective assessment of their capabilities would show their optimum role should be.

Second is the assumption that we live and work in an unpredictable, confusing, even hostile community environment in which to develop air transportation terminal facilities needed to make better use of rotorcraft and commuter aircraft.

I believe planners and suppliers can engage in some useful dialog to help each other develop a better understanding of these two underlying assumptions.

My contribution to this discussion will be to offer some ideas about how a planning organization such as the Metropolitan Transportation Commission (MTC) can help in finding a path through the tangled web of community concerns and government finances to implement valid transportation ideas.

Chris Brittle, a Senior Planner of our MTC staff will be presenting a paper on "The Role of Regional Agencies in the Development of Commuter Air Transportation," which will document some of MTC's current activities in support of improved short-haul air transportation and an improved overall San Francisco Bay Area aviation system. These MTC activities have included:

- Development of the Regional Airport Plan
- Noise Mitigation work at the major hub airports
- Ground access improvement planning
- Development of capital investment priorities and programs for all regional transportation systems including airports
- Review, and coordination with other agencies, of all federal grant applications in the nine county region under the A-95 OMB requirement

MTC is basically a regional service agency and coordinating mechanism. Although we have certain approval powers, our power is limited in practical terms because our constituency is a forum of commissioners representing local governments and regional agencies. Our objective, therefore, is to use our limited planning resources—staff, data, contacts, and knowledge of the area—in the most positive way we know how, to help others deliver good service.

The basic question you suppliers probably have of MTC and other regional planning organizations is: can we be of significant assistance in helping to implement the facilities you see as needed? The answer is that our ability to help you depends on whether you have something reasonable to sell and whether you wish to invite us as a partner in delivery. I think these factors will be *the* fundamental determinants of the value of this Conference and the dialog that is being established here.

To give you a better understanding of what our role is, and might be, let me describe for you in brief what MTC is and how it operates. In most basic respects of interest to you we are similar to metropolitan planning organizations in large urban areas throughout the country.

Our basic role is to serve as a forum of local government officials on all matters of regional interest in the transportation sector. The governing Commission is composed of 16 members appointed by local government plus one representative each from the State and U.S. DOT. Commission members come to MTC with a long standing tradition of representing their own constituency, but of doing so in a spirit of attempting to work toward solutions and priorities that recognize regional values and regional goals that have been worked out in our comprehensive transportation and land development plans.

We are required by California law to develop and periodically update a comprehensive transportation plan for the nine county Bay Area, and this must include an aviation element. Any regional transportation project that seeks federal or State assistance must conform with the adopted plan and must be submitted to MTC for review and comment.

A second major role of MTC is serving as a regional information center on all aspects of transportation—finance, travel, transportation services, plans and programs, and a wide variety of related data including relationships to land development.

We are particularly concerned about the financial implications of all important regional transportation proposals, with an emphasis on the cost responsibility for the various local governments and other funding sources. Our basic financial management tool is a five year Transportation Improvement Program (TIP) which we update and adopt annually. It covers all transportation capital improvements projects in the region which involve State or federal assistance. The current five year TIP includes 144 State Primary and Interstate highway projects, 183 transit improvement projects, and 67 projects in the general aviation system.

Once MTC adopts a plan and program we are willing and able to become an advocate. We retain representatives in Sacramento and Washington, D.C., and we put a substantial amount of staff effort into development of advocacy material for use in the legislative process. Our role goes well beyond seeking support for appropriations and for specific project approvals requiring legislative actions. We have successfully sponsored legislation or have been a major party to legislative initiatives dealing with taxation, intergovernmental relations, responsibilities and authorities of regional agencies, and powers over regional transportation expenditures by all units of government.

We have tried with some success to serve as a catalyst for the activities of other private and public groups in the legislative process, as well as in other arenas.

MTC has developed an effective working relationship in these matters with the private sector. The Bay Area Council has been a particularly effective mechanism for bringing together business and other private sector interests to work on regional transportation and related issues. Some examples of projects we have successfully worked with the private sector on include:

- Provision of operating subsidies to Greyhound for commuter bus service
- Operating subsidies and capital improvements for the Southern Pacific commuter rail service
- Contracting with taxi operators to provide specialized service for the elderly and handicapped
- Assistance to corporations and to Rides, Inc. (a non-profit corporation) in providing van pool service for employees

In summary, MTC is a regional transportation agency which offers a wide range of potential types of working relationships with people participating in this Conference and their fellow suppliers. We seek constructive partnerships in achieving objectives.

I recommend that we take advantage of our time at this Conference to join in searching for opportunities and ways of working toward common objectives.

SESSION V: ROTORCRAFT AIR TRANSPORTATION

CHAIRMAN:
Glen Gilbert, Consultant
Helicopter Association International

I would like to call your attention to two draft reference documents for this session this morning on "Rotorcraft Air Transportation Benefits and Opportunities." These form the basis of a study being prepared by the Helicopter Association International and its support contractor, Vitro Laboratories, under contract to NASA's Ames Research Center.

One of the draft documents available this morning contains a compilation of various types of data related to rotorcraft. The other has some information and other kinds of data that supplement the first volume. So, if any of you don't have these two documents, I think you would find it definitely worthwhile to pick them up before you leave here. At this point they are working documents. Shortly after this Conference, we will consolidate these documents and publish the final study in December.

With that little bit of information I would like to go right into our program. The first document, you will note, has a number of tabs on it, and each tab covers a particular area of subject: intermodal relationships, rotorcraft technology — I'll talk about that separately in a second — then there is a section on heliport guidelines, one on noise, one safety and reliability, and one on rotorcraft opportunities and benefits.

The presentations this morning will follow that format with one exception, and that is that the rotorcraft technology section has been covered previously by Tom Stuelpnagel in Session I of the first day. At the end of this Session this morning, in the rotorcraft opportunities and benefits presentations, there will be two presenters. One will cover rotorcraft urban applications, and the other will be an overview of rotorcraft opportunities and benefits.

At the end of these presentations, we will go into a panel discussion with two distinguished panelists, and I will introduce them when we get to that point.

Our first presentation this morning will be on the subject of intermodal relationships. Dr. Robert Winick is Chief of Transportation Planning for the Montgomery County, Maryland, which is right next to the District of Columbia. He will give us the lead-off speech on intermodal relationships between rotorcraft and other types of transportation.

INTERMODAL RELATIONSHIPS

Robert M. Winick
Transportation Planning Division
Maryland National Capital Park and Planning Commission

Introduction and Summary

My part in this study has focused on intermodal relationships and the particular ways in which they affect public transportation applications of rotorcraft. I will first review some aspects of integrated services and general comparisons with other transportation modes. Most of the presentation will be about two potential application scenarios: down-to-downtown rotorcraft service and urban public transport rotorcraft service. Some summary highlights include the following:

To integrate well with ground access modes community rotorcraft service should be limited stop service with published schedules, and operate on a few specific routes between a few specific destinations.

For downtown-to-downtown service, time savings favorable to rotorcraft are benefits that reflect its more direct access, relatively higher line-haul travel speeds, and less circuitous travel.

For the scenario of public transport within urban areas, first, improving cruise speeds has a limited potential due to allowing for a "station spacing" effect. Secondly, public acceptance of higher acceleration/deceleration rates may be just as effective as a technological innovation as achieving higher cruise speeds. Thirdly, the minimum spacing between heliports appears to be in the range of 10 to 15 miles. Fourthly, to have a minimal community rotorcraft system would probably require an area of a million or more residents.

Integrated Services

In comparing planning for integrated services and in comparing modes, it is the specific transportation functions and *not* the vehicle technology that need to be integrated or compared.

Each mode tends to organize the services it provides into functional classes which usually form a hierarchy of service as shown in Figure 1. The transportation roles of travel mobility for people and access to property or places in various combinations of degrees define different functions for an aviation functional classification. The two lower classes on the hierarchy: commuter service and community service, are the focus of this overall study. For community service, there is a strong concern for access to places and less for serving through travel. Rotorcraft is well noted for its ability to provide accessibility to almost any place on earth—in fact, it can go many places where even the auto can not.

Several principles of integrated service can be derived from the concept of functional classifications, namely:

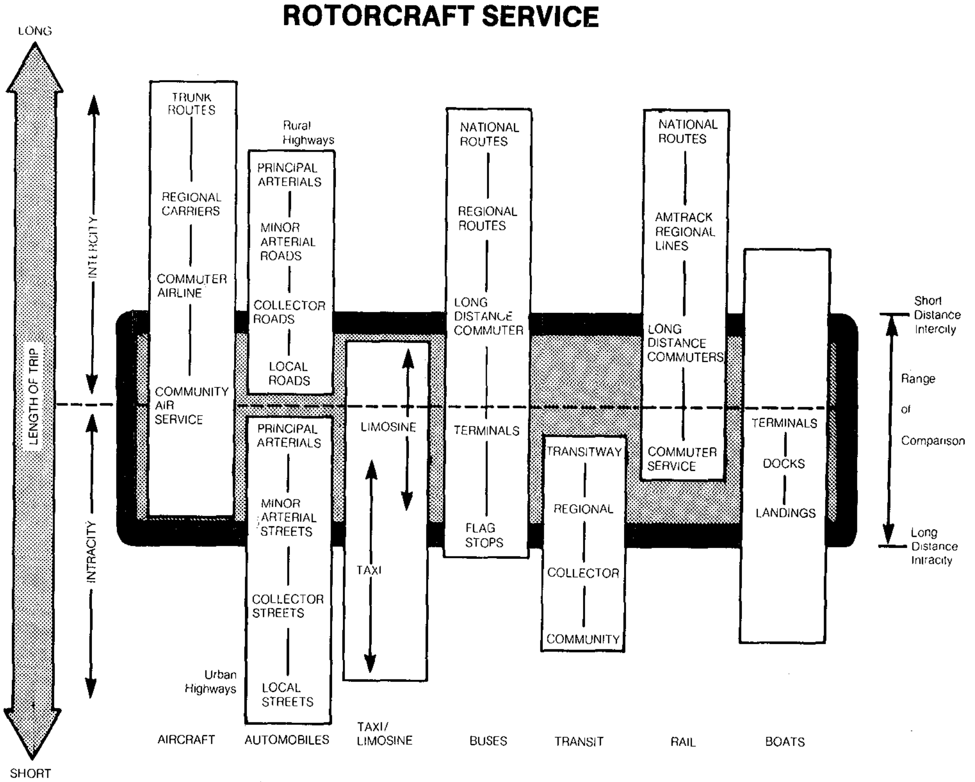
1. Good integration is highly valued by users of transportation services,
2. Functional classes of service need to be integrated within a transportation type and between types of transportation, and
3. Integrated service can be provided by different private companies or public agencies operating different classes of services.

FIGURE 1: TRANSPORTATION FUNCTIONAL CLASSIFICATION APPLIED TO AVIATION

Transportation Roles		Highway Functional Classification (for Urbanized Areas)	Aviation Functional Classification	Aviation Trip Geography
Travel Mobility	**Access to Property**			
high	—	Principal Arterials	Trunk Routes	National & International
medium	low	Minor Arterial Streets	Regional Service	Connects smaller urban areas or to hub airports
low	medium	Collector Streets	Commuter Service	Transfer from smaller areas or to hubs
—	high	Local Streets	Community Service	Within urban areas or between nearby smaller areas

These principles have several implications for providing integrated rotorcraft services: For integration within a system of rotorcraft service, practical limitations on having "point-to-point" service will result in a hierarchy of service requiring integrated transfers. For integration with longer-haul aviation, rotorcraft have been providing connections for travelers between nearby airports as well as having complementary or competitive commuter and ground access functions. To integrate well with ground modes requires limited stop service with published schedules and operations on a few specific routes between a few specific places. The ideal of a local air taxi accessible to many places is difficult to integrate well with ground transportation modes.

FIGURE 2: FRAMEWORK FOR COMPARING COMMUNITY ROTORCRAFT SERVICE



A framework for comparing community rotorcraft service was developed that highlights functions and applications favorable to rotorcraft. It is in part based on a functional class hierarchy for each mode and the different relative transportation roles provided by each class of service. It is also based on trip lengths favorable to rotorcraft.

Figure 2 graphically shows this framework. The arrow on the side indicates the relative length of the travel. There are individual vertical representations for several transportation modes with terms generally categorizing the functional class hierarchy within each mode. A horizontal range of comparison is highlighted cutting across each mode, which is bounded by long distance intraurban trips and short distance intraurban trips. Several observations can be made from this comparison framework:

First, the relative vertical position of the box for each mode indicates the typical trip lengths for those modes. The framework shows that no two modes serve the same range of trip lengths.

Secondly, each of the transportation modes provides a range of service, expressed in terms of trip length, which extends beyond the range of comparison being focused on in this study. A major implication of that observation is that rotorcraft should not be expected to completely substitute for or replace any other mode.

Thirdly and last, reading across the diagram, it can be seen that within the range of comparison, different parts of the functional hierarchies of the different modes provide the analogous transportation function to community rotorcraft service. That means in doing specific comparisons to another mode, rotorcraft service should provide the same combination of transportation roles, the degrees of mobility and access, provided by that mode.

Downtown-to-Downtown Rotorcraft Service Scenario

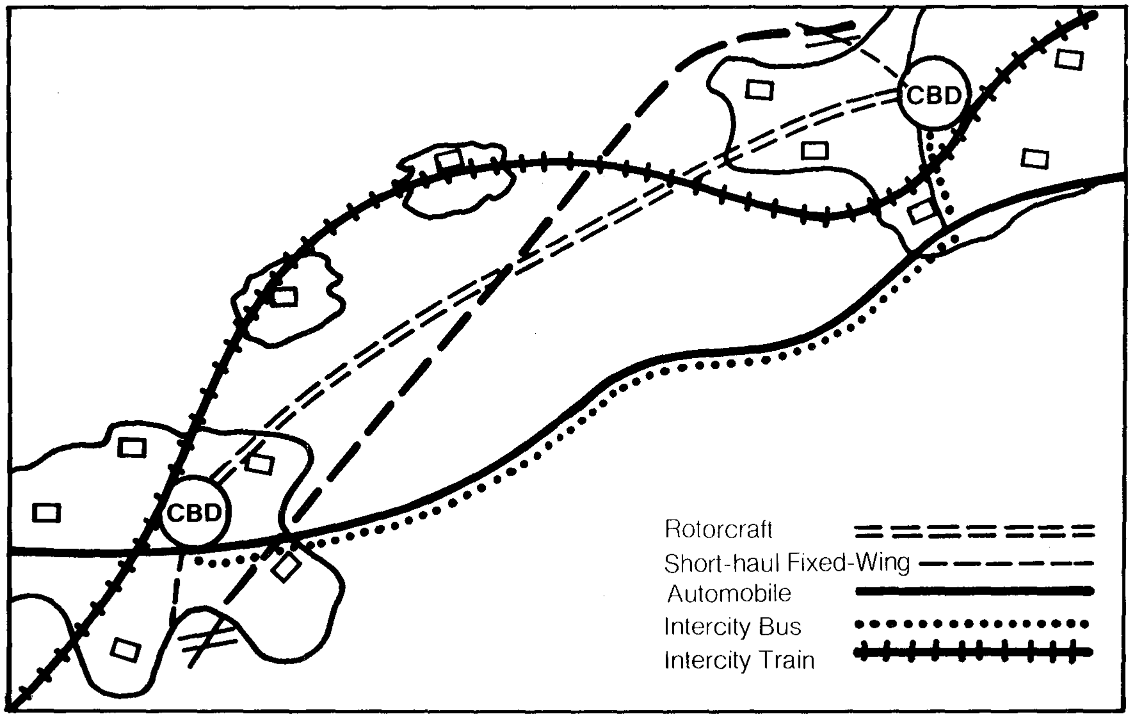
Potential Interaction: There are many downtowns also termed Central Business Districts (CBDs) which are relatively close to those of other urban areas. There is a significant amount of interaction between the CBDs, primarily among business related activities but also by people vacationing in both areas and small package services.

Transportation Options: Figure 2 identified several transportation modes as being options for short-distance intraurban trips: rotorcraft, short-haul fixed-wing, automobiles, intercity buses and intercity trains. This sceanrio uses a distance range of 50 to 300 miles as the range of comparison. Figure 3 shows one characteristic common to each mode, that of circuitous travel paths. That results in unequal distances by the different modes with the rotorcraft being the base distance measuring the separation between the CBDs.

Function Class Relationships: The transportation function being provided by this scenario is high access to each CBD with some business to conduct in the other CBD. The connections for other modes may represent a different access/mobility balance, for example, rail service may have several intermediate stops giving added access to those places and mobility to other travelers.

Current and Future Technology: The average speed of

FIGURE 3: TYPICAL CIRCUITY OF INTERCITY MODES OF TRAVEL



the line-haul portion of each of the transportation options is an important technological characteristic. This range of speeds for each mode over the distances between CBD pairs is shown in Figure 4 which reflects different classes of service and changes in technology. With the exception of improved high speed rail in selected corridors, the major technological speed innovation which could be applied in connecting any pair of nearby CBDs is that of improved rotorcraft.

Trip Components: Figure 5 shows the component parts of a trip traveling on the different modes between CBDs which are 150 miles apart. The chart shows the total travel time as well as the amount for each component. The line-haul portion of each mode requires some sort of local access or circulation to the terminals, usually by a different mode. In this scenario, short-haul fixed-wing CBD-CBD service has different access requirements from the other modes, reflecting the airports each being located some significant distance from the CBDs. The time differences shown in this chart can also be viewed in another way.

Travel Time Differences: Figures 6 gives the total travel time differences expressed in hours between rotorcraft and the other modes for the range of distances in the scenario. This figure shows one of the major benefits of this rotorcraft service. The time differences which are favorable to rotorcraft over this distance range reflect the combination of a) more direct access, b) relatively higher line-haul speeds, and c) less circuitous travel. The figure also shows two basic patterns: compared to trains, autos, and buses, rotorcraft has increasing time savings, the farther apart the CBDs, and compared to fixed-wing short-haul aircraft, there is generally decreasing benefits with increasing separation except in the lower distance range for propellered fixed-wing. The magnitude of the time savings are sensitive to the various assumptions used in the scenario.

Time Difference Sensitivity: This first sensitivity graph, Figure 7A, shows what happens if the rotorcraft speeds were 10 percent higher or lower than the basic assumption of 160 mpg. Relatively, it shows little sensitivity with differences of 10 to 15 minutes being covered by the bands. The other sensitivity graph, Figures 7B and 7C, show generally much greater time difference sensitivity for ten percent variations in the speeds of each of the other modes (except for short-haul fixed-wing jet aircraft). Variations of one half to three quarters of an hour are shown. Local service for one of the other modes can increase the time differences by 15 to 20 minutes per stop.

Cost Differences: the two different patterns of time differences discussed above indicate that relative cost differences should be more important to the traveler when comparing rotorcraft to the fixed-wing aircraft option. Figure 8A shows estimates of direct operating cost over various distances for rotorcraft and fixed-wing short-haul aircraft. Generally rotorcraft have two to three times the direct operating cost for the line-haul on a seat mile basis than fixed-wing. Larger capacity rotorcraft have less of a cost difference. However, for fixed-wing, the cost of airport access adds up: cab fare, limousine service, or driving and parking one's car, plus access costs at the destination can add twenty dollars or more to the fixed wing cost. Over the mid-part of the distance range, those access costs can eliminate the difference of the higher line-haul rotorcraft costs. Time efficiency and cost avoidance are two indirect benefits of rotorcraft in this scenario. Figure 8B shows that the rotorcraft option makes the most efficient use of an executive's time for the distance range of the scenario. At the longer distances, the aviation choices enable the executive to more easily avoid the costs associated with an overnight stay.

FIGURE 4: CURRENT FUTURE TECHNOLOGY SPEED COMPARISONS

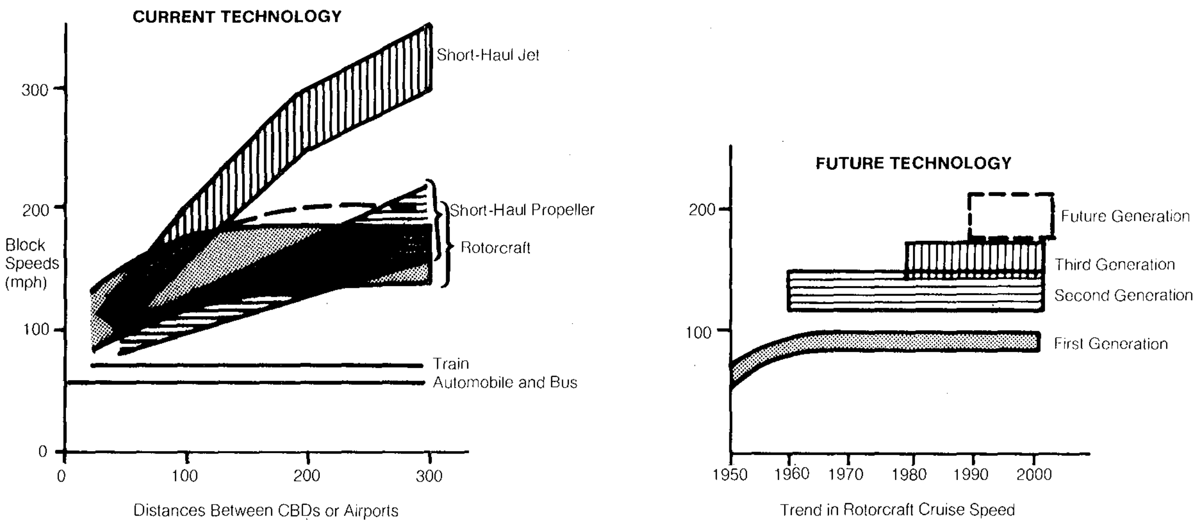


FIGURE 5: TRAVEL TIMES OF TRIP COMPONENTS FOR SEVERAL MODES

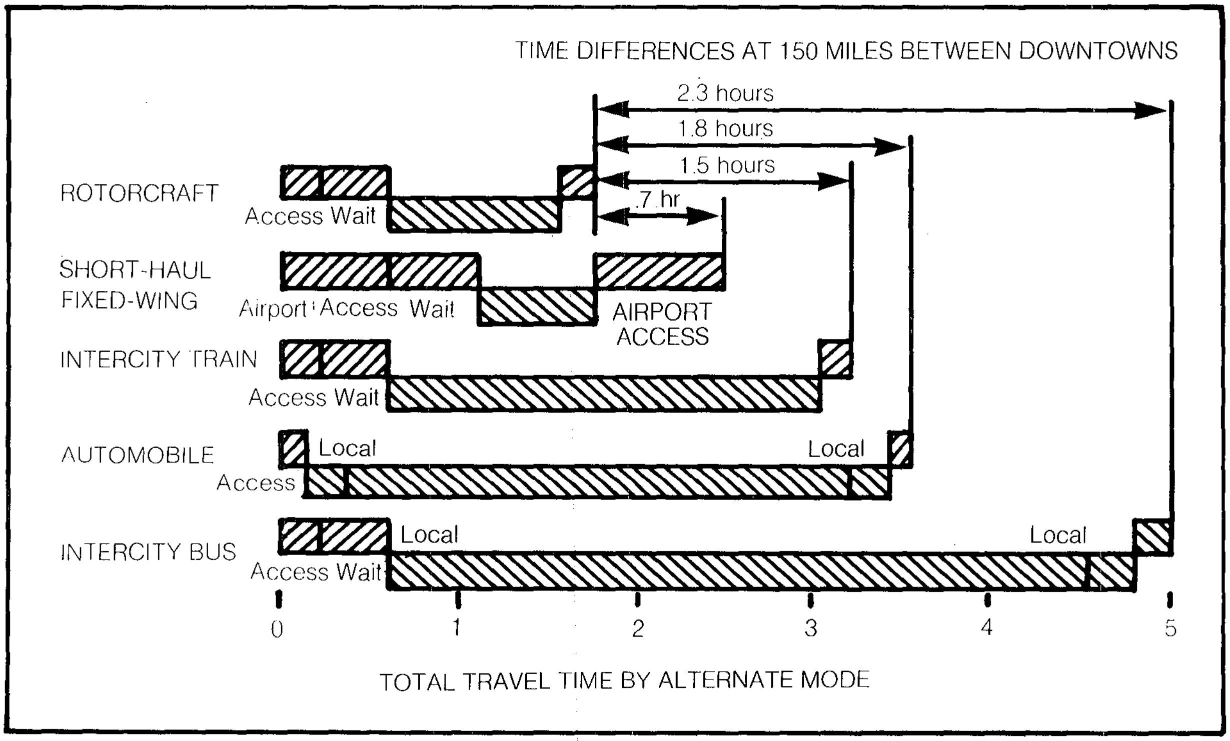


FIGURE 6: TIME DISTANCE (HOURS)
COMPARED TO ROTORCRAFT

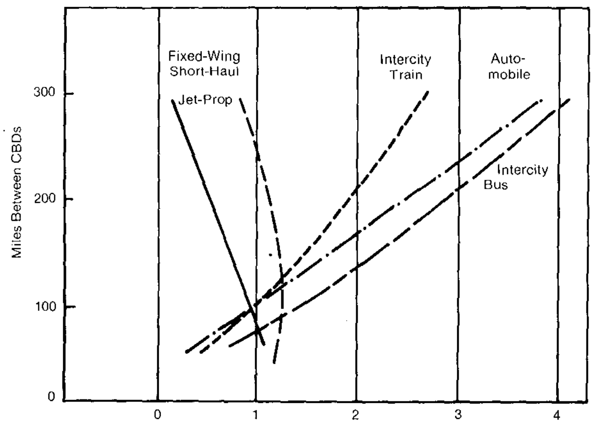


FIGURE 7A: TIME DIFFERENCE SENSITIVITY
TO ROTORCRAFT SPEED

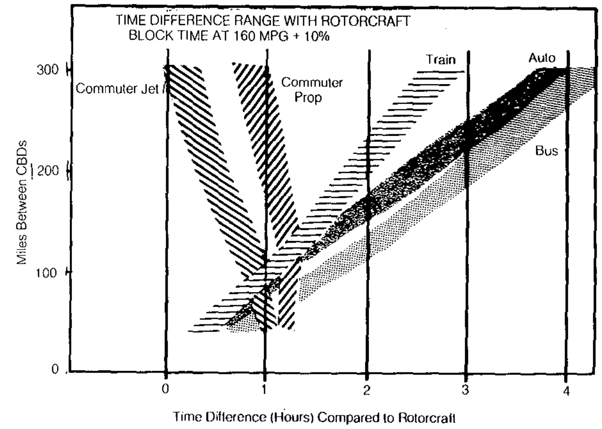


FIGURE 7C: TIME DIFFERENCE SENSITIVITY TO SPEED
OF OTHER MODES

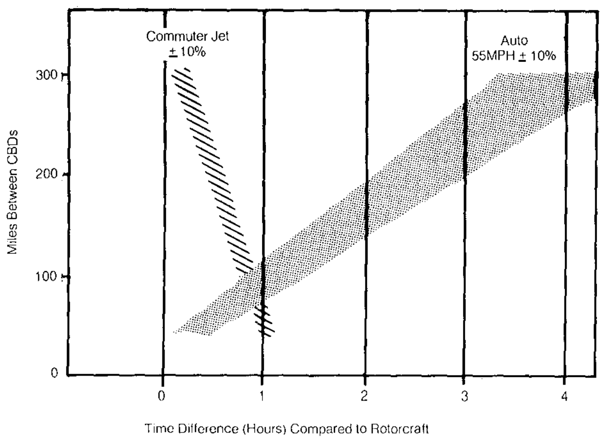
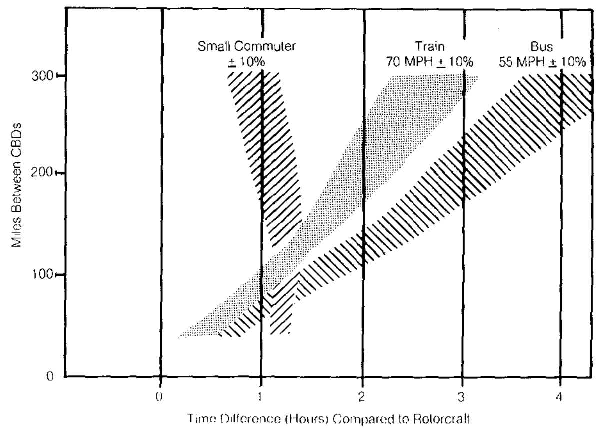


FIGURE 7B: TIME DIFFERENCE SENSITIVITY TO SPEED
OF OTHER MODES



Urban Public Transport Rotorcraft Service Scenario

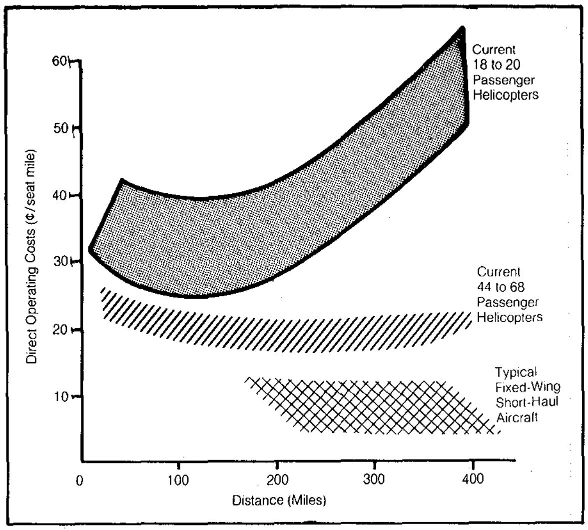
Potential Interaction: The longer trips not based at one's home, typically about ten percent of daily trips, represent the most likely use of a community rotorcraft service. The ones that would be easiest to serve are business trips that both begin and end in major activity centers. Such travelers may not necessarily be residents of the urban area. Other likely users are people on business travel making intercity connections or people on vacation or personal business who are also making intercity connections.

Transportation Options: The framework given earlier identified several transportation modes as options for longer distance intraurban trips: rotorcraft, automobiles, taxis or limousines, and public transit. This scenario uses a distance range of 5 to 50 miles for the range of comparison. The schematic map given in Figure 9 illustrates how the transportation options typically relate to one another. One typical feature which is important to consider in the scenario is the relative circuity of the various options. The flight distances of the rotorcraft is used as the base measure of travel distance and the other options are assigned relatively longer travel distances between the same start and end points.

Functional Class and Interface Relationships: In this scenario the framework showed that rotorcraft provides the function analogous to principal and minor arterial highways. Therefore, the combined transportation function for rotorcraft should be to have a medium to high degree of through movement of urban trips while providing direct access only to a limited set of suitable activity places. Other modes of access would be required to serve other nearby places. Suitable activity centers include: central business districts, large shopping centers, hospitals, universities, or office and industrial parks, and lastly, airport and outlying intercity terminals. A strategic location within each activity center can have many travelers within a walking distance of 2000 feet, an area of about 300 acres. There is also a need for necessary and sufficient access facilities for taxi, automobile drop-off or parking, local transit and pedestrian connections.

Current and Future Technology: As in the previous sce-

FIGURE 8A: LINE-HAUL OPERATING COST COMPARIOSNS



nario, the line-haul speed is an important technological factor. In this scenario, rates of acceleration and deceleration acceptable to the traveling public are also important. The range of speeds used for the other options reflects different class of service being operated. The average speed for rotorcraft is shown in Figure 10 as a function of distance due primarily to the time it takes to accelerate to cruise speed and then decelerate in order to land. Rates of 4 mph per second reduces a cruise speed of 180 mph to an average speed of 145 mph for a ten mile flight, and it drops to 125 mph for a five mile flight. This is analogous to the "station spacing" effect in transit planning. The more frequent and closer the stops the lower the average speed along a route. Therefore, depending upon "heliport spacing" distances greater cruise speeds may not significantly improve the transportation benefits of community rotorcraft service in this scenario. Sensitivities to variations in cruise speed and acceleration rates show that for trips of 15 miles or less, there is greater variation in average speed due to the range in acceleration rate assumptions.

Trip Components: There are four basic ways to connect the three suitable activity center types given a minute ago: 1) CBD to airport, 2) CBD to suburban activity center, 3) suburban activity center to airport, and 4) suburban activity center to suburban activity center. Each of these basic connections, of which two examples are shown here in Figure 11A and 11B, have different characteristics such as terminal times, relative speeds, and relative circuity. The assumptions for each of the basic connections were selected in a consistent fashion. The estimates of line-haul travel time were calculated by combining assumptions on the average speeds over various distances with assumptions as to the relative circuity for those distances which ranged from 5 to 30 percent more circuitous than rotorcraft travel. The time differences shown in these charts are seen better by arraying them against distances for each of the four basic connections.

Time Differences: Figure 12 is a set of graphs that shows the total travel time differences expressed in minutes between rotorcraft and each of the other modes for the range of distances in the scenario. There is one chart for each of the basic connections between activity places. One observation is that each graph has a similar pattern implying that no other mode provides a unique transport service. A second observation is that each graph shows a cross-over point of equal travel time that ranges from 7 to 17 miles separation between places which reinforces the presumption that community rotorcraft service would tend to serve longer distance intraurban trips. A third observation is that rotorcraft have increasing time savings, but at a decreasing rate, as the separation between activity centers increases. A fourth observation is that for travel connected to the CBD, taxi or limousine are the next fastest while for travel to suburban activity centers, it is the automobile. A final observation is that in each graph transit is shown as the least competitive while it provides its best relative service for CBD to airport service.

A Community Rotorcraft System: These graphs and cross-over points give a general indication of the minimum spacing between heliports to have an effective community rotorcraft system: about 10 miles between CBD and airport and CBD and suburb and 15 miles between suburb to suburb. Tieing together these minimum distances results in a schematic system map of two or three suburban activity centers and airport ringed around the CBD as shown in Figure 13. Such a system would probably correspond to an urban area covering 300 to 400 square miles and given typical densities would have a population of one million people or more. In order to have a system serving many activity centers, the urban area would probably have to be a good deal larger than one million people. The service provided by such a community rotorcraft system could be integrated with the type of rotorcraft service given in the CBD to CBD scenario.

Summary of Findings and Conclusions

In conclusion, in order to be successful as public transport, new rotorcraft services need to firstly add to people's existing transportation options, and secondly, should be integrated and coordinated with other types of transportation. New rotorcraft technology has the potential for being that special ingredient which significantly increases the choices of travelers and shippers. I have used the general concept of functional classification and showed how it applies to aviation to define several principles of integrated service. I also presented a comparison framework that was based on trip lengths favorable to rotorcraft as well as the functional class hierarchy for each transportation mode.

For the CBD to CBD scenario, the time savings of rotorcraft reflect its more direct access, higher line-haul speeds and less circuitous travel. Those savings are most pronounced increasingly for trains, autos, and buses. The narrower time savings of fixed-wing makes the marginal cost differences more of a determinant, but airport access cost can equalize the greater line haul cost of rotorcraft. In general for the typical likely user, an executive on a one day business trip, rotorcraft is the transportation option that makes the most efficient use of the executive's time.

For rotorcrafts within urban areas, their best market is relatively long trips for business purposes. Heliport spacing and acceptable rates of acceleration are probably just as important technology concerns as increasing cruise speeds of rotorcraft. In order to achieve time savings with rotorcraft service, the minimum spacing between heliports would be in a range of 10 to 15 miles. With such minimum spacing, it would probably take a metropolitan area of a million people or more to support a minimal community rotorcraft system.

FIGURE 8B: HOURS AVAILABLE FOR BUSINESS ON A ONE-DAY TRIP WITH A TWELVE HOUR TIME BUDGET

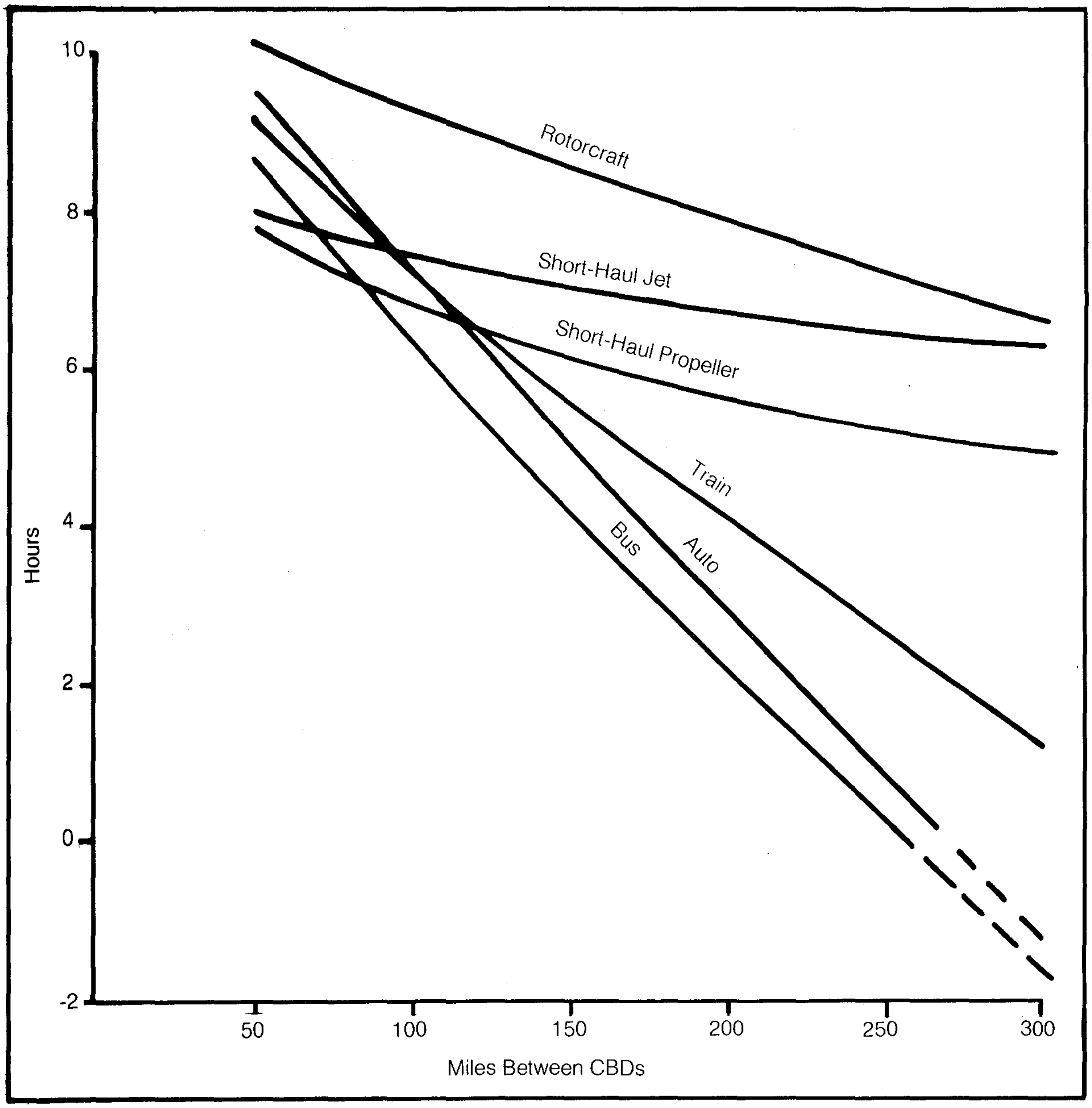


FIGURE 9: RELATIVE CIRCUITY OF THE DIFFERENT MODES WITHIN URBAN AREAS

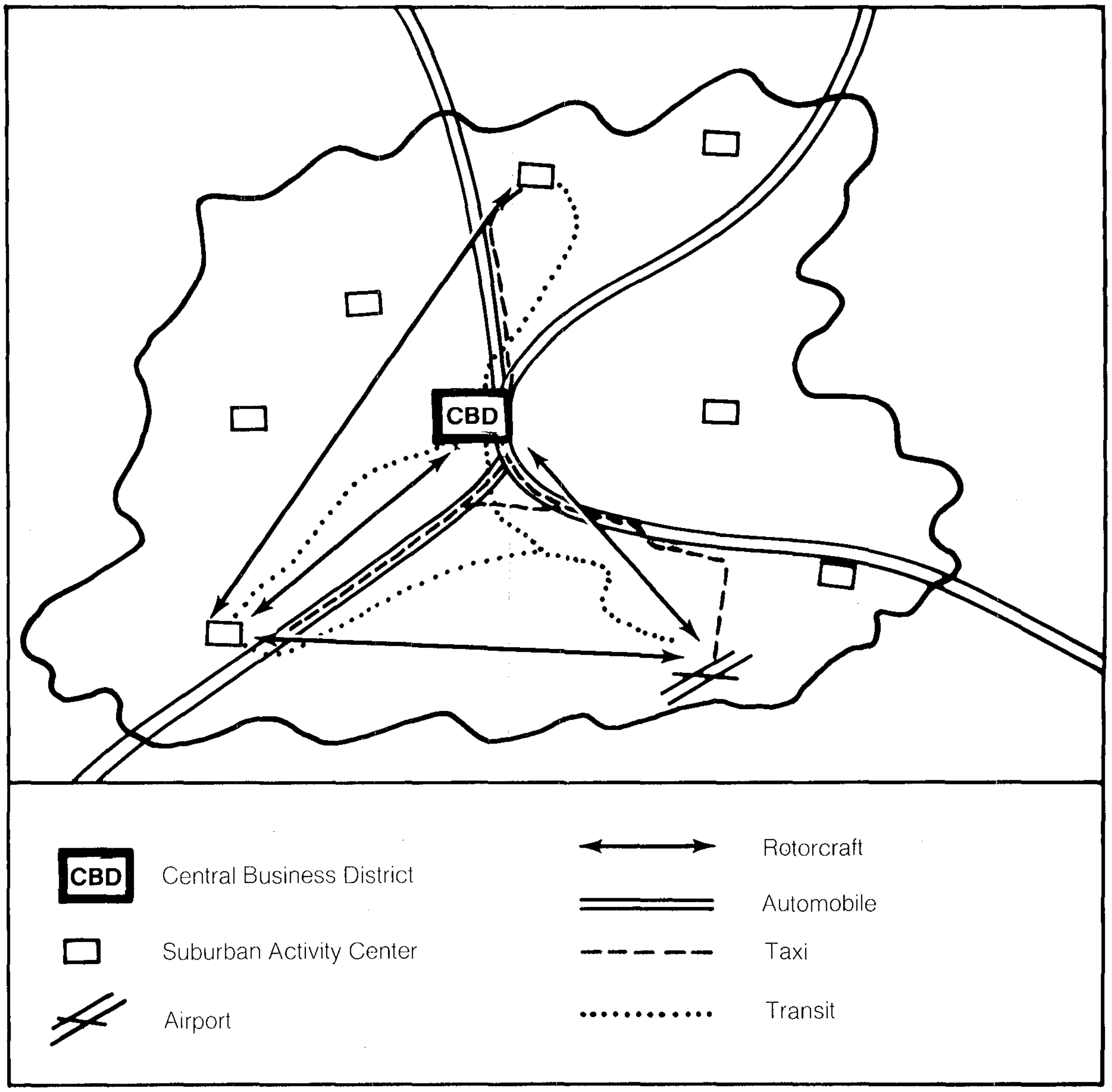


FIGURE 10: EFFECTS OF ACCELERATION AND DECELERATION ON AVERAGE BLOCK SPEED

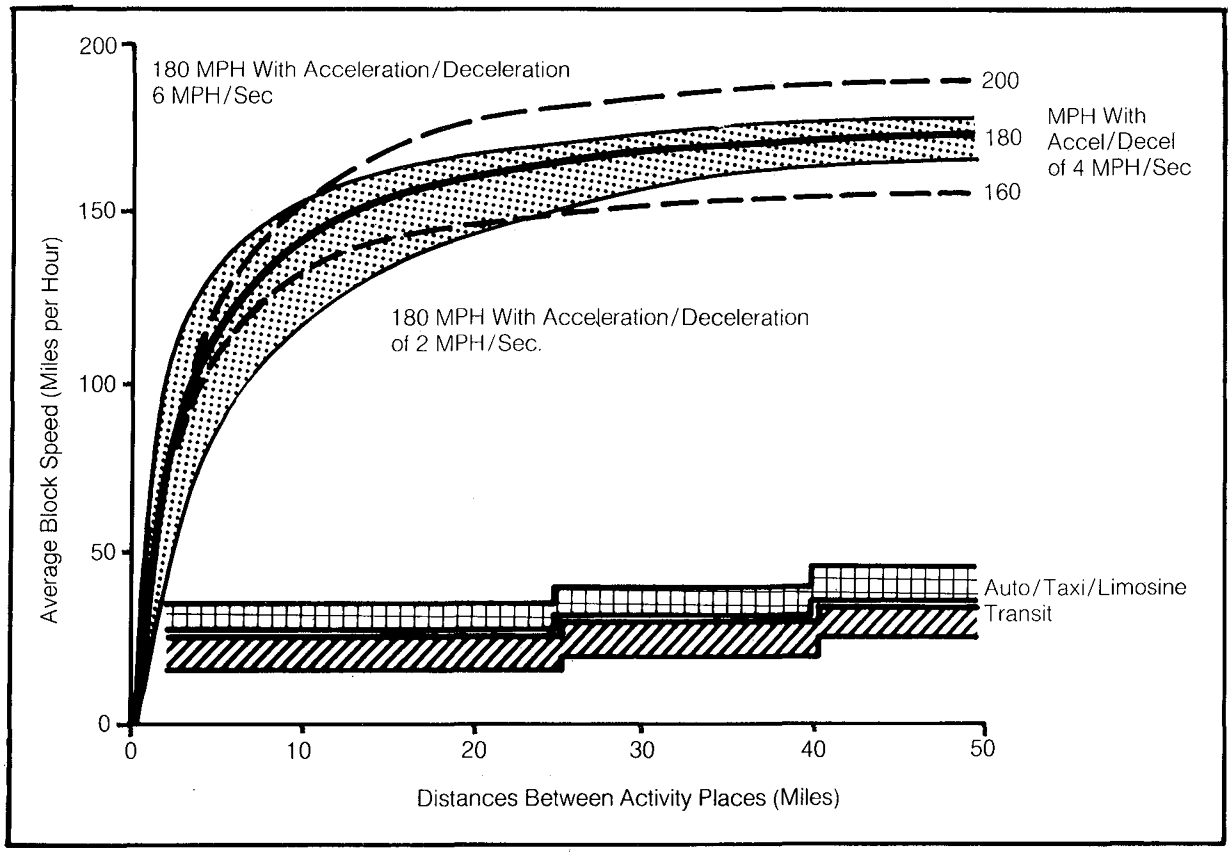


FIGURE 11B: SUBURBAN ACTIVITY CENTER TO SUBURBAN ACTIVITY CENTER TRAVEL TIME COMPARISONS

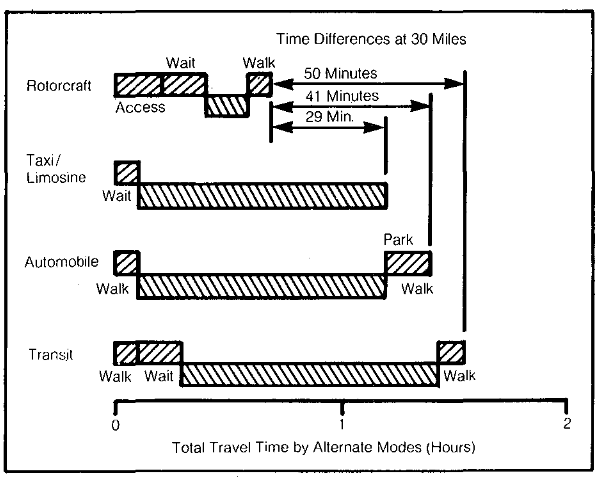


FIGURE 11A: CENTRAL BUSINESS DISTRICT TO THE AIRPORT TRAVEL TIME COMPARISONS

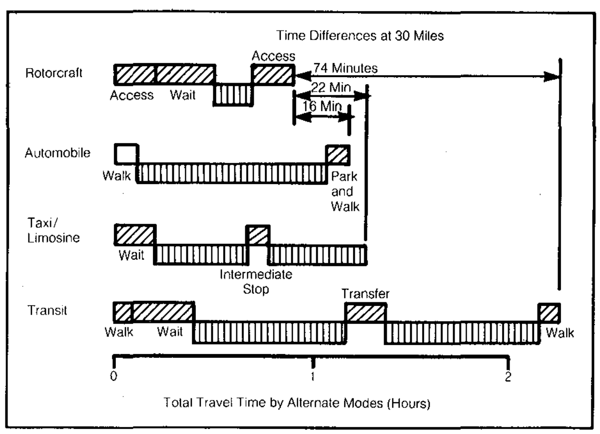


FIGURE 12: TIME DIFFERENCE CHARTS FOR FOUR SCENARIOS

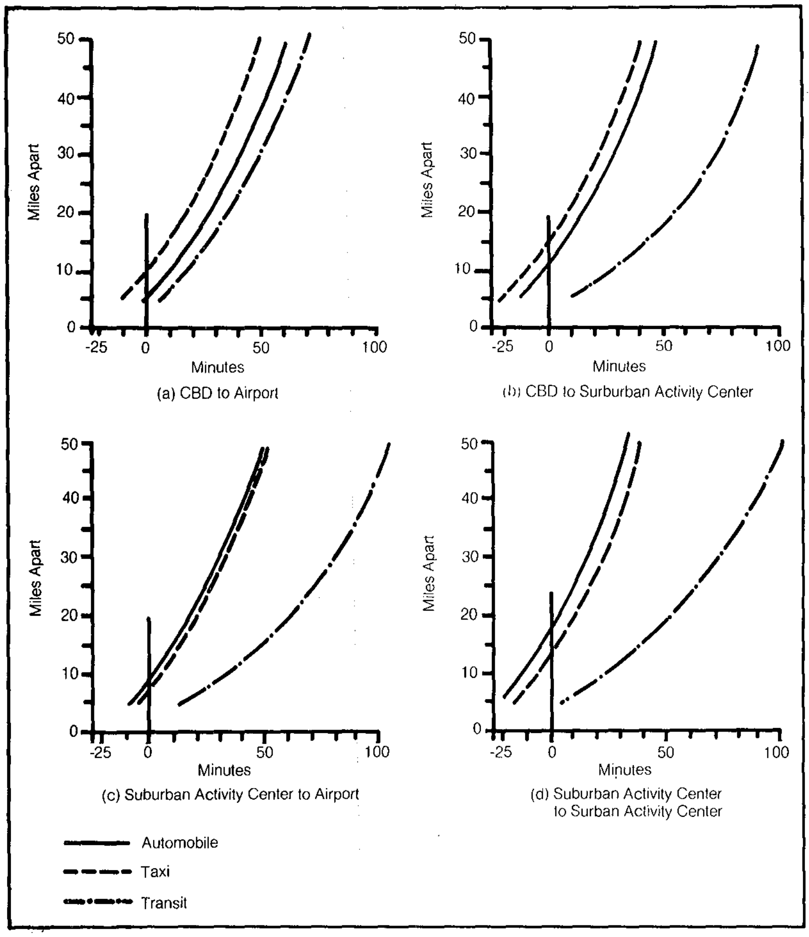
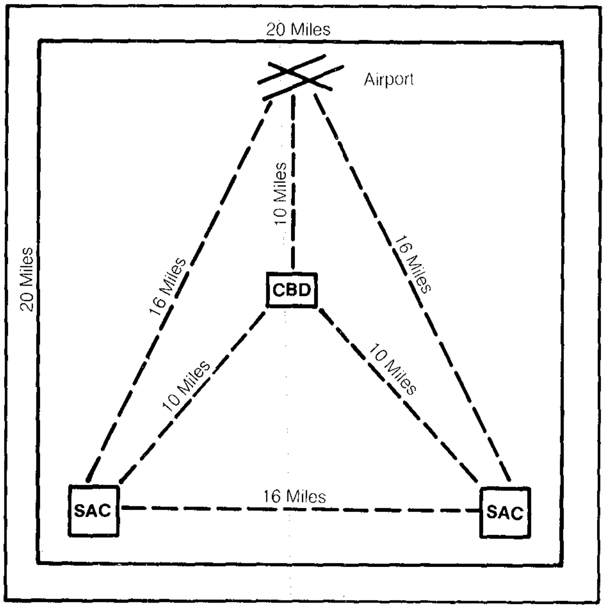


FIGURE 13: SCHEMATIC MAP OF A COMMUNITY ROTORCRAFT SYSTEM



HELIPORT NOISE

Charles M. Cox
Acoustics Group Engineer
Bell Helicopter Textron

As familiar as helicopters are to us in the industry, they are still a novelty to many people. There are more people who have never seen or heard or been around helicopters than those who have.

Working with different operators and assisting them in getting heliport approvals and renewals, I have found that people unfamiliar with helicopters and their operations express concern about two major things: safety and noise. With regard to noise, the feeling most often expressed at hearings and before city councils and zoning boards is that of *apprehension*—apprehension as to how much noise; apprehensions as to how many helicopters; apprehension as to what flight paths they will fly. Mixed in also are worries about safety, intrusion, and loss of privacy.

These apprehensions can be relieved. Accurate information and planning in advance are the keys. This requires a combined effort on the part of the manufacturer, the operator, and you, the planner.

Let's look at how this is done.

The real estate exposed to helicopter noise is small (Figure 1) as compared to that for jet-powered airplanes. This is due, in part, to the relatively low noise levels inherent to the helicopter's slow-turning rotors. Low noise characteristics are also due to the flexible flight paths the helicopter can safely fly.

On the other hand, because of its performance capabilities, the helicopter will operate closer to people than other aircraft types. Also, the sound produced by a helicopter is unique and can be readily identified. In certain flight regimes, the main rotor(s) can emit an impulsive signature. These characteristics tend to draw the attention of first-time listeners, and can influence their initial reaction to the presence of the helicopter.

A heliport's noise environment can be planned and controlled (Figure 2). First, factual information about the specific operation at a proposed heliport must be known. This consists of the helicopter's sound level, the number of movements, the flight patterns into and out of the heliport, and the piloting techniques used, particularly during landings. Second, the environment that already exists at the proposed heliport site must be known. Such things as the type of district in which the heliport is to be located, siting relative to surrounding buildings and natural barriers, ground level versus a roof top site, and ambient masking noise influence, all play a role in 'balancing out' a heliport's acceptibility.

Let me elaborate on some of these factors.

Helicopters vary in size, and as a result, vary in sound level. Sound level can be expressed in several measurement units, similar to temperature which can be expressed as °F, °C, °R, etc. One measure of sound is called A-weighted sound level or dBA. The dBA unit measures sound on a scale that approximates the way it is heard by people. More "weight" is given to the frequencies of sound that people hear more easily.

- The sound level of helicopters is comparable to that of familiar transportation vehicles and equipment (Figure 3). At typical distances, sound of the light class of helicopters is about the same as that produced by the average automobile. Medium and intermediate helicopters are about as loud as trucks and city buses. The large helicopters emit sounds only 4 to 5 dBA higher.
- The frequency of operations into and out of a heliport, in contrast to an airport, is relatively low. Typically, only one or two operations occur per day. Very few operations occur at night. Hence, the daily exposure to noise due to helicopters amounts to only a few minutes. By contrast, the major airports in the U.S. average upwards to 55 movements per hour, many occurring in the late afternoon and night period.
- Helicopters can operate safely and efficiently in a variety of flight regimes. Pilots regularly use different flight patterns and techniques to perform the same operations. This capability can reduce noise impact significantly and practically eliminate any impulsive signature. Following is a list of piloting techniques, most of which can be tailored to a specific operation and incorporated in the heliport planning:

1. Select route into and out of heliport over least populated area.
2. Follow major thoroughfare, railway roadbeds and other high ambient routes.
3. Take-off using a high rate-of-climb and make smooth transition to level flight.
4. Fly at highest practical altitude while enroute.
5. Maintain moderate cruise airspeeds, particularly over populated areas.
6. Make all turns and maneuvers smoothly.
7. Reduce rotor rpm to allowable flight minimums (if helicopter is so configured) while over densely populated areas.
8. Approach and land using low noise flight profiles appropriate to the particular helicopter (Figures 4 and 5).

Use of these piloting techniques is wide spread. Most manufacturers make available this type information about their specific helicopter models.

- Community noise environments are complex and a function of population density and activity. In high activity areas—near freeways, in city centers, in manufacturing, industrial, business and commercial districts, urban shopping centers, etc.—the ambient noise is typically high. In most cases, those ambients mask the sound introduced by the helicopter (Slide 6). Helicopter operations are ideally suited in areas with such ambients. Also, the length of time during which the helicopter is heard is short, typically only 5 to 10 seconds.

I now want to cite experiences at several heliports where one or more of these factors contributes to the acceptability of the heliport. They are as follows:

—Los Angeles Convention Center temporary heliport (Figure 7). At one of the annual meetings of the Helicopter Association International, a temporary permit was granted to operate a shuttle service between the Center and downtown. All incoming and outgoing flights were routed over the adjacent freeway. Landing and take-off flight paths were selected such that the helicopters flew only over the Center's property. During the four day shuttle service, no noise complaints were received. There was one inquiry—a citizen wanted to know what had happened to cause so many helicopters to be in the area.

—30th Street, 60th Street and Wall Street heliports in New York located along the Hudson River (Figures 8, 9, and 10). Landings and take-offs are made over the River, and a major thoroughfare is between the heliports and nearby business districts. Noise has not been a serious problem, even though these heliports have a large number of movements per day.

—Public use heliport located on Pier #4 in Baltimore (Figure 11). Landings and take-offs occur over water. There have been no noise problems.

—Rooftop heliport on Cobo Hall in Detroit (Figure 12). A large parking garage adjacent to the Cobo Hall heliport acts as a buffer. Routes into and out of the heliport are over water. Again, no noise problems exist.

—Rooftop heliport on First Pennsylvania Bank (Figure 13). In this case, flight paths over several thoroughfares are used to my knowledge, no complaints have been made about noise.

Penzance Heliport* located in semi-rural area. Penzance, England, (Figure 14). This is a scheduled service, up to 24 movements per day, operated by British Airways Helicopters, Limited. Seventy residential homes lie within 800 to 2000 feet of the heliport site. Dwellings are not overflown and there have been very few complaints. The local authorities state that noise problems have never caused serious concern. Also, the helicopter operators "... have always been cooperative and this must go on record as being one of the main reasons why service operates without giving annoyance to local residents."

—Battersea Heliport* situated on the River Thames in 'built up area' five miles from the center of London, England (Figure 15). There are 30 to 40 movements per day. The local area consists generally of high rise buildings. A noise limit criterion is in effect which limits the size of helicopters permitted to use the heliport, although exceptions are made. The level of complaints is extremely low. The few complaints received are usually a result of banking turns prior to approaching the heliport.

In summary, the factors I have discussed should be fully exploited in planning and consideration of environmental concerns at each heliport site. Experiences both in the U.S. and in Europe show that when these factors are taken into account, and the novelty and apprehensions of helicopter operations wear off, the heliport is accepted. This is true even in areas that are quite noise sensitive, such as hospitals.

*Information and experiences of these heliports were furnished courtesy of Dr. John Leverton, Westland Helicopters.

FIGURE 1: NOISE CONVERSION FOOTPRINT

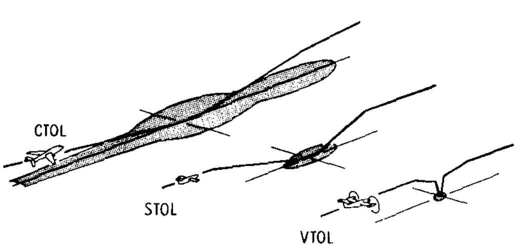


FIGURE 2: HELIPORT NOISE ENVIRONMENT

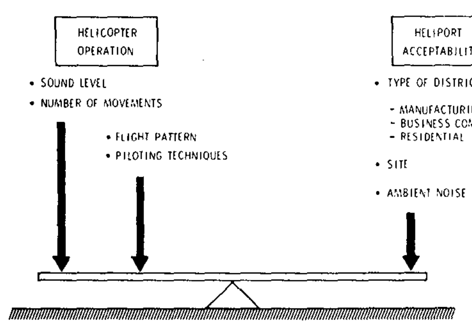


FIGURE 3: COMPARISON OF SOUNDS

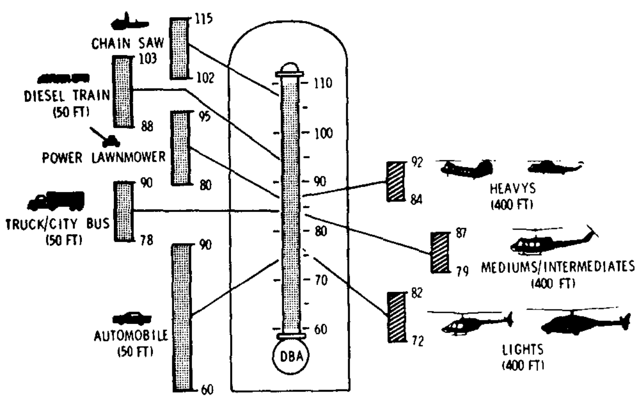


FIGURE 5: PILOTING TECHNIQUES

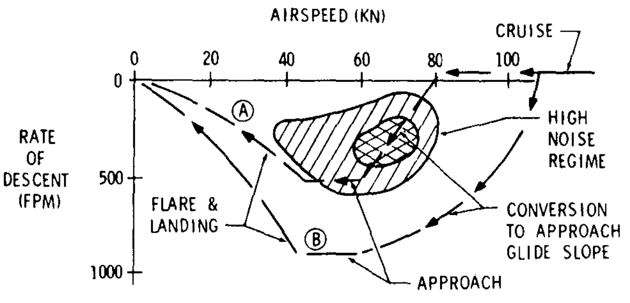


FIGURE 4: PILOTING TECHNIQUES

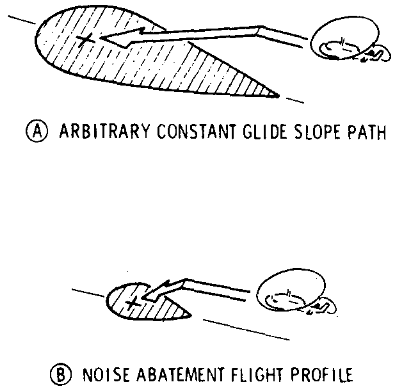


FIGURE 6: AMBIENT NOISE

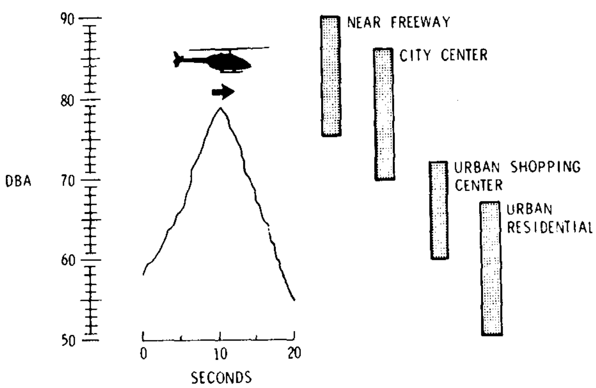


FIGURE 7:
CONVENTION CENTER,
LOS ANGELES

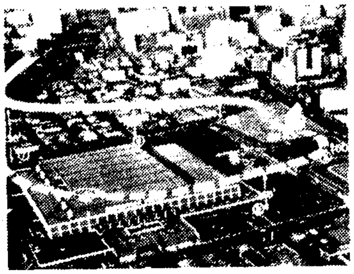


FIGURE 8:
THIRTIETH STREET, NEW YORK

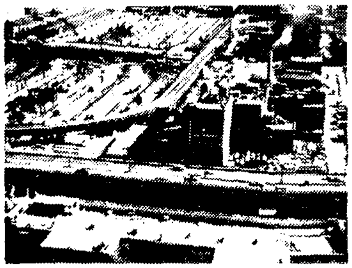


FIGURE 9:
SIXTIETH STREET, NEW YORK

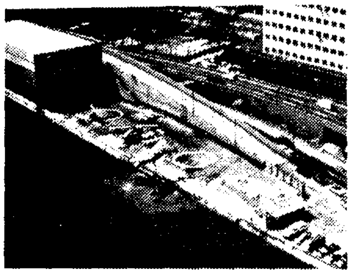


FIGURE 10:
WALL STREET, NEW YORK

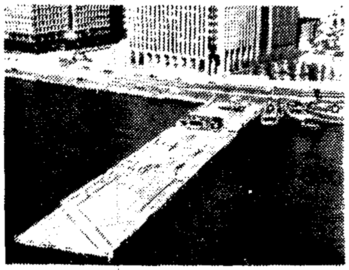


FIGURE 11:
PIER #4, BALTIMORE

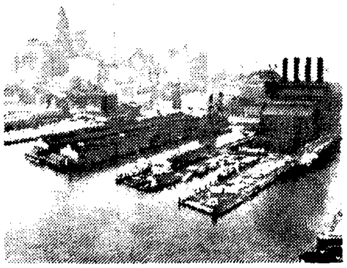


FIGURE 12:
COBO HALL, DETROIT

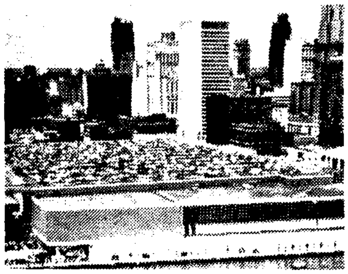


FIGURE 13:
FIRST PENNSYLVANIA BANK

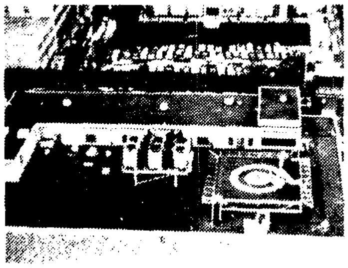


FIGURE 14:
PENZANCE HELIPORT,
PENZANCE, U.K.

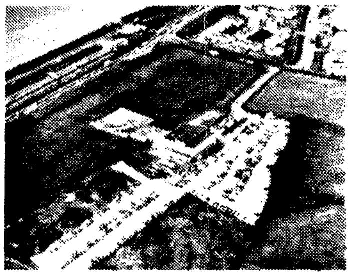
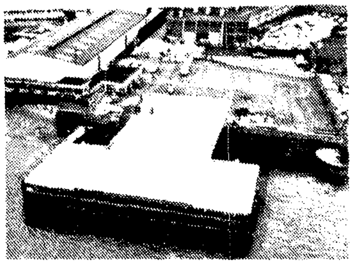


FIGURE 15:
BATTERSEA HELIPORT,
LONDON, U.K.



HELIPORT PLANNING GUIDELINES

Jack Thompson
Aviation Representative
Ohio Department of Transportation

I am sure it doesn't come as any great surprise to anyone, either those of you in the helicopter industry today, and those of you that are listening to many of these presentations we've had for the last couple of days that one of the biggest problems facing the rotorcraft industry today is the lack of public-use heliports in the business districts of major cities.

Now, from what you have probably heard here, it would seem that this is a very difficult problem to overcome, and certainly, it is.

However, I do want to interject a brief ray of hope here. As many of you may know, I'm a Buckeye, and a Buckeye has been defined as either a big nut or a person from Ohio — I hope you will just apply the last definition to me.

But, I do want to talk a little about the State of Ohio. It's very interesting, from a statistical standpoint. It's a very agricultural and rural state, and yet, at the same time — it's very heavily industrialized.

Another point I would like to bring out is that the State of Ohio has more major metropolitan areas, on the order of a population of a half-million or so, than any other state in this country. And that is significant in itself, I guess, but also in light of the fact that we have a public-use heliport in the central business district of every major city in the State of Ohio, a fact that I take a great deal of pride in.

I'm talking about Toledo, Cincinnati, Dayton, Columbus, the Akron-Canton area, and Cleveland. The one in Toledo actually is still under construction. It will be open later this year, around Thanksgiving time.

The point I'm trying to make, though, is that it is possible to get CBD public-use heliports — we've done it in Ohio. As a matter of fact, now we're working on some of the smaller cities, intermediate-sized cities — 50,000 population or more, and frankly, we're having a degree of success in that regard.

Let's get down to the subject of guidelines for setting up heliports that we have used in Ohio, and that certainly can be applied elsewhere throughout the country. A short decade ago, a formal, instructionalized approach to planning for urban heliports did not exist. The first metropolitan heliport began operations in 1947. The plan for the integration of helicopter transportation into urban transportation planning, did not appear until the early 1970's, 25 years later.

The advent of the sophisticated turbine-powered helicopters preceded the formal planning efforts of the early 1970's by about five years, roughly the same as Mr. Stuelpnagel's presentation, the first talk that we had, on Tuesday.

The phenominal growth of the business and commercial helicopter market, where helicopters are used to transport industry people into and out of the seats of commerce and government, has brought about planning by crisis in many of our country's major metropolitan areas. This is a fairly typical way that things are done, but certainly not the most advantageous or the most desirable.

The issues to be addressed in planning and subsequent siting of metropolitan heliports generally require a comprehensive study that focuses on many aspects. One of these aspects we ought to consider initially is, for instance, the market assumptions.

The growth of helicopter sales can be a fairly reliable barameter in priority assessment for local and regional transportation planners. These growth patterns should be taken into consideration when developing transportation scenarios — in other words, what is going on.

The political issues involved, beyond some of the more concrete parameters related to planning and siting public-use heliports, is the often times difficult one of just identifying the political climate within the community.

Judging from some of the speakers that we heard last night at the dinner, I think it was rather graphically illustrated that an assessment of equipment characteristics is needed. In other words, what are you going to use in heliport siting considerations and planning?

Land-use compatibility is another element to be assessed, such as the proximity to noise-sensitive areas. Is the proposed site programmed for future rehabilitation? This leads to the questions as to what time period can we reasonably expect to keep a heliport at a particular site? Should the heliport be at ground level or elevated? What about transportation interfacing? Access to the CBD's, zoning adjacent to the site, and the proximity to airports and other heliports, are all considerations in land-use compatibility.

Something that has not been mentioned yet, but is a matter to take into consideration, are the aesthetics. Now, what does that have to do with heliports? Well, for example, resistance to a poorly planned heliport could be anticipated if a proposed site is adjacent to or on top of a historical or other aesthetically-sensitive site.

Yet, on the other hand, you can use a heliport to actually improve the aesthetics of some places, particularly in industrial areas. A heliport, perhaps situated on an elevated platform or over a railroad track, some place where there is little land use or space use competition, can actually increase or enhance the aesthetic qualities of the site.

You also have to look at the requirements for the facility itself. Is it going to be simply an open area in which to land, or do you have passenger waiting facilities, taxi stands, and so on — you know, everything from soup to nuts. It just depends on what you are going to be doing at that particular site, and what you need to do it with.

Financial considerations sometimes can be very cumbersome when you are trying to work in the public sector and need to get public funds, whether state or federal, or even local, to do your heliport development. However, don't overlook the possibility of private funds for public heliport development. We have been relatively successful in the State of Ohio, using the latter means.

Another thing I would also like to mention is that quite often it's possible, with a private heliport — privately owned, private use — to convince the individual or company that owns it, in the interest of public service and recognition to convert that private heliport into a public heliport. And, of course, that only works if the site is located at a place where other prople would like to go, as well as the private individual who owns that heliport.

These are all considerations that should be taken into account when considering the development of a heliport.

I would like to recommend, or at least remind you, of the Advisory Circular, the Heliport Design Guide published by the FAA, which is known as the heliport designers' Bible. That has got everything that you ever wanted to know, or were afraid to ask, about heliports in it. Finally, I recommend that if you have any problems, contact your local or state aviation divisions, or the planning offices of FAA —the local GADO offices can also provide information. There are a lot of sources you can go to, and they're all just out there, itching to help you. Thank you very much.

ROTORCRAFT SAFETY AND OPERATIONAL RELIABILITY

Arthur Negrette
President and Chief Executive Officer
Flight Safety Institute

Perhaps the most difficult issue relating to helicopter flight safety is the divergence between public perception of helicopter safety and the real-world facts. Indeed, during the past several days, we have heard several speakers, and I am sure you have heard, in the workshops, some reference to this particular problem.

The basis for this documented, but elusive, phenomenon remains a mystery, but analysts offer various explanations, to include the following: first of all, a lack of understanding by the general public of how the helicopter works and basic flight principles; second, the myth that helicopters will crash if an engine fails, since helicopters lack wings, and hence are unable to glide.

And to really understand the role this particular issue plays, ask your neighbor some time if he understands what "glide" means, and how airplanes glide, and he will probably say yes. In fact, small children understand that concept.

But ask your neighbor if he understands what autorotation means, and I'm sure you will find that he probably has never heard the term.

Third, the obvious number and complexity of moving parts associated with helicopters, has caused some part of this myth that helicopters are inherently unsafe. Fourth, the comparatively small and frail appearance of early helicopters, has also been a contributing factor, and finally, the wide publicity given civil and military helicopter accidents has also been a factor.

While the public's misconception of helicopter safety has yielded only minimally to successful efforts of aeronautical engineers, safety specialists, pilots, maintenance personnel, and helicopter operators, the statistics on helicopter accidents reflect a continuous series of victories in the battle to reduce helicopter accidents.

The safety record for civil helicopters in the United States reflects an impressive improvement trend, from 35 accidents per 100,000 hours in 1969, to less than 14 accidents per 100,000 flying hours in 1979. And this trend is continuing to improve in the '80's.

This dramatic reduction in the helicopter accident rate occurred despite extremely rapid growth in the number of civil helicopters, numerous and previously untried new applications for helicopters and helicopter technology, the very unforgiving environments in which helicopters operate, and I'm thinking now of such things as offshore operations, mountainous terrain, deserts, and arctic conditions, where both man, pilots, maintenance personnel and equipment are put to the ultimate test.

And, fourth, the use of helicopters to perform many inherently dangerous activities, such as the evacuation of people from burning high-rise complexes and other tall structures.

Helicopter public transportation operations have even a higher safety record. The accident rate for air taxi operators certified under Part 135 was only 3.3 accidents per 100,000 flying hours for the three-year period 1977 to 1979, a rate which was lower than that for commuter carriers during the same period.

While the usual methodology for reporting accident rates is in terms of accidents per 100,000 flying hours, this approach tends to bias comparative statistics in favor of long-haul flights. Since accidents often occur during either takeoff or landings, additional insight into helicopter safety records vis-a-vis the other types of operations can be gained by comparing the number of accidents per 100,000 departures.

Using this methodology, during the period 1977 to '79, the accident rate per 100,000 departures, for different types of operators, was as follows — 0.32 for certified helicopter operators, 0.14 for ceritficated carriers, and 1.17 for commuter air carriers.

I think the results of this analysis indicate that helicopter operators, those who operate certificated air taxi operations, compare quite favorably to the scheduled trunk airlines, and better than many other operators.

An explanation of this dramatic improvement in helicopter accident statistics would have to include such factors as, first, the utilization of turbine engines.

For example, an analysis by Boeing of helicopter accidents during 1975 concluded that the accident rate for turbine-powered helicopters was 9 accidents per 100,000 hours, whereas it was 29.7 accidents in helicopters with reciprocating engines, a threefold increase over the turbine helicopter rate.

While the number of helicopter shipments with reciprocating engines has decreased slightly in the past five years, the number of turbine-powered helicopter shipments by the manufacturers has increased significantly. The demand for turbine-powered helicopters is expected to increase during the 1980's in most major segments of the industry, such as offshore operations, logging, corporate air, air ambulance, and air taxi operators, which will yield still greater improvements in the accident rate for helicopters.

A second factor playing an important in the improving safety record for helicopters is the use of multi-engine helicopters. As more manufacturers have included one or more multi-engine helicopters in their product line, the number of multi-engine helicopters in the civil fleet has shown a steady increase. During 1975, the accident rate for multi-engine turbine helicopters was only 3.9 accidents per 100,000 flying hours, whereas the accident rate for single-engine turbine helicopters was 2½ times greater, at 9.9 accidents per 100,000 hours.

The demand for multi-engine helicopters is also expected to increase during the '80's, as new performance demands are placed upon helicopter operators which necessitate the greater power availability of multi-engine helicopters.

A third factor which has contributed and will continue to contribute to helicopter safety is the greater control of maintenance, training, and operations, which is allowed by the use of micro-computer technology. While operators have always had control over operations, training, and maintenance, the micro-computer allows the helicopter operator to greatly expand his capability in these area, to both the direct and indirect benefit of safety.

Another area, which many of you are already familiar with, but which will continue to play an important role in helicopter safety, is the IFR certificaiton of more and more helicopters. The availability of IFR helicopters has enhanced flight safety in many ways, including first of all, the development of improved stability augmentation systems and autopilots.

These systems reduce pilot workload, and limit the potential for vertigo, or disorientation, and error accidents by flight crews. The availability of IFR-approved helicopters has also enhanced safety considerably in other areas, including the requirement for additional and more highly trained pilots. This has produced, as an end product, higher safety levels as it has allowed pilots to not only have IFR ability, but also to maintain their IFR proficiency, as we find more and more IFR helicopters entering the flow of traffic.

By having IFR helicopters, we find that helicopter operators are allowed to make greater utilization of FAA facilities and services, such as NAVAIDS, air traffic control services, weather briefings, and so forth.

Just a final comment on local government planning considerations and helicopter flight safety. Although great strides have been made in safety by the efforts of aeronautical engineers, pilots, operators, maintenance personnel, safety specialists, and others, there is room for the local planner to assist in this process.

While many can help to improve the helicopter's operating environment, the professional planner is especially well-trained and positioned to seriously assist in promoting a safer environment for helicopter operations, especially as the number of urban helicopter and urban heliports increases. The planner, by virtue of his or her position in the approval process of local government, can insure that certain planning considerations are given early attention which will subsequently affect flight safety.

Planning considerations relating to helicopter safety include an awareness of wires and structures. Over 208 wire strike accidents occurred between 1970 and 1979. A recent NASA study indicated that these 208 helicopter accidents accounted for 37 fatalities, 52 serious injuries, and over $11 million damage.

By carefully examining development plans, zoning variances and land use applications, the city and community planner can play an important role in reducing these accidents. Though it is not practical to mark every wire, the planner can and should be critical of proposed wires or abstructions in the vicinity of known or potential heliports.

Other areas where the professional planner can be of assistance is in reviewing the location and layout of helipads and in preparing appropriate zoning and land use plans in the vicinity of heliports.

In summary, the safety record of helicopters has dramatically improved during the past ten years. Planners can contribute to helicopter safety by taking into consideration certain environmental factors which may affect safety and the use of heliports.

ROTORCRAFT BENEFITS AND OPPORTUNITIES IN URBAN APPLICATIONS

David S. Lawrence
Manager, Business Planning
Sikorsky Aircraft

Those of us who have lived with the helicopter industry in the last decade are a little dazzled by the way it's changed. For one thing, the size of the business has doubled in real terms from about $15 billion in the seventies to $30 billion in the eighties, and it continues to grow at about 7% per year ahead of inflation. Second, the helicopter of the eighties is nearly half again the real value of the helicopter of the seventies. This suggests an increase in the size of military transports, but to a greater extent it reflects the fleeting up of the civil market from small, light helicopters to larger twin-turbine equipment. Perhaps most importantly, the civil market, which was less than half the value of the military market during the seventies, will nearly match the military market in the eighties, growing at a real rate of 11% per year.

Thus, we perceive an increasingly urgent message from the marketplace that we had better respond to specific civil helicopter needs with the same attention we have previously directed to the military side. As a result, the parameters by which commercial helicopter users measure the goodness of helicopters have become firmly established in our own design requirements. Consequently, such things as operating costs, comfort, and environmental compatibiity have improved substantially. Moreover, as the importance of the civil market continues to increase, and as the manufacturing community continues to respond to those signals, the improvements of this decade will dwarf those of the last.

A wide variety of civil helicopters is produced today. If we were to average out the significant attributes of these helicopters, the result might be a cruise speed of 140 knots, an effective range of 200 nautical miles, and an operating cost of about 40 cents per available seat mile. These data, with typical associated costs and revenues, might add up to the hypothetical operator's profit and loss statement summarized in Exhibit 1. Obviously the bottom line is marginal in this example; many of you know that that situation was not uncommon in the history of commercial helicopter operations. That is why they have succeeded only in unique circumstances, where their instrinsic high costs were insignificant in some critical mission, or they were balanced by high alternative costs. Thus, the helicopter succeeded in offshore service, and in certain jobs in the lumber business and the pipeline business, where no alternative exists and where the revenues at stake are exceptionally high. And it has found a home in transporting business managers whose time is disproportionately valuable to their companies.

These market parameters are always shifting: For example, deregulation of scheduled airline service has increased the difficulty and cost of transportation between certain communities, so that helicopter service that once seemed prohibitively expensive now seems marginal, and service that once seemed marginal appears now to be successful. But more significant than changing market factors is helicopter technology, which is moving toward substantially improved costs, productivity, and community acceptance.

In the operating cost data above we can see that of the major costs, 51% is driven by manufacturing cost and 41% is driven by inherent aircraft operating characteristics (Exhibit 2). In other words, a total of 92% (at least in theory) is largely under the control of aircraft manufacturers. And these costs are being driven down rapidly by new developments in manufacturing and design.

First, in the area of aircraft structures, perhaps the most significant technological improvement of this decade will be a wholesale shift from traditional metals to advanced composites such as Kevlar epoxy and graphite epoxy. This shift is evidenced in our S-76 introduced in 1979, as well as in other products now in production. It affects manufacturing costs in three important ways. First, it reduces our need for aluminum and titanium for which we depend heavily on foreign sources, and thereby it will help stabilize the cost of material. Secondly, widespread use of composites will reduce the horsepower requirement and thus the cost of the aircraft. Finally, composite structures lend themselves to automation, which further reduces the cost of aircraft manufacture.

A second area of cost reduction is that of manufacturing technology. Robotics, while not nearly as well-developed as in the automobile industry, is now being integrated into helicopter production. We are using robotics in chemical milling, for example, and we have identified many other applications which will result in downstream reductions of manufacturing costs. Another advance is pulsed laser processing. You may be aware that one of the major obstacles in dealing with significant reductions in cost and improvements is quality control.

Most of our ability to improve helicopter operating costs, however, is in the 41% related to aircraft performance. We expect significant improvements in maintenance costs as a result of reduced vibration and of parts simplification; we expect a substantial improvement in the fuel economy of helicopters as a result of work being done by our engine manufacturers, and we expect major improvements in the service lives of helicopter components, which will halve the maintenance time needed on a typical 3,000 hp helicopter drive system.

The result of all these changes should mean a substantive improvement in helicopter operating costs, perhaps by as much as 30% (Exhibit 3). In addition, the cruise speed of the 1990 helicopter may exceed 180 knots. This is certainly written into advance specifications for military equipment that will be required in the early 1990s, and we have every expectation that a pure helicopter with that speed capability will be available to the civil market at about the same time. The effect of the increased speed and reduced costs could cut seat-mile costs in half, to the neighborhood of 20 cents. Other costs and revenues remaining the same, the gross margin in our example would increase tenfold, bringing it well into the area of financial reality.

Finally on the subject of product improvement, we may briefly address the business of noise. The FAA has defined standards for the external noise of helicopters that we in the industry feel will be difficult to meet. We are concerned partly with the cost of the technology necessary to reach these prospective standards; we are particularly concerned with the state-of-the-art of measuring helicopter noise, which makes it difficult to know when in fact you have met the standards; and we are concerned with the potential loss of markets for the U.S. helicopter industry, whose standards may be far more stringent than those overseas. However, while we work with the government toward an agreeable compromise, we can all be assured that the final position will be a substantial reduction in helicopter noise. I think it safe to predict that we will arrive at a workable standard that will enhance the helicopter's compatability with urban communities, and thereby will significantly increase its usefulness in that setting.

Let me summarize these introductory thoughts. First, the helicopter has been economically marginal, but it enjoys obvious unique attributes that make it essential in certain operations for which there are no reasonable alternatives. Second, the technology improvements that we see maturing during the next few years will make it far less marginal economically, and far more essential operationally. Given these two observations, let's examine the function of the helicopter in urban areas.

There are three widely accepted uses for the helicopter: First, to provide service for the business community in the form of flexible, rapid transportation for those whose time is particularly costly; second, to provide convenience for air travelers whose trip-ends would otherwise lose efficiency in the urban complex; and third, to provide public service in the form of police, fire, and medevac missions. The value of these functions obviously increases as urban areas become larger and more complex.

What may be less obvious is that these functions, once viewed as elitist, are essential to the value of the large urban complex.

A few facts of urban growth may give us a better perspective. It seems inevitable that as an urban area grows up around a base industry, its resource cost structure will change, and the economics of the center city will become inimical to the very industry that gave it its growth. Specifically, as a city responds to forces of agglomeration, it must decentralize functions that are land-intensive, and at the same time it will increase the technological complexity of its core. This is not a preventable evolution.

Since residence and manufacuting uses are notoriously land-intensive, while finance and decisionmaking are technologically complex, large corporations will attempt to disperse their labor-oriented functions, while still maintaining a strong presence in the centers of commerce and trade.

Some of you are familiar with the works of J.H. von Thunen and John Meyer. While 150 years apart in time, both considered differences in the productivity of land in its various uses, and differences in the cost of moving various products to market. They concluded that land intensity and transportation cost would dictate the distance from a central market that economic activity would take place—for example, you wouldn't normally graze cattle in the central business district. In fact, modern cities must inevitably look just the way they do: High-density functions are at the center; jetports, suburban homes, and so forth are on a vague perimeter that continuously expands.

Thus, the large corporation must be in two places at the same time: at the periphery, where it lives and manufactures; and in the center, where it does its financial maneuvering and decisionmaking. This leads to an expensive network of cross-hauling, that is in fact the classic urban transportation problem; and that leads to inefficiencies in the linkage between corporate operations and corporate headquarters. These inefficiencies may cause the typical corporation to abandon the urban center for a suburb that seems (at least superficially) to satisfy its locational requirements.

While the corporate exodus is one of the most visible problems in long-term city growth, there is broader problem, one not so easily seen, whose insidious threat to the city is far more serious.

The typical city grows up around a single base industry, or at the most a handful of industries that have found it a comfortable place to be. So Detroit has cars and Houston has oil, and so on. But once New Bedford had whaling, and Ruth, Nevada had a copper mine. The point, of course, is that base industries don't live forever, and the question then must be, how can a city jump from a sinking base industry. The classic example of an urban area that did make such a jump is that of Eastern Massachusetts, which has made the difficult transition from textiles to electronics. Urban scholars will tell you that this was made possible because of Boston's rich infrastructure. But a more careful assessment might suggest that the electronics industry is incidental, and, as Wilbur Thompson has put it, that the real economic base of the metropolitan area is the flexibility of its transportation networks and the other dimensions of the infrastructure itself.

Because the central city does best those activities that depend on rapid communication and face-to-face contacts, whose inputs are information and whose outputs are decisions. These activities become a new export commodity, one in which the mature city has a distinct comparative advantage. Like any export, it must be transported, but not by 18-wheelers or piggy-back freight cars.

This new export needs high-speed, flexible, personal transportation between intra-regional components and from city centers to long-haul airports. And that is a key to the extended viability of mature urban areas. It was his understanding of this need that led the late Robert Moses, in his 50 years of reinventing New York, to commit resources to flexible, personal transportation. His love affair with the car at the expense of mass transit probably caused his political downfall, but it preserved for Manhattan the business advantages that it still enjoys.

In other words, despite its high labor costs and crowded land—or perhaps because of them—the resource potential of the urban core remains great. The city can keep its power base and attract new primary industries if—and only if—it can accommodate the necessary corporate cross-haul.

I don't mean to lecture on regional economics—certainly not to this audience—so let me wrap up this digression.

Viable urban areas need fluidity in transportation to link opposing land uses and to ride a changing economic base. The helicopter offers that fluidity of transportation. Moreover, today's helicopters—and the remarkably improved helicopters that will be built in this decade—can satisfy this need while earning a fair and attractive profit for their corporate and commercial operators.

Yet, if the cities are to fully exploit the helicopter's potential, we will need some effort from the cities themselves. Beyond the purview of the helicopter manufacturers or operators are such things as heliports, and far-sighted policies on land use and noise containment. With the importance of sophisticated infratructure to the growing city, and the essentiality of flexible personal transportation to the infrastructure, can we really believe that the costs and benefits of that transportation are actually internal to its users? Clearly the benefits extend to the city as a whole; and some of the development costs must be shared by those who will benefit. These are issues that urban and regional planners must address.

The venerable geographer Erich Zimmermann once said that "resources" aren't "things" but the way things are used. A city isn't a resource unless it's a vibrant center of commerce. The helicopter is a resource that can keep it that way.

Exhibit: 1 HYPOTHETICAL OPERATOR'S INCOME STATEMENT

Revenue			$1,080,000
Cost and Expenses			
Direct Operating			
Flight Crew	$ 78,000		
Insurance	73,200		
Depreciation	120,000		
Maintenance	240,000		
Fuel & Lubricants	192,000		
Total		703,200	
Indirect Operating		352,800	
Total Operating Expenses			1,056,000
Gross Operating Income			$ 24,000

EXHIBIT 2: MAJOR HELICOPTER OPERATING COSTS

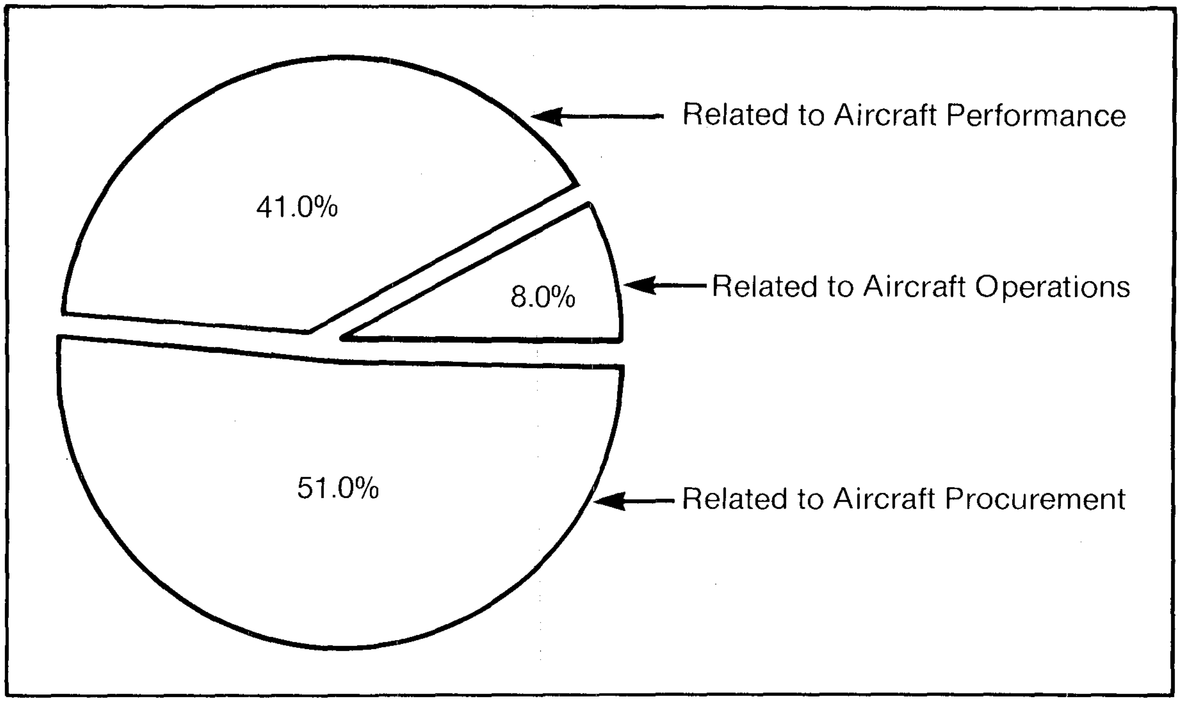


EXHIBIT 3: PROSPECTIVE IMPROVEMENTS IN HYPOTHETICAL BALANCE SHEET BY 1990

	1981	1990
Revenue	$1,080,000	$ 1,080,000
Cost and Expenses		
Direct Operating		
Flight Crew	78,000	78,000
Insurance	73,200	59,712
Depreciation	120,000	89,570
Maintenance	240,000	144,000
Fuel & Lubricants	192,000	120,960
Total	703,200	492,240
Indirect Operating	352,800	299,880
Total Operating Expenses	1,056,000	792,120
Gross Operating Income	$ 24,000	$ 287,880

COMMUNITY ROTORCRAFT AIR TRANSPORTATION OPPORTUNITIES AND BENEFITS

D. J. Freund
Vitro Laboratories

Introduction

As Glen Gilbert pointed out in his introduction, this morning's session has been reporting material related to The Study on Rotorcraft Air Transportation. The study was conducted by the Helicopter Association International, with the assistance of VITRO Laboratories Division of Automation Industries, Inc., located in Silver Spring, Maryland. The draft version of the study report is contained in two volumes bound in blue that you received when you registered for the conference.

The primary objectives of the Helicopter Study were:

One, to present the current status and future projections of rotor technology — in a form suited to the attendees at this conference.

Two, to study the intermodal relationships between rotorcraft and other transportation vehicles.

And, third, to study promising rotorcraft transportation, community opportunities and benefits. That is the subject of this presentation. I should note that the adjective "promising" is most important. We have been deliberately looking for opportunities where the rotorcraft can excel — we were not attempting to make an objective study of all opportunities for all transportation vehicles. Hence, the scenarios we examined were clearly structured toward situations that favored the helicopter (or rotorcraft). Our test of acceptability was simply: "Even though the scenario might be biased, was the scenario realistic?"

From the very beginning of the study we recognized that there would be some planners at the conference who would not be familiar with helicopters and that some background material that highlighted how and why the helicopter was different would be useful.

With that in mind we prepared some material on "Unique Rotorcraft Capabilities." It was our view that while everyone knows that a helicopter can take-off and land vertically, there are other corollary capabilities, not as well known, that should be understood when considering helicopter opportunities.

We then went one step further and summarized some of the applications where the unique characteristics were important. So Section "G" of the Study Report on Opportunities and Benefits, is preceded by a discussion of those two topics — and I would like to spend a few minutes doing the same thing in this presentation.

After that, the main discussion will focus on "Opportunities and Benefits."

Unique Capabilities of Helicopters

The helicopter has a number of unique capabilities that cannot be duplicated by normal airplanes, and many of these capabilities are useful in the transportation of people or cargo from one place to another. I would like to discuss each of the more important unique capabilities to show why and how it can be important.

Vertical Take-Off and Landing

During a typical final approach to landing, a helicopter decelerates from cruising speed and descends in altitude until it reaches a hovering condition just above the intended point of landing. If necessary, it can move sideways, forward, backward, or even rotate until it is positioned precisely for landing. Only then does it descend vertically for the final few feet to touchdown.

It has been said that an airplane lands and then stops, whereas a helicopter stops and then lands. The maneuvering flexibility close to the ground enables a pilot to land a helicopter with great precision. A minimum sized heliport need only be slightly larger than the rotor diameter of the largest helicopter expected to land there. As a result, there is great flexibility in selecting sites for heliports.

Operation on Unprepared Surfaces

Helicopters are unique among aircraft in being able to operate from unprepared surfaces such as open fields. This enables helicopters to perform many missions that are not possible for other aircraft types. This capability exists because helicopters have large rotor blades which result in a relatively low velocity of the air that is propelled downwards.

As was pointed out by Jon Magee on Tuesday in his presentation of the Tilt Rotor, other vertical take-off and landing aircraft (such as the fan/jet) have high velocity as well as high temperature downwash characteristics that require the aircraft to be operated from hard, heat resistant surfaces (such as concrete.) The ability to operate from unprepared surfaces provides the helicopter with an almost infinite choice of landing sites.

Hover and Hover-Taxi

The ability to hover is the helicopter's most striking capability. It is an essential characteristic in many of the missions that the helicopter is called upon to perform. It is this capability that makes the helicopter so useful in rescue missions such as at sea or at fires of high rise buildings.

The large majority of helicopters have skid type landing gear and cannot taxi in the way that airplanes do. Instead their "ground movement" must be done by hover-taxiing a few feet off the ground. This turns out to be an advantage rather than a disadvantage and provides great flexibility in movements around an airport or heliport. For example, after making an instrument approach at an airport, a helicopter pilot can go from his minimum descent altitude directly to the helicopter landing site by hover-taxiing—without interfering with the path of airplanes on the landing approach and without actually touching down on the runway and consuming valuable runway time. In fact, the preferred practice is for the helicopter to have completely separate approach and landing patterns that do not interfere with the patterns used by fixed-wing airplanes.

Slow Flying

With some minor restrictions, the helicopter has the latitude to fly at any speed from zero to its maximum cruising speed. This provides great flexibility in flight patterns and contributes to the value of the helicopter in many applications.

From a safety standpoint, the slow airspeed that can be flown by helicopters in approach patterns to landing are particulary important. High airspeeds have always been a problem for fixed-wing aircraft in such approaches. They reduce decision time in the air and have all of the hazards of high speed operations on the ground. As the speed of the aircraft's flight decreases, the approach becomes progressively simpler and safer. Under conditions or poor visability, the helicopter, flying at typically slower approach speeds can make adjustments in selecting and maneuvering to the specific landing site—capabilities that would be impossible for the airplane — particularly high performance jet aircraft.

Because of its slow fight capability, the helicopter can make approaches to landing at considerably steeper approach angles than airplanes, without exceeding a safe vertical speed. This increases considerably the number of locations where a helicopter can land. The normal instrument approach angle for most airplanes is three degrees, and the maximum about six degrees. A helicopter can operate comfortably up to about 12 degrees. Steep approaches can also be useful in reducing the noise footprint at the landing site.

Agricultural spraying is another example, and the low speed capability provides advantages both in spraying close to obstacles and in reducing the time and space required to turn around and start the next swath.

Because of the ability of the helicopter to take off and land vertically, chemical refueling trucks can be brought right to the fields being sprayed. To minimize loading and reloading time, the helicopter lands on a special platform on the truck, and as soon as the loading operation is complete, the helicopter takes off and resumes spraying.

In tall crops such as corn, or fruit trees, downwash from the helicopter provides better penetration of the applied material. The spraying of the Medfly takes advantage of this capability.

Cargo/Hoist

The helicopter is also an effective vehicle for carrying external loads, the primary restriction being one of weight rather than shape or size. Two applications that illustrate this capability are the erection of radio and TV towers on the top of large high rise buildings and the use of the helicopter in logging operations where the terrain is too difficult for ground vehicles to be operated. Other examples of external lift include carrying part of the structure of an oil rig and carrying part of a pipeline under construction in an area that is not readily accessible by truck.

With respect to weight carrying capability, helicopters are currently in produciton that can carry an external load of almost 30,000 pounds. Also, the technology is available to design helicopters that can carry 200 people or equally heavy external loads.

The hoist capability is an important element in making helicopters as useful as they are for rescue operations. A recent rescue mission that illustrates this important ability of helicopters took place when the cruise ship *Prinsemdam* sank in October 1980, 150 miles off the coast of Alaska. All 450 passengers were rescued without serious mishap despite cold weather and stormy seas. Of that total, 350 of the passengers were rescued by helicopters which hoisted them from the life boats into which they had escaped from the sinking ship. Coast Guard personnel who supervised this mission expressed the belief that most of the passengers would not have survived if helicopters had not been available.

Inaccessible Sites

The ability of the helicopter to fly quickly to sites that are not accessible to other vehicles accounts for any of its applications. Flying to offshore oil rigs is the largest commercial use of this characteristic.

The final example I would like to mention is a heliport operated by Petroleum Helicopters in Morgan City, Louisiana. It has landing and parking pads for over 40 helicopters, and to my knowledge, is the largest heliport in the United States. For anyone comtemplating a large heliport, this is a good place to look at to get ideas.

Opportunities and Benefits

Now let us turn to the analysis of opportunities and benefits. The helicopter applications just discussed illustrate its value in public service, in corporate flying, and in many commerical ventures. However, the helicopter is reaching the stage in its development where many people feel that it can compete more and more with other forms of passenger transportation on the basis of time savings, cost savings and convenience.

This is one of the main challenges of this Conference—namely, to examine this potential and see if it is real—and if it is real, to investigate ways in which its use can be fostered.

On Tuesday, Tom Stuelpnagel pointed out that a basic and underlying trend that has opened up the potential for passenger transportation is the substantial technical improvements that have been made in helicopters over the past decade.

The third generation helicopter such as the Bell 222 which you saw at the airport Tuesday is indeed a different vehicle than its predecessors, and those of you who took orientation rides have some appreciation of that difference.

The steps in the methodology we used to conduct the study of opportunities and benefits are listed below:

1. Review of Helicopter Applications
2. Classification of Environments
3. Preliminary Assessment of Benefits
4. 24 Promising Scenarios Identified
5. Scenario Assessment
6. Translation to Opportunities and Benefits
7. Conclusions
8. Recommendations

We started off by reviewing all the helicopter applications we could find as well as the environments in which they can operate.

Ten broad categories were identified, namely:

Public Service
Public Transportation
Corporate/Executive
Energy Exploration and Production
Construction
Cargo
Agriculture & Forestry
Other Commercial Applications such as TV news reporting and mapping
Flight Training
Personal Use

We then attempted to make a preliminary assessment of six categories of opportunities and benefits. These included:

Economic
Community Quality of Life
Improved Safety
Transportation Interface
Energy Conservation
Special or Unique Services

Finally, we identified seven categories of environments, namely:

Central Business District
Suburban
Small Community
Remote Area
Topographically Constrained
Airport
Ocean Area

At this time in our study we were quite concerned. Here we had a three dimensional matrix with over 400 combinations to be analyzed. To do in-depth research for data in each of these areas and to create scenarios in the process was simply beyond the resources we had available to us. Somehow we had to narrow down the problem.

The way we did it was this. We reexamined the matrix and identified (based on the experience and judgement of knowledgeable people on our team) 24 applications as having the best potential for realizable opportunities and benefits. For each of those applications we created scenarios for analysis. Table 1 lists the 24 scenarios we picked. The first three categories received the greatest attention.

Public Service: 7 Scenarios
Public Transportaiton: 6 Scenarios
Corporate/Executive: 3 Scenarios

Now let me give an indication of how we performed Step 5, the analysis of the 24 scenarios. Figure 1 is a flow chart of the analysis methodology we used. Block 1 on the top-left represents the creation of each scenario. Block 2, just to the right, is the identification of criteria that were considered important in assessing the value of the helicopter (and also competing transportation vehicles) in that scenario. These were items such as speed or productivity.

In Block 3, we prioritized the criteria and assigned weighting values.

In Block 4, we established, whenever possible, a measuring stick for determining a value (usually on a scale of zero to ten) of how well each vehicle performed in each criteria. For example, in the criterion of transit time in a particular scenario, we might assign a value of 10 if the trip was made in one hour and a half that amount or 5, if made in two hours.

Block 5 in the flow diagram represents the performing of that assessment of vehicle performance. We then made the computations to get a total value for each vehicle. And from there, we made variations of key parameters in the scenario so we could identify trends or relationships.

To make this more specific and realistic, let me give an example:

One scenario covered the case of public transportation service between two Central Business Districts (CBDs) that were 100 miles apart.

The class of users considered for this service was upper and middle level business supervisors and managers. The airport at each CBD was 25 miles away; a public service heliport was located in the center of each CBD. Non-rush hours were assumed for the assessment.

The transportation options considered were:

- Scheduled helicopter (with 4 flights available per day)
- Rental car
- Scheduled bus (with 5 trips available per day), and
- Scheduled air commuter and taxi (4 flights per day)

The assessment criteria considered important for this scenario were:

- Time efficiency
- Schedule convenience
- Service reliability
- Comfort (spaciousness)
- Annoyances (noise, traffic congestion, etc.)
- Costs

Two variations of the scenario were assessed, i.g., one with the distance between CBD's increased to 200 miles, the other with the distance increased to 300 miles.

On the top of Figure 2 you see the six criteria and the weighting factor applied. For example, time efficiency was given a weight of 1, schedule convenience 0.7, et cetera.

In the graphs of Figure 2 you can see the performance measures that were established. In transit time for example, the value of the vehicle goes down as the duration of the trip increases. In schedule convenience, the value decreases as the number of available trips per say decreases, et cetera.

In Figure 3 you see the type of plots we used to interpret the results. On the horizontal scale, in this case, there are three variations in distance between CBDs—the vertical scale represents performance values.

At this point, I would like to assure you that we did not place too much credence on the specific values, but we were interested in the trends. In this case the helicopter does better than the airplane at the shorter distances, but the airplane improves quickly with increasing distance and eventually does a better job in this scenario at the longer ranges.

Before leaving the subject of the scenarios and their analysis, I would like to mention the following points.

We feel that an assessment of the scenarios on the basis of judgments of people having experience with helicopter operations has some value but it also has some important limitations. The assumptions and judgments used by the assessment team had a direct effect on the results obtained and other experts would undoubtedly arrive at different absolute results. Nevertheless, it is not the absolute values of the results that are important but the trends from considering variations in the scenarios.

Second, we think that the methodology used in the analysis could be successfully used by planners in considering their own helicopter transportation possibilities.

Third, we think that the methodology used in the analysis could be successfully used by planners in considering their own helicopter transportation needs.

The appendix to the Rotorcraft Report provides the details of this analysis process in twelve of the scenarios.

With the information gained from the analysis of the two dozen scenarios, we then turned to the translation of this material into opportunities and benefits, Step 6—and after that, we formed our conclusions and recommendations.

To do this we needed a structure—so we turned to one that had been developed by Bob Winick in his study of intermodal relationships.

The results of these analyses revealed that there are quite a number of applications where there are important existing and potential opportunities and benefits. While there isn't time to discuss the details in this presentation, they are in the report. However, here are one or two summary comments.

The urban setting has a greater diversity of potential helicopter use than any other environment. Also it, together with the airport environment, is the primary location where there appears to be a large potential in the near future for helicopter use in public transportation. In addition, the urban area has an intensified need for helicopters in public service work such as fire rescue, ambulance, and law enforcement. It is natural environment for at least one of the terminals in much of the corporate/executive type of flying. Finally, a number of the applications in which the helicopter is used as a tool of production are found in the city (e.g., TV news, reporting construction, traffic reporting, bank mail transfer).

The report has many conclusions and ideas for consideration. I would like to pick out a few that seem to have the greatest underlying significance to the development of helicopter transportation. For planners, we have three of these:

First, public-use hub heliports in major cities. We feel that the helicopter cannot fulfill its role in the city until it has a place to land. With airplanes, airports were built first, and this encouraged the growth of airline transportation. The same pattern is needed to encourage helicopters. One public-use hub heliport in Washington, Boston, Los Angeles, and other large cities could be an important step in that direction.

Secondly, many small (essentially no-expense) heliports in heavily populated areas would encourage private, corporate, and business flying in those areas. They would also be a major contributor to safety in the city through improved public service flying.

Third, planning for national disasters. National disasters differ from the more normal helicopter rescue operations in the magnitude and scale of the rescue effort that is required. There are about eleven generally recognized types of disasters that can occur:

Flood	Tornado
Snow (frost/freeze)	Earthquake
Large scale mountain timber fires	Landslide
	Avalanche
Shipwreck	Drought
Hurricane	Volcanoes

Also, as in most other life activities, if an event can occur—eventually it will occur. The recent eruption of Mount St. Helens and the recent fires in California are examples.

Perhaps the most important factor leading to the success of rescue operations is the extent to which contingency plans have been made, and arrangements made, for the use of the necessary resources when the disaster occurs. Helicopters can make a major contribution to the nation in disaster relief—but only if detailed planning for their use is done ahead of time.

For researchers and technologists, I would like to focus on a single recommendation.

Progress in most fields of endeavor is characterized by quantum jumps of improvement, spread over time. Some little piece of the jigsaw puzzle is found at the right time, and that opens up a flood-gate of progress. In our work on the helicopter study, it seemed to us that the helicopter is on the verge of a large quantum jump of this type—and furthermore, we may know what piece of the jigsaw puzzle is needed.

The growth in airline transportation was directly related to the extent to which the aircraft could operate reliably, most of the time. This infers the ability to operate safely and on schedule in most weather conditions. Today, the airlines operate with very high reliability.

The pattern for helicopters is likely to be the same. Their use will increase progressively when the helicopter can do in bad weather what it can presently do in good weather. The problem is more complicated for the helicopter because, instead of having a few large centralized landing sites (like airports for airplanes), it has an almost infinite selection of small sites. Furthermore, only a few large city heliports can afford the necessary navigational aids such as instrument landing systems.

The offshore helicopter operators have developed a concept that offers potential to solve this problem, namely, more of the landing system should be contained in the aircraft and less (or none) at the landing site.

Much of the problem has already been solved. The point-in-space approaches used in the helicopter Northeast Corridor experiment can get the aircraft to the general location. All that is left is to pin down the location more accurately, to test the ground for flatness and freedom from obstructions, and then to land. The fact that the helicopter can fly slowly and hover, greatly assists in solving the problem.

Some new sensors are needed to do this. Perhaps the most important is the low-speed, speed indicator. Also, an accurate terminal navigation system is needed—perhaps airborne radar using corner reflects on the ground, or forward looking infra-red detectors working with a ground heat source. Finally some inexpensive system is needed to probe the ground characteristics prior to the final hover-descent from 100 feet or so in altitude. This is particularly important if the landing is at an unplanned and remote destination.

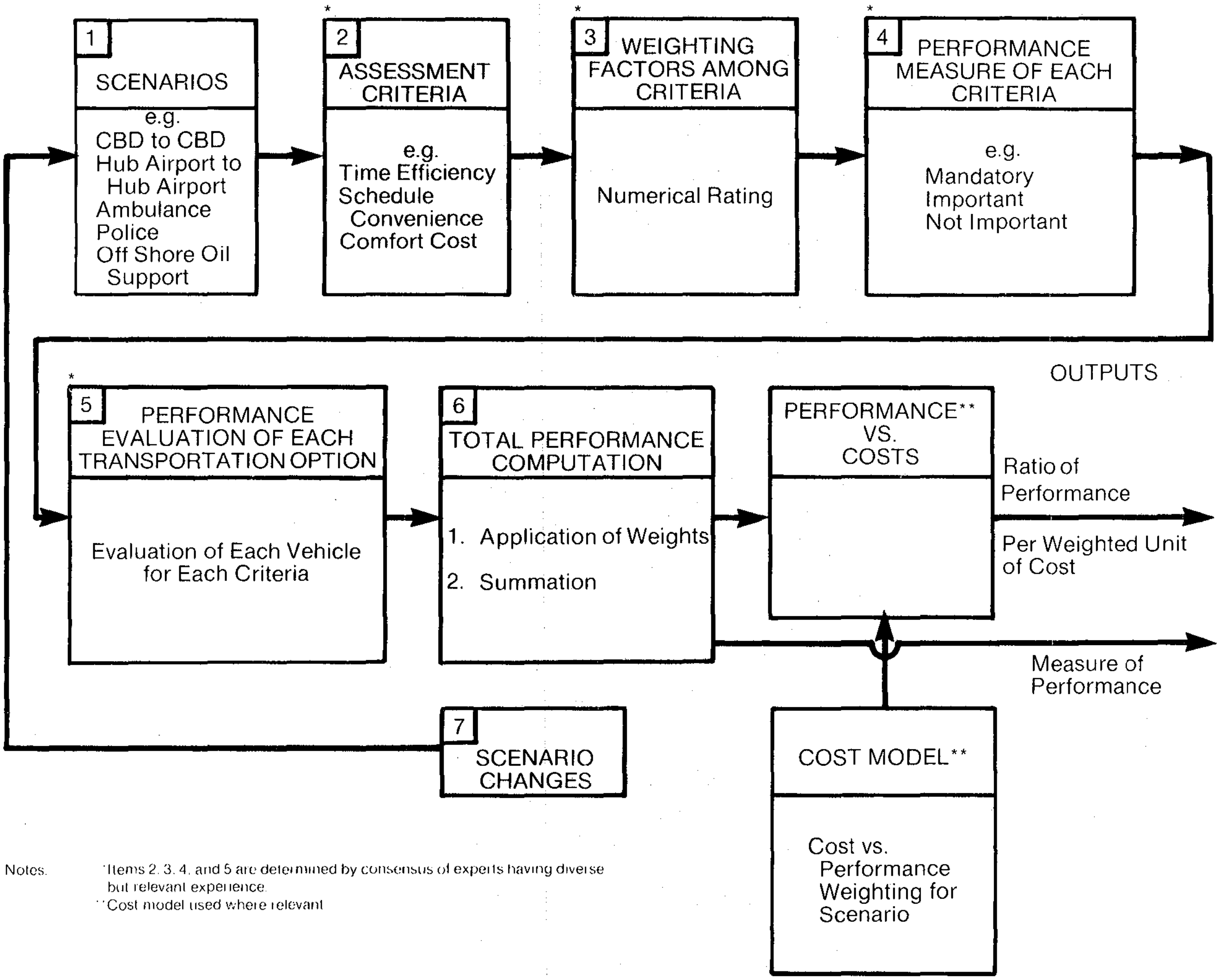
The emphasis placed in this recommendation stems from the realization gained in this study that the next major increase in helicopter use may take place when the helicopter can do under IMC (Instrument Meteorological Conditions) what it can now do under VMC (Visual Meteorological Conditions), that is, to fly to essentially any prepared or unprepared landing site, almost irrespective of the weather. It therefore appears that emphasis in development work to solve that need is warranted.

Thank you for your attention.

TABLE 1: PROMISING HELICOPTER SCENARIOS

1. PUBLIC SERVICE
   - a. Law Enforcement Search
   - b. Public Safety: Ambulance
   - c. Public Safety: Fire Rescue
   - d. Disaster Aid: Flood
   - e. Disaster Aid: Snow Storm
   - f. Disaster Aid: Large Scale Mountain Timber Fire
   - g. Search and Rescue: Mountain Area
2. PUBLIC TRANSPORTATION
   - h. Large Helicopters - Scheduled: To and From CBD's
   - i. Medium Helicopters - Scheduled: Intra CBD
   - j. Medium Helicopters - Scheduled: To and From CBD's
   - k. Medium Helicopters - Scheduled: To and From Airports
   - l. Large Helicopters - Unscheduled: To and From CBD's
   - m. Small Helicopters - Air Taxi: Topographically Constrained Area
3. CORPORATE/EXECUTIVE
   - n. Medium Helicopters - To and From CBD's
   - o. Medium Helicopters - To and From Suburbs
   - p. Medium Helicopters - To and From Airports
4. ENERGY EXPLORATION
   - q. Offshore Oil Rig Support
   - r. Powerline Laying: Remote Area
5. CONSTRUCTION
   - s. Crane: Intra CBD
   - t. Pole Laying: Suburbs
6. CARGO
   - u. External Lift: Ocean Area
7. AGRICULTURE/FORESTRY
   - v. Grain Spraying: Rural Area
   - w. Logging: Remote Area
8. OTHER BUSINESS/COMMERCIAL
   - x. TV Reporting: Intra CBD
   - y. Photography: Small Community
9. FLIGHT TRAINING
10. PERSONAL USE

FIGURE 1: EVALUATION MODEL



Notes. *Items 2, 3, 4, and 5 are determined by consensus of experts having diverse but relevant experience.
**Cost model used where relevant

FIGURE 2: SCHEDULED PUBLIC TRANSPORTATION BETWEEN CBD'S

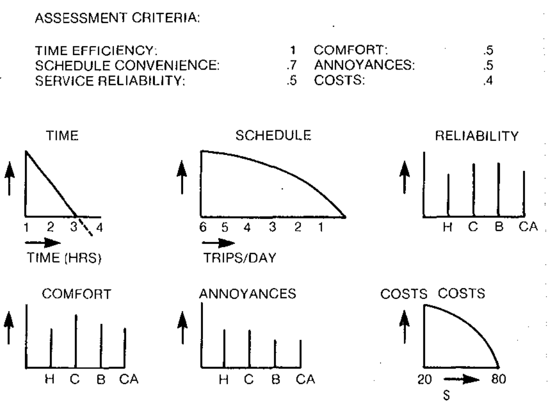
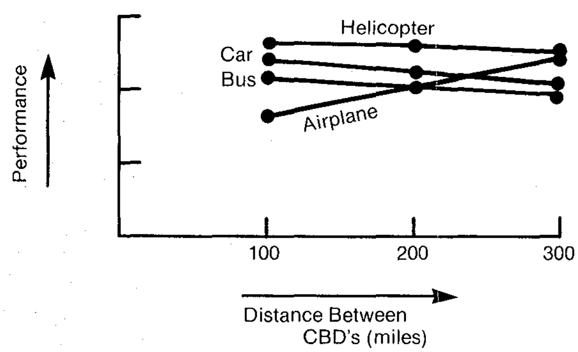


FIGURE 3: PERFORMANCE COMPARISONS AT VARIOUS DISTANCES



Margorie Kaplan
Economic Research
Douglas Aircraft

In assessing the potential growth of any product or sevice there are always significant supply and demand factors that are not easily quantifiable. The helicopter and commuter air transportation industries are no exception to this phenomenon. As we have heard throughout the Conference, there is great concern among manufacturers and operators about things such as safety, noise, modal preference, public acceptance, and other items that are difficult to incorporate into forecasting models. In such instances, it is useful to employ empirical knowledge, intuitive reasoning, and even a bit of armchair philosophy.

The focus of my talk is to address a few of these nonstatistical variables, the ones I believe most directly and dynamically impact the outlooks of the industries we are discussing. In particular, I refer to the social/political/cultural mood that has evolved over the past 20 years, the baby boom contingency, trends in work force makeup, and public sentiment about helicopter usage and helipad operations. Obviously, there are other noteworthy subjects, but these appear to be of prime significance in assessing future markets for helicopter and commuter air services.

The Mood of the Times

A number of social/political/cultural events have rumbled across the domestic scene over the past 20 years, slowly and then sometimes not so slowly, restricting long standing convictions and customs. It has been an unsettling time, characterized by confrontations over civil rights, shocking and grievous assassinations, a disillusioning war, student unrest and rebellion, political scandals, plus economic and social destabilization brought on by oil and gas shortages. Such events served to remind the populace that many of the environmental components of their lives were neither controllable nor reasonable, and that often they were not what they appeared to be at first or second blush. The prevailing feeling that evolved was an awareness that government might not be able to solve all the problems of its people. Consequently, a reluctance developed to pay for or trust the ability of a large centralized governmental system to feed, house, and provide medical care where it had originally only governed and preserved the peace. Though undoubtedly years in the making, the first large overt expression of these sentiments was the retrenchment of California taxpayers in 1978 via Proposition 13, a populist tax revolt that drastically reduced property taxes and severely constrained the State budget.

Baby Boom Cohorts

This large group of persons, born roughly between 1945 and 1960, pushed and squeezed through all facets of the American lifestyle, emerging into adulthood cynical and frustrated. There simply was not enough slack in the system to accommodate all of them at the same time. From grammar school through college, the job market and recently the housing market, they found themselves in a musical chair routine. It was a classic supply-demand inequality: too many persons chasing too few opportunities and resources. These persons reached maturity exuding a "live now" mentality that has pervaded all age groups. As the cohorts head into the 1990s, approaching their peak earning years, they carry their philosophy with them, translated into great concern about their own quality of living. They are the business and recreational travelers of tomorrow, the corporate decisionmakers and executives that will dominate both the private and public sector. They want to go more places more often, have more comfort, convenience and fun, with less regimentation and responsibility than their predecessors. This mentality is one reason why the service industry (which includes the travel industry) has been the fastest growing sector in the U.S. economy in recent years (see Figure 1). It may also have something to do with the drop in the savings rate over the past few years (see Figure 2), high growth in household formations, and the stabilization of the fertility rate at population replacement.

Work Force Makeup

Add to the baby boom cohort mentality the fact that the workforce is aging, that disposable income levels are rising (see Figure 3), that two-wage earner families are becoming the norm, and that leisure time and activities are becoming increasingly valued, and it is not difficult to see what pushes the current trend toward a shorter work week.

Given this setting, it becomes a clear that when deregulation-induced air fare price wars hit the marketplace in 1978, there was bound to be an enthusiastic response. The population was somewhat off-balance philosophically, having just emerged from a recession during which many of their recreational trips had been foregone. Not only was demand for travel high, it was fed the opportunity to visit somewhat exotic places. This option fired up existing demand and also unleashed latent demand previously suppressed by price. Once initiated, many new travelers stayed in the market, creating a structural change in the business/recreational market balance for a number of hubs.

Consequently, we see the demand side of the equation for forecasting air transportation market size changing. It includes a much broader range of client types than we had thirty years ago, when air travel was not exactly a "middle class" activity.

Public Sentiment About Helicopters

This ties into the issue of why the public is reluctant to support private transport helicopter usage in metropolitan areas, let alone provide public financing and/or maintenance of helipads, even though it actively supports fire and rescue uses. I have heard the quizzical question posed over and over: if they value rotorcraft for public service why are they so negative about private transport? The reason for this seemingly illogical dual position is that the persons benefiting from public service helicopter usage are randomly selected. They span the spectrum of age, ethnic group, sex, religion, and socio-economic class. We are all potential users and we all secretly fear that we may be in a position some day to require such services. Most people do not feel this way about the use of rotorcraft for short-haul travel, however. The user in such a case has the public image of being corporate, wealthy, famous, or privileged in some other fashion. Helicopter transportation is currently a high cost service and its use implies elitism.

It is not clear that this perception will endure, just as commercial air travel has lost its special interest connotations, but given the current purchase, maintenance, and operating costs associated with helicopter usage, there is no reason to assume that this sterotype will have any reason to be shaken over the short term. Thus, the poush for publicly supported helipads could not come at a more inopportune time. The helicopter and corporate air transport market is becoming mature just when the public is retreating from governmentally supported facilities. For example, in California, where everyone is dependent on cars and freeways for mobility, there exists a lack of support for the care and maintenance of roads and highways. Obviously, tightening of the public purse is strongly rooted. It becomes even more so when the business cycle hits a downturn. The current message appears to be, "let the user pay". Since this has not always been the case, there is a charge of unfairness brought by those industries caught short by the new philosophy, and the argument is proffered that if communities provided facilities they would

FIGURE 1: THE COMPONENTS OF REAL CONSUMPTION (BILLIONS OF 1972 DOLLARS)

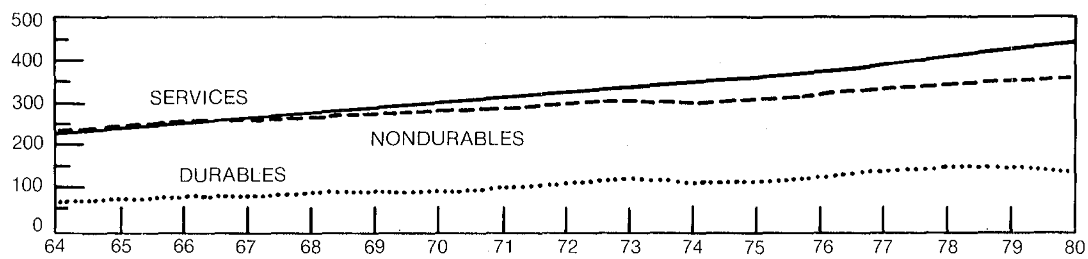


FIGURE 2: PERSONAL SAVING RATE

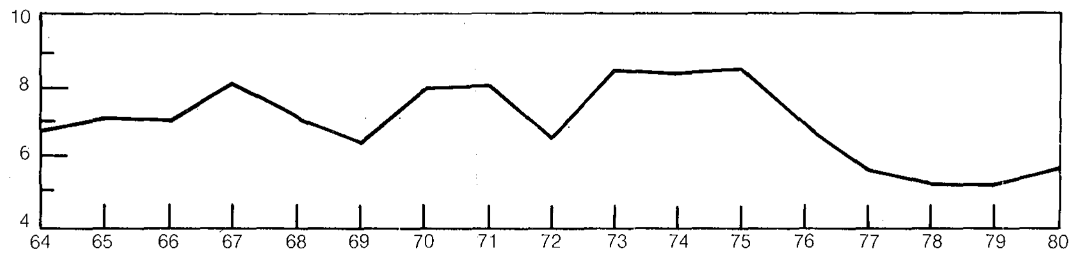
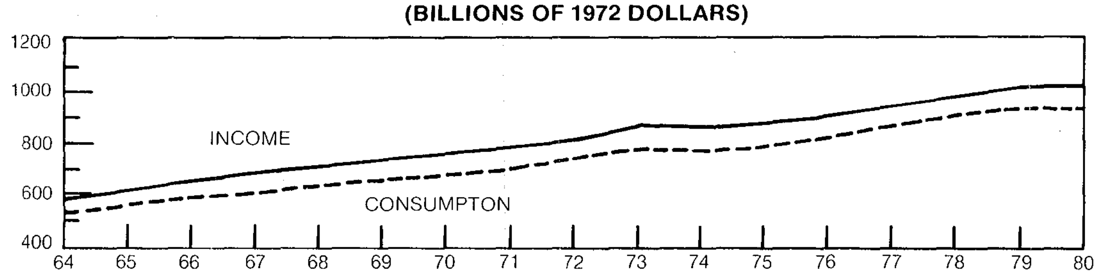


FIGURE 3: REAL DISPOSABLE INCOME AND CONSUMER EXPENDITURES (BILLIONS OF 1972 DOLLARS)



benefit from the additional business activity generated. Unfortunately, such comments do little to offset the reality that public sentiment regarding resources and economic relationships has become extremely conservative, that such conservatism may be the natural outgrowth of years of high inflation and disillusionment with government, and as such, is not likely to loosen in time to meet the expansionary desires of individual growth industries including air transportation.

Conclusion

What we have, in sum, is an expansive and growing market coupled with an industry actively working to serve it, but constrained by the size and configuration of the existing airport/heliport network. If this network is not improved, the result can only be lost customers. If the public remains reluctant to address the constraint, then perhaps only the industry is left.

Edward M. Hall
Office of the City Manager
City of Phoenix, Arizona

Introduction

After listening to a distinguished panel like this, what is left to say? It does give me the opportunity for a little nostalgia, and that's always nice. Further, I'd like to focus in on urban transportation.

About 25 years ago, the City of San Diego was a pilot City of the National Committee on Urban Transportation. As Transportation Research Director and head of the Regional Transportation Study, I was involved in a joint effort with Convair to see what potential helicopters might provide for the movement of people in urban areas.

Three basic problems were evolved at that time:

The need for common origins and destinations; the problem of landing, or really, the parking problem, at these origins and destinations, and helicopter traffic control, and safety.

Our goal was to move 25,000 people per hour by helicopter in the urban scene. Well, let's forget all of those old days, and come to today.

Certainly, the rotorcraft has established itself as having a very useful role in highly specialized operations in the urban areas. These include air evacuation and medical service, police and fire, resue, mail, special observations, transfer from airport to special terminals, and executive and key person transportation. Certainly news media like them and traffic sky watch is popular.

One of the things we learned in Phoenix in our recent four major floods was the tremendous value of helicopters. They enabled our Mayor and other key people to review the scene, and for our engineers and staff to get up and get awfully close to the bridges that were washing away, as well as rescue opportunities.

The Challenge

The basic question I would like to address is, do rotorcraft have potential for moving large numbers of people in urban transportation.

Now, I want to stretch your minds a little, if I may, and suggest I'm talking, about say, 10 percent of the person-trips in our urban area. That would be 500,000 person-trips in the morning and 500,000 in the evening.

Now, if that causes your mind to snap, just come on back down to maybe half of that—250,000. Well, maybe only 1,000 persons in each peak period from some special, central location to another location. Is there a potential? In urban transportation, we need all the innovative ideas and effort that we can come up with, that are practical, that are economically feasible, and that will move people safely.

Another potential may be a multi-modal origin for helicopters, where buses and automobiles bring passengers in, and the helicopters carry people to common destinations, say, downtown, or a satellite CBD, or an industry. We might call this a vertical park-and-ride. Is there potential for this?

Once some of these concepts might be established on a small scale. Perhaps they could be expanded—*if we could develop the technology.* I'm not talking about the technology of the aircraft. I'm talking about the technology of moving large numbers of people in rotorcraft—if it's economically feasible.

The questions revolve around economics, safety, and the availability of land for operations that would be compatible with nearby land uses and community acceptance. Also, the third-dimension movement within a city could involve visual impacts relating to privacy, as well as, of course, noise, which has been thoroughly covered in the meeting.

We can put an express bus, or an articulated bus, and accomplish the movement of 1,000 people from a park-and-ride operation more economically, and have easier passenger discharge, but the rotorcraft, obviously, has the speed advantage—time, which is important. And keep in mind I am concentrating on the urban transportation movement. My goal is really to bring forward these as a challenge, or perhaps an opportunity.

Planning

We might talk a little bit about some planning methods and data for large movement. We certainly need basic origin-destination data of the potential passengers—the magnitude of it. This would help determine the cost per passenger.

We need to know the time of concentration of the desired movement at the destination point. Can you bring in 50 helicopters within a short span of time? The economics of the rotorcraft operations and the facility itself need analysis. All of these would need to be considered in relation to what the passenger would be willing to pay on a daily basis for this service.

The public acceptance is of key importance. I am delighted to hear so much concentration on safety (and perceived safety). I think that's important.

It would also be essential to locate and identify available land for aircraft operations at both the departure end and the concentrated arrival end of the trip.

These types of studies and others would be necessary, I believe, in order to really evaluate the potential of the rotorcraft in movement of large numbers of people in the urban scene.

Summary

In sum, then, the movement of any substantial number of people, in the urban transportation scene, would require large numbers of rotorcraft, or significant numbers of large capacity rotorcraft. Further, the ground space requirement and operations both at origin and destination, would need to be carefully thought through and studied. The financing of the terminals—who finances the terminals—would be another key question. In a very real sense, the parking of the rotorcraft, i.e., the landing, may be the significant control factor.

Based on the information available, the use of rotorcraft for the movement of large numbers of people in the urban scene appears to have many challenges that must be overcome before it would be cost-effective and reliable enough for considering as a major—I emphasize major—component of the urban transportation system.

Thank you for the opportunity to participate in this interesting and timely Conference.

SESSION VI: FIXED WING COMMUTER AIR TRANSPORTATION

CHAIRMAN: *Lou Williams, Manager, Commuter and General Aviation Program, NASA Langley*

LESSONS FROM THE PAST: STOL SYSTEM STUDIES AND OTTAWA-MONTREAL STOL DEMONSTRATION

Robin Ransone
Senior Specialist in Communications
Vought Corporation

I should say at the outset that my presence here is through the courtesy of my employer, not through any interest that he has in short-haul transportation, which is the subject of our meeting today. Can I have the first slide?

In 1968, my first year of studies for American Airlines, there was terrible congestion—congestion on the ground, congestion in the terminal, congestion on the apron and taxiways, and congestion in the terminal area. The en-route airspace was not a major problem.

Passengers through the three northeast corridor airports were predicted to more than double between 1967 and 1973. Clearly we needed to plan solutions, and the solutions had to be compatible with the solution of national problems, such as pollution, noise, land use, energy conservation, inflation, and institutional factors.

Furthermore, the air transportation subsystem had to interlock smoothly with the other modes of the national transportation system, whatever that is. In 1968, VSTOL technology, including helicopters, was too costly. STOL, on the other hand, operating from, say, 2,000-foot runways, seemed worthy of detailed study. STOLPORT facilities were an order of magnitude less than conventional airport costs, and even less, compared to high-speed rail systems.

STOL promised to provide significant environmental benefits in areas of community noise exposure, exhaust pollutants, and land use. For example, JFK Airport, with over 16,000 acres, encompasses more land area than the island of Manhattan.

We were especially interested in the enormous noise improvement which STOL promised to have, compared to narrow-bodied jets. These studies led us to a two-month flight evaluation of the McDonnell-Douglas Model 188 STOL transport (Brequet 9410.)

These tests provided documented data on safety, concept suitability, air traffic control factors, the most advanced state of the art in on-board navigation and landing systems, and airline operation simulation. (There will be a sound film on the report of those tests during the lunch hour, in here.)

We were pleased with the results. We concluded that STOL aircraft, equipped with three-dimensional area navigation systems and microwave landing systems, were operationally and technically feasible and safe. The most effective use of STOL for congestion relief would be at dispersed, conveniently located STOLPORTS. Our tests did not provide data on economics or marketing aspects, however.

To be succesful, a STOL system must be accepted by the aircraft and airline industry, by passengers, and by the public who must live and work in the same town with it. We were now beyond the point where studies could be of value. We needed good, solid, hard data which could only come from an actual STOL service demonstration with bona fide fare-paying passengers on a scheduled route.

Our four objectives were to start development of a STOL system on a small scale using existing aircraft and simple interim facilities, to define the detailed requirements for a viable operational system, to demonstrate actual operational, marketing and economic factors, and to actually start carrying short-haul passengers to help relieve the congestion problem.

We initiated studies in each of these areas. We had in mind a small, convenient, attractive STOLPORT, using readily available STOL aircraft, equipped with the most advanced 3D RNAV and landing guidance equipment.

You may think our dream bears a slight resemblance to the 1974 to 1975 Air Transit Canada STOL demonstration. You may also notice that I'm green with envy that our Canadian friends have successfully accomplished what we down here in the "colonies" lack the nerve to do.

There were several likely areas for STOL service demonstration but prospective manufacturers of STOL aircraft told us that the northeast corridor STOL system was essential to STOL aircraft production. There were, in fact, suburban STOL operations already successful in the other areas, notably the Houston Metro Airline service between Clear Lake Airport and Houston Intercontinental Airport, using Twin Otter aircraft.

Clear Lake Airport is located less than a quarter-mile from a comfortable income residential area, and has been completely accepted by its neighbors.

Federal support in air traffic control system changes, aircraft certification, and perhaps even financial support made it desirable to include Washington, D.C., in the STOL service demonstration. For these reasons, we decided the STOL service demonstration would be studied for the Manhattan-Washington, D.C. route. Furthermore, the Hudson River site, adjacent to the Chelsea community, would be the site for the Manhattan STOLPORT.

During our McDonnell-Douglas Model 188 evaluation in 1969, we made repeated STOL approaches down to 300 feet height at the Chelsea STOLPORT site, and no noise complaints were received by the City of New York as the result of any of these flights.

The most likely STOL aircraft for a service demonstration was an "airlinized" version of a military plane, the de Havilland Canada DHC-5A "Buffalo," so in May of 1970 we asked de Havilland for a proposal for six of these aircraft, outfitted for 36 passengers, and FAA certificated for safe operation from 2,000-foot STOLPORTS. At the same time we focused our attention on the Manhatton STOLPORT.

I had conceived the idea of a simple, relatively inexpensive, floating STOLPORT, which I believed could be initially located on the Hudson River near Chelsea, but could be towed to other locations as desired. It would not require extensive foundations or footings, but could be easily modified, and could be sold for scrap when no longer needed.

We called this the Floating Interim Manhattan STOLPORT, or FIMS, and selected the architect and engineering firm of Howard, Needles, Tammen and Bergendoff, to do a $36,000 technical feasibility study.

Unfortunately, American Airlines ran out of money about then, but we submitted an unsolicited proposal for this study to the FAA, which they accepted, and the contracts were signed June 22, 1970.

American Airlines prepared the news release, FAA approved it, and it appeared in the July 2 New York Times. It was a bomb! The Chelsea reaction was immediate. They held a press conference July 10, at which they denounced the STOLPORT study. Several of the Chelsea political representatives were there, and a statement by then-U.S. Congressman Edward Koch was read.

I telephoned him in Washington and tried to set up a meeting with him, but he refused to see me. He told me he was against the study, against the STOLPORT, and didn't want to discuss it. Unfortunately, this position closed all the channels of communication between us, and we had no further contacts.

The first contract between American Airlines and the Chelsea Against the STOLPORT Committee occurred July 29 at their first reorganizational meeting. Our speaker was Jim Pyle, Director of the Aviation Development Council, which represents the Port Authority and all the airlines serving the New York Metropolitan area.

Mr. Pyle was the first speaker, and carefully explained that this was not a study to build FIMS, but only a technical feasibility study to obtain information. The audience was attentive, courteous, and asked the questions any of us would ask in similar circumstances, and I was encouraged. Of the 300 or so people in attendance, most did not seem to be strongly opposed to the FIMS study, although a few were very strongly against not only the FIMS, but the study as well.

The remaining dozen speakers were mosty politicians, who were starting their campaign for the November elections four months away, and they were strongly against the FIMS study. The subjects fo the Vietnam War, the U.S. supersonic transport, motherhood, religion, and care for the aged, all managed to sneak into these speeches. This is not a criticism of them or of politicians in general. It is mentioned to give you a feeling of the situation in which American Airlines and I now found ourselves.

We were treated courteously by the residents, and especially by the Chelsea Against the STOLPORT Committee, and Mrs. Schwartzman, their chairwoman.

It would be helpful at this point to list the objectives of the various principals involved in the FIMS issue. The objective of the Chelsea Against the STOLPORT Committee was to stop the FIMS study. When that was successful, their objective became to stop FIMS itself, in which they were successful, or partly successful.

My objectives were to complete the FIMS study, which I did. I wanted, also, to complete the other related studies, which I also did. I hoped to win over the Chelsea community with arguments of benefits to Chelsea, but in that I failed.

I changed this objective to try to develop STOL's sociological criteria, in which I was partly successful.

American Airlines had its own objectives, of which mine, of course, paralleled. The City of New York, the politicians, the Department of Marine and Aviation, the Port Authority, the City, State and Federal environmental protection agencies, and the media, all had their own objectives.

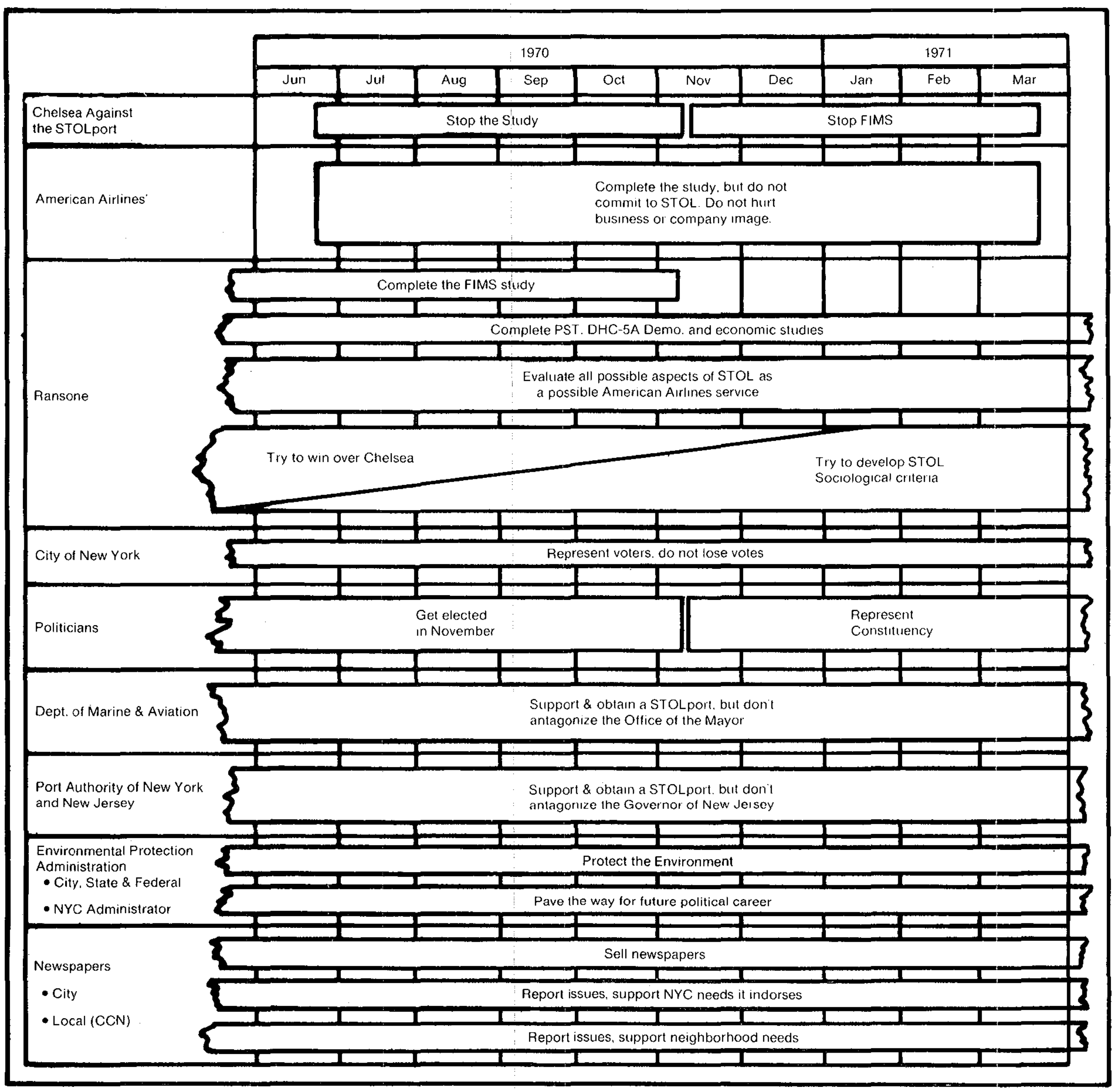
This will give you an idea of the complexities of the public confrontations such as this. Believe me, if your activities do not support the objectives of the other parties involved, they will not support your project, regardless of its actual value.

One of the concerns expressed by the Chelsea Against the STOLPORT Committee was a fear of a faceless Federal Aviation Administration. They did not know the officials personally, and could not communicate effectively.

To correct this problem, I arranged a meeting with the proper authorities to be in Mrs. Schwartzman's home. In addition to the FAA Associate Administrator for Plans, other STOL Program Office officials, I invited representatives from the Federal, New York State, and New York City environmental protection agencies. The Chelsea Against the STOLPORT Committee was there, as well as other key community leaders.

I explained our study program, and that this was only one small part of a much larger study, which was investigating all aspects before any STOL decision could be made. One of the Chelsea residents, not a Committee

FIGURE 1: OBJECTIVES OF THE PRINCIPALS



member, told me, however, "Why don't you be quiet? We don't want you, we don't want your STOLPORT, we don't want your study. Just go away—leave us alone!"

Well, I anticipated this reaction, if not quite so forceful. But I was prepared with a carefully rehearsed invitation. I told them that the FIMS study would be completed, and even though it was a technical study, that I would include the Chelsea Against the STOLPORT statement, without editorial comment or modification, as an appendix to this report, if they wished.

This invitation was accepted, and the 23-page appendix was included in the FIMS study report.

From August through September, the Chelsea Against the STOLPORT Committee was very busy, in a well-planned, well-organized, and well-executed campaign against the FIMS study. These activities included obtaining about 40,000 signatures on a petition against the study, statements read at the American Airlines stockholders' meeting in Wilmington, Delaware, personal appearances on television and radio, appearances at the Department of Marine and Aviation, and a demonstration in front of American's corporate headquarters, then in New York City.

It was a wet, chilly October day. They handed out leaflets, and paraded a STOL dragon which I helped repair when it got torn. Our public relations people sent out hot coffee.

The lady on the left in the photo is saying, "They're just trying to buy us off. Don't drink their coffee."

(Laughter)

The gentleman thinks the young ladies are charming. The stewardesses aren't quite sure what they've gotten into, and the college kid on the right, well, he didn't give a flip for any of them. He was just trying to figure out how to get a date with one of the stewardesses.

(Laughter)

There had not been a big issue for the November elections before FIMS. The candidates were not missing any opportunity to tell the voters what they wanted to hear.

Now, this is not a criticism of the candidates, but a simple statement of fact. Technical people must learn to understand and communicate with politicians. They work and survive in a different arena than in the sheltered world of the engineer-scientist.

STOL proponents were critical of elected officials, who, in response to neighborhood pressure groups, had refused to build STOLPORTS. I think this is unfair. It is the responsibility of elected officials to support the will of their constituents. If the majority of the voices they hear are voters saying, "We don't want a STOLPORT," and only the airlines, the aircraft manufacturers and the FAA, none of whom vote in New York City, are saying, "We want a STOLPORT," then the proper course of action is clear—painfully clear. There should be no STOLPORT.

The proper course of action for the proponents would be to determine if STOL is really better than alternatives, and, if so, to convince the people, through an educational process. The politicians will then support it.

Now, this is where the US SST failed. This is where STOL failed, and this is where Concorde had its work cut out for it the whole time it was flying in this country.

The FIMS study was completed at the end of October but was left at the printer's until after the November election, to avoid aggravating the controversy. So you see I was learning. The study found the FIMS concept technically feasible, and the cost to be remarkably low—fourteen and a half million 1970 dollars. The chronology is shown in Figure 2.

FIGURE 2: FIMS PROJECT CHRONOLOGY

	1970							1971		
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Jun 22 - AAL-FAA FIMS study contract signed	X									
Jun 24 - AAL-NYC contacts re FIMS news release	X									
Jul 2 - AAL news release. NY Times		X								
Jul 10 - Chelsea first press conf		X								
Jul 13 - AAL-Congressman Koch telecon		X								
Jul 29 - Chelsea first organ meeting at P.S 11		X								
Aug 4 - Chelsea began petition			X							
Aug 11 - AAL meeting in Chelsea with Chelsea. FAA. EPA			X							
Sep 9 - Chelsea at AAL annual stockholder s meeting				X						
Oct 9 - Jackie Schwartzman on TV 6					X					
Oct 14 - Chelsea at Dept. of Marine and Aviation, NYC					X					
Oct 22 - Chelsea demo at AAL HQ					X					
Nov 4 - Congressional election						X				
Nov 11 - AAL completed FIMS study						X				
Nov 23 - AAL released FIMS study and copied Chelsea						X				
Nov 26 - CCN article on Ransone s interview						X				
Mar 20 - Congressional Hearing at Chelsea										X

The study indicated that the site would be suitable for this purpose from a technical standpoint. The report was given to the Chelsea Against the STOLPORT Committee the following week.

With the published report finding FIMS feasible, the reaction continued even stronger, and the Chelsea group objective became to block the STOLPORT itself. We tried to understand the specific concerns of the Chelsea community, rather than to convince them that we were right.

Our understanding was that there was concern for noise, concern for pollution, concern for safety, and concern for ground congestion. Now, these were all technical problems, and we had extensive research and study activities in each of these areas, and were confident these problems could be solved.

The biggest problem, however, was the concern itself. Air pollution had not killed the U.S. supersonic transport program. *Concern* for the air pollution killed it. Even if we solved the technical problems expressed by the Chelsea concerns, it would be to no avail, unless we also resolved *their concerns for those problems,* as well.

At the conclusion of this presentation, I will propose a method for doing this, and the method is detailed in my paper (SAE 7605323, May 18-20, 1976).

Now, throughout the entire time, my overriding position with the Chelsea group was one of absolute honesty. Furthermore, my contacts with the Chelsea Against the STOLPORT Committee and the Chelsea community, were through Mrs. Schwartzman. This was in order to preserve my credibility, and preserve the excellent communication channels which we had established.

I never tried to convince Mrs. Schwartzman that I was right and she was wrong. I doubted that I could change her mind at that point, even if I were successful, and if I were successful, her Committee would have simply rejected her, and elected another leader.

The Chelsea community was perhaps more knowledgeable than most citizens' groups, but they were still laymen who did not understand many of the technical terms. Noise measurements were a case in point.

Some measurements were made in dbA and others in PNDB, still others in EPNDB, or NEF, and this was confusing. I tried to provide the Committee with materials to help them understand more of the technical aspects of the problems.

Many times I would call Mrs. Schwartzman and tell her of a study or a research program which I felt she should know about. Some of these programs were not yet ready for public discussion, and I would caution her to keep this to herself, but that I felt she should know.

On occasion, she would call me back for permission to report these things to her Committee, so I believed that she was completely trustworthy and would stand behind her word. I know she felt the same way about me. One day I told her, after answering a question, that I would never lie to her—but sometimes I may not answer the question, because after all we were opponents.

She said that she knew she could trust me. I said that perhaps some of her Committee members, whom I might not have dealt with personally, might not feel the same way. But she said they all knew they could trust me.

Booz-Allen and Hamilton, Applied Research Consultants, in 1976 completed a study of transfer of aerospace technology to public transportation for the National Air and Space Museum in Washington, D.C. One of the six case studies documented in this report, and which was considered for display at the Air and Space Museum, was the FIMS controversy.

The authors interviewed Mrs. Schwartzman, and reported, and I quote, "Mrs. Schwartzman felt that Ransone was presenting them with good, reliable information, and was a man of integrity." I think my efforts were well worth that trust.

The FIMS controversy came to a head on March 20, 1971, with public hearing organized by Mr. Percy Sutton, Manhattan Borough President. It was held in the Longshoremen's National Maritime Hall on Manhattan's Lower West Side.

As the first scheduled speaker, I had a prepared statement describing the purpose of our STOL studies. I played a recording which compared the noise levels of the STOL aircraft to the present generation of conventional, narrow-bodied jets, and promised that American Airlines had no intention of ruining the neighborhood.

I summarized the many contributions which American made each year to social programs around the country, in order to prove our good intentions. The hearings continued the rest of the day, and many people, both pro and con, had their say. The hearing itself was unnecessary as far as the outcome of the controversy was concerned, but it did provide a convenient focal point for the cessation of hostilities.

Then Secretary of Transportation Volpe, had already determined there would not be a STOLPORT at Chelsea, because of community reaction.

This hearing was an interesting experience. After the prepared statement, the speakers were questioned by a continually changing panel of politicians, who made many short speeches with question marks at the end, which were, of course, unanswerable. In such instances, one should maintain his sense of humor, keep his eye on the main issue, and receive the verbal custard pies in the face with as much dignity as possible.

I had opened my prepared statement with an appropriate, if not original, ad lib, which was duly quoted in the press, "I feel like a turkey invited to a Thanksgiving dinner!"

Now, let's discuss briefly the sociological, or people things we learned: People are complex individuals who act in ways resulting from their varied backgrounds and emotional makeups. Therefore, there are many personal factors involved, which have nothing to do with the specific issue in question.

In his book, "Community Activitists' Handbook, A Guide To The Citizen Leaders and Planners," Hohn Huenefield advises the community organizer, and I quote "As you set out to overcome public apathy by recruiting co-workers for your project, at least consider another approach. Think a bit more deeply about your own motives. Whatever grand rationalization we construct for ourselves, most of us really get involved in civic projects for very personal reasons."

I am not proposing that the Chelsea group was involved for personal gain. What I am saying is that the proponents of the issue, as well as the reactionists, are all people, acting according to their individual motivation patterns, in spite of the fact they may be united for a common cause, which is the specific issue. This concept is shown in Figure 3.

The problem arises when the issue itself is addressed without regard to these other factors. Some of these factors will be present to varying degrees in both the proponents and the reactionists, from a level of "non" to "their main reason for participating." Note that only one factor is directly associated with the specific issue. Only that one factor can be addressed by logic and technical explanations. For example, if the reactionist group's main concern, perhaps from previous exposures, is "resentment at being pushed around," then there is nothing the proponents can do alone to solve the issue problem. The reactionists will resent the project, even if it is perfectly sound.

The solution is for the reactionist group representatives to help plan the project. This course of action not only addresses the specific issue, but also provides a productive outlet for the group's need "to avoid being pushed around," the antithesis of which is to do the planning for themselves.

The biggest problems are in recognizing and admitting these factors in yourself, and in determining which factors are strong enough, in the reactionist group, to warrant special attention.

There are other lessons to be learned from the Chelsea STOLPORT case, which should be well noted by anyone attempting to apply new technology of any kind, or attempting any new project which affects the quality of life, as the citizens perceive it—*as they perceive it.* First, a complete and open explanation must be made at the earliest possible time of the project purpose and preliminary plans, before any news or rumors have leaked out. Now, this will always be long before you really want to talk about it—before you even want to mention it.

The proponents must establish their credibility by speaking the truth, the whole truth, and nothing but the truth. Silence or trick answers will rapidly destroy your credibility, and you will never be able to regain it.

And, third, responsible representatives of the affected citizens must be given a very real voice in the project planning. Now, *this* idea will *terrify* you!

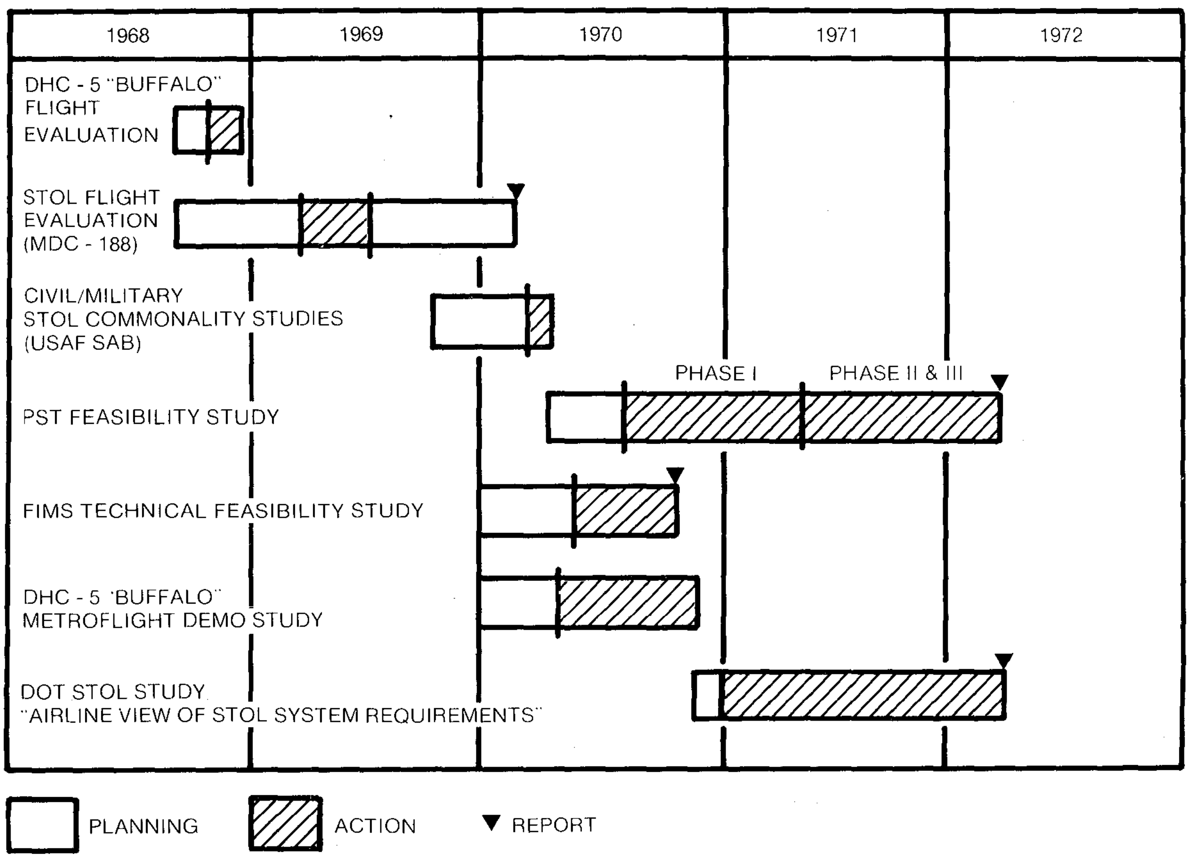
Failure to observe these three points and act accordingly will increase the likelihood of an adverse citizens' reaction against your project, and, if it occurs, it will be exceedingly difficult, perhaps impossible, to go back and do these steps after the fact.

Now, the citizens' representatives have certain responsibilities, too, if they accept the recognition these actions afford. First, they must state their concerns openly and honestly. If fear and other human feelings are involved, they must not be ashamed to say so.

Second, if confusion arises because of conflicting statements heard out of context, or from others outside the group, they must determine the truth before reacting.

Third, they must not react prematurely to comments made during early planning sessions, or take things out of context, nor be a party to the start of rumors. And, fourth, they must fairly represent their views of the citizens they

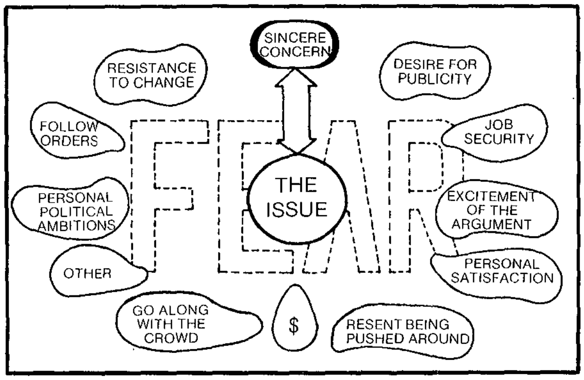
FIGURE 3: AMERICAN AIRLINES STOL ACTIVITIES



represent and keep them accurately informed of what is taking place. (There is a detailed plan in the SAE paper.)

After all this work, what happened to STOL and FIMS? The American Airlines STOL studies were complete in May 1972, after a very thorough four-year effort, shown in Figure 4. This included STOL aircraft flight evaluations, FIMS technical feasibility study, operational aircraft proposals from industry, very detailed market and economic evaluations, community acceptance concerns, and overall American Airlines corporate policy.

FIGURE 4: CONFRONTATION MOTIVATION FACTORS



The FIMS concept itself, exclusive of siting, would have been feasible technically and operationally. It would have been marginally feasible economically, but only with significant financing by airport development assistance program funds.

The Chelsea site for FIMS was not acceptable because of the community reaction, and also because of questionable ease of access from the middle and upper East side of Manhattan.

American Airlines decided not to implement STOL service, for these and other reasons related to corporate objectives, overall airline economics in 1972 and long-range plans.

Now, the main message I want you to get from this lesson from the past is this: the reaction against FIMS had absolutely nothing to do with it being a CBD STOLPORT. The reaction was solely, and only, because it was in a residential neighborhood.

This is important, because some people feel that you can't put in a downtown STOLPORT or heliport, that you have to go out and expand reliever airports—expand the general aviation airports as reliever airports.

There is a little general aviation airport near where I now live, just south of Dallas, in Duncanville. It's called Red Bird Airport, and there are talks about expanding that and the citizens are reacting against it.

If you try to expand these general aviation airports, you may have the same reactions that we had against FIMS, because it's in a residential area.

Several STOLPORT studies had been made of the Chelsea site before ours, and I'm sure ours will not be the last. The big difference in our study, I am convinced, is that we learned far more than all the others. We not only acquired competent technical answers, but we also learned about people. We have two ears and only one mouth, and there is a message in that. We learned about people by the simple expedient of shutting our mouths and listening to them, and I wish each of you the same success.

KEYS TO SUCCESSFUL COMMUTER AIR TRANSPORTATION

Watson Whiteside
Vice President - Marketing
Air Wisconsin

The Changing Picture

Air Wisconsin's 540 employees consider it an honor to present our comments to this prestigious group.

We are not exactly sure that all of you really understand small airlines, and assume that our role today is to share with you some industry and Air Wisconsin roles in relation to our nation's transportation picture. We appreciate the opportunity to relate how the expanding air carrier picture interplays with your varied missions. We are fortunate to be a part of the air transportation industry that has yet to realize the outer limits of its potential.

To amplify our comments and to relate the Air Wisconsin story further in depth, I will be pleased to project for any of you a twelve-minute film on our operation at 12:45 p.m. today in this room.

For our nation's major airlines' growth begets problems as a price of progress. Operational costs coupled with aircraft unsuited for short haul transportation have caused drastically altered service patterns in hundreds of mid-sized cities. In our opinion, prudent management and operational economics more than deregulation, have caused this evolution.

Commuter/Regional Industry Development

Air Wisconsin is to you a small airline, despite the fact that it is now designated by the CAB as a large regional carrier with 1981 annual revenues projected at fifty million dollars. Just sixteen years and eleven days ago, we started scheduled service under the CAB designation of an air taxi. In 1965, there were a total of seventy-eight such carriers which, today, total in the two hundreds.

Such tremendous growth is only possible because of airline development as a whole, public acceptance of the now called "commuter" or "regional" system and the advanced technology used to develop specialized aircraft for this service. In Air Wisconsin's case, we are keeping up with modern technology by acquiring our sixth aircraft type—the one hundred seat British Aerospace 146, with fuel consumption specifies per seat projected on a par with our fifty passenger de Havilland Dash 7 aircraft.

Obviously, there are different schools of thought regarding the choice of aircraft for carrier and market needs. The choice also includes new versus used aircraft. While we see "instant airlines" purchasing older used aircraft I question their judgment with concerns for fuel inefficiency, high maintenance cost, and noise pollution. The low acquisition cost of older used aircraft is attractive, but not in tune with basic airline economics. Clean, quiet, modern, efficient aircraft can initially capture and sustain higher load factors with reliability and profits.

The business world has recognized the commuter/regional industry. This is evidenced with an influx of high caliber management, efficient operating staffs, and solid backing by the financial community.

We have all heard tales of woe about cities that have lost or have had greatly reduced service by the majors. Community prestige reportedly is hurt when they lose their two daily scheduled jet flights, not realizing that we can arrive on the scene with frequent flights offering greater convenience—generating additional passengers and air freight.

By operating aircraft which make short hauls profitable with forty to fifty percent load factors, the community is better served, as smaller operators can react quicker in matching service to needs.

Our Systems and Rates

A linear network system is almost mandatory for major carriers spanning the country and world. Most successful non-subsidized commuter/regionals have found the basic hub and spoke system allows for the best user schedules. Air Wisconsin's system is a series of hub and spokes with our smaller city traffic converging on the hubs of Chicago, Cleveland, Detroit, Minneapolis/St. Paul, and Pittsburgh.

As established members of the airline club, we have found that the public will pay for reliable service, and we have known that management, employees, investors, and bankers are all fond of a good return on investment.

Integrated Facilities

Most carriers of our size and smaller have found that over seventy percent of our onboard traffic is merely using us as a convenience to and from our interline friends—that is, the passenger or box is connecting to another airline. Such integrated traffic dictates that our airport operations cannot be relegated to an unused storage shed. For facilities planning, we desire to directly lease main terminal locations on a par with major airlines including equal public area signage, cargo facilities, and fuel access, all of this while recognizing that nothing worthwhile is free. Air Wisconsin operates all of its stations with its own personnel on the theory that no one will look after our business better than ourselves. In short, we like to control our destiny.

The success of most commuter/regional carriers has not been attained by being unique—quite the opposite—we are common—a common carrier, catering to the scheduled air transportation needs of the communities we serve. Our sales staff include: all worldwide airlines, travel agents, commercial accounts, air freight forwarders and agents. Since most of us do not specialize in the downtown-to-downtown airport business, all of our operational practices are fully integrated with the nation's air transport industry. Our schedules, fares, rates, and rules are displayed in all commonly used reference guides and industry computers.

Now, And The Furture

A commuter/regional airline is no longer treated as a threat to the Republics, Frontiers, and Uniteds as we supply them with needed revenue. For example: during 1980, our interline revenue contribution to United was nine million, three hundred twenty-eight thousand dollars. Our industry has pulled itself up by the boot straps, arisen through free enterprise to establish a firm place in this great aviation industry. All airlines, more than ever, must continue to work as a cohesive unit—just as we need your assistance in the aviation planning of tomorrow, and in the continued development of aircraft suited to short-haul operations. Modern, efficient aircraft are the tools of our trade.

Pending Issues

We must caution all listeners that to continue to serve the public, this highly successful industry must continue to perform as an integrated system. We are very concerned that several of many current programs are susceptible to being tossed to the wind.

It is our opinion that:

A. The industry must maintain an integrated passenger fare and air freight rate program—that includes the continuation of mandatory joint air fares. A program essential to the maintenance of small community air service with reasonable fare benefits for the passengers.

B. The current high density airport slot restrictions should be eliminated—leaving flight schedule and control under the FAA's highly sophisticated approach systems implemented many years after slot restraints were established.

C. The current FAA aircraft loan guarantee program should be eliminated for aircraft over sixty seats. A mature industry has built the world's finest airline system and the government should not subsidize "instant airlines" to peck away at sustaining high volume routes.

Once again, I invited you to view our short informative corporate firm in this room at 12:45 p.m. today.

Thank You.

THE GENERAL AVIATION MANUFACTURERS PERSPECTIVE

Stanley J. Green
Vice President and General Counsel
General Aviation Manufacturers Association

The General Aviation Manufacturers Association, GAMA, represents 38 manufacturers of fixed wing general aviation airplanes, airplane engines, propellers, avionics, and equipment. Though, technically, commuter airlines are air carriers, we traditionally think of them as using the type of aircraft manufactured by GAMA members. In the numbers of airplanes, the major portion of the fleet considered by the Civil Aeronautics Board to be commuters has been manufactured by GAMA Members.

In the mid-1970's, before deregulation was a common term in the airline busines, GAMA members foresaw a need, in the mid-1980's, for a substantially smaller airplane, propeller driven, operating below 25,000 feet (usually from 12,000 to 18,000 feet) than was then being certificated to Part 25 standards. We envisioned this aircraft to be in the 30 passenger class, with provision for growth up to 50 or 60 passengers, and weight growth up to 50,000 pounds, but not necessarily certificated to Part 25.

In 1977, we requested FAA to consider developing a new Federal Aviation Regulation geared particularly to the certification of a new generation of light transport aircraft.

There was a substantial effort, by FAA and many segments of the industry, to develop a certification rule, entitled FAR 24, that, conceptually, would fit between Part 23 and Part 25. By mutual consent, the effort was brought to a halt as deregulation in the airline industry greatly accelerated. The need for the new class of commuter aircraft was no longer post-1985, as we had envisioned it would be, but pre-1980. The publication of a new Part, with its attendant uncertainties, was no longer in tune with the need for new aircraft before 1985. For those who intended to go forward with a new airplane, Part 25 was the only choice. In terminating FAR 24 activity, FAA and industry both recognized that some changes to Part 25, to accommodate these smaller aircraft, must be made by mid-1982, thus enabling the certification of a safe, more economic, light transport category airplane than would otherwise be certificated under Part 25 in its present form. This action is under study by FAA now.

In the interim, it must be recognized that many of the smaller commuter airplane types certificated in the 1960's and '70's will still be in production during the '80's and beyond and will, in fact, comprise the bulk of production. New versions of these airplanes will incorporate minor rather than major or significant design changes. Evolutionary change is the order of business in general aviation.

One must also appreciate that the newer commuter airplane types under development will see initial operation in the 1984/1985 period. All will emphasize aerodynamic refinement, lightweight structure, new, more fuel efficient power plants, digital avionics, and less noise. Most of the design features and innovations to be incorporated in such aircraft are well identified, today, and frozen for production reasons.

As a practical matter, the time frame from 1985-1990 offers the most promise for innovation and for application of still newer technology. Let us dwell on this a bit.

Major emphasis through the '80's and into the '90's will center on improved fuel economy, attainable through a combination of features involving aerodynamics, structural materials, more efficient, lighter weight engines, use of flight management systems to improve operational efficiency, increased use of sophisticated avionics, and more efficient computerized engineering and production capabilities.

Overall, the emphasis will be directed to optimizing the empty aircraft weight to increase the operational efficiency, pound for pound, over present day designs.

On the aerodynamic front, "natural laminar flow" airfoils will be used, thus permitting improvements in the lift to drag ratio. Winglets and advanced flap technology will further contribute to aerodynamic improvement.

Increased use of composite materials will occur in primary structure. Already there are a number of secondary applications in use, both in general aviation and transport type aircraft. The extension of this class of materials to primary structure, such as wing skins, and to propeller blades, is already evident.

Systems technology offers almost unlimited possibilities for improvement, both from reliability and potential weight saving viewpoints. Miniaturization and digital technology will provide this and lead to installation of more advanced on-board computers and related communication and navigation equipment.

In addition to the airplane technical innovations to save fuel, there are a number of emerging new and improved system operating elements. Already well along is the utilization of Area Navigation by commuter air carriers. By far the most common Area Navigation link is to compute the bearing and distance of Area Navigation "waypoints" from the VORTAC or standard short-range navigation transmitter. Alternate sources for Area Navigation coordinates and waypoints include the LORAN C low frequency hyperbolic grid system, OMEGA, a very low frequency worldwide high power system, and a satellite-based system under development by the Military called NAVSTAR GPS Global Position System. Needless to say, all of these variations offer Area Navigation that permits the use of the most fuel efficient routes.

Another area of implementation which promises to take place in the decade of the 80's, is in digital communications. Provisions for change have already emerged from the experimental stage and we can safely anticipate that during the 80's, the new Discrete Address Beacon System, DABS, will be implemented to provide for the exchange of digital information both air-to-ground and air-to-air.

It would appear that the avionics evolutions available to us in the decade of the 80's will be of sufficient significance in and of themselves to force modifications in some of the most stable institutions peripheral to the aviation business. Weather data collection and dissemination will be automated and available in real time by telephone or radio. ATC clearances will become much more disciplined and will probably lead to the assurance of a guaranteed arrival slot at destination airport before engines are started for departure.

There is another issue of paramount importance to cover. It concerns noise. At each end of every successful commuter flight, there must be an airport. Noise is the biggest single factor in eliminating airports or, at least, in reducing their usefulness.

Generally speaking, noise is the issue around which people rally to oppose the construction of, or the improvement to, an airport, or to advocate its closing. From a technology point of view, all that can be done to keep the new generations of aircraft as quiet as possible, will be done. I should point out that "can be done", in the airplane business, is a compromise term that includes cost, maintainabilty and practicality. Airplane designs are compromises, and noise is one of the elements of the compromise. But it is a key design parameter and we are working to minimize it.

At most general aviation airports, the most important factor is the loudness (during takeoff or landing) of the aircraft that use the airport. Aircraft loudness effectively "controls" the Ldn value. Ldn levels are expressed in decibels (abbreviated dB) . . . the traditional unit of sound and noise measurement. Individual Ldn values are compiled for different points on and near an airport to monitor takeoff, sideline, and approach noise levels.

Because of the size of the general aviation fleet of propeller driven airplanes, about 200,000 of them, reductions in the overall fleet noise level come slowly, considering an attrition rate of less than 3,000 airplanes and but 7 to 10 thousand additions per year. The business jet fleet, because of its small size, about 2,500 airplanes, is experiencing some noticeable reduction in the fleet noise average as the newer turbofan powered airplanes replace the older, noisier turbojets.

What is needed in the near term is the adoption, nationwide, of an operational methodology to reduce noise. This methodology, which could affect virtually all airplanes that make significant contributions to the cumulative noise in the area surrounding the airport, could be in being within two years. Also needed are some changes in the way FAA and the aviation community have attacked the noise problem.

Safe, low noise takeoff and approach techniques, approved by the FAA, appropriate for the particular conditions (takeoff gross weight, temperature, etc.) can be presented for the aircraft, as a function of noise produced.

It has been apparent to many persons involved in the regulatory and certification aspects of the airplane noise problem that reasonable people subjected to noise, care not for the complexities, procedures and metrics accepted as the norm in working the airplane noise problems. The people care only about the noise they experience. The size of the noise source is of no concern—its loudness is the issue. Likewise, the methodology of reducing the loudness—sound supressors, nacelle acoustic treatment, re-engining or operational techniques—is of no concern as long as the loudness is reduced to a reasonable level.

It is recognized that FAA must have some reasonably repeatable method to determine the noise level of an airplane for certification purposes. FAR 36 Appendix C is such a repetitive method but was developed to rate airplane noise, from different airplanes, on a single scale, and for the purpose of establishing a noise ceiling for the turbojet class of airplanes. The FAR 36 Appendix C takeoff procedure is not used in normal operations nor is it required to be used. All Airplane Flight Manuals (AFM) or Pilot's Operating Handbooks (POH) used in general aviation airplanes have recommended takeoff procedures that are used in normal operation. These procedures could be optimized, consistent with safety, to produce the lowest level of noise practicable.

FAA is in the position today to sanction such a concept for use at Washington National Airport, an airport it owns. It can, through its preemption authority, adopt such a concept for all airports in the National Airport System Plan and for those not in the Plan that have received federal funds. It is GAMA's wish that this be done—we need an airport at each end of every successful trip, and its good business to encourage lots of trips.

OPPORTUNITIES AND BENEFITS

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Introduction

The commuter airlines are facing new opportunities due to major economic and regulatory changes affecting the air transportation system since late 1978. They provide service to a broad spectrum of communities and this will expand in future years because of their increased role as short-haul air carriers. The potential exists for enhanced community and passenger acceptance of commuter operations and aircraft through the application of advances in technology. This paper summarizes the service characteristics and changes affecting commuter operations, looks at community and passenger considerations, and finally presents the benefits identified in recent NASA-sponsored aircraft studies.

Service Patterns

The commuter operator is important to all types of communities. Figure 1 attempts to illustrate the diverse service patterns of commuter operations. Fundamental to major commuter markets are route structures that connect outlying communities with a major population center or large hub airport located at one or both ends of the route structure. Routing and service concepts for commuter airlines are usually either "hub and spoke" or "linear," and are characterized by the types of markets they serve. Close-in communities geographically located around an airline hub and which generate significant interline travel will normally be served by a "hub and spoke" route structure, as will be relatively short stage length markets around a hub that may exhibit significant origin and destination travel. Alternatively, smaller communities spaced greater distances from a hub will normally be served by a linear route structure, characterized by one or two legs oriented toward "collecting" passengers. Some commuter airlines have instituted short distance "shuttle type" service that provides high frequency flights from close-in points to a transportation hub in a major metropolitan complex. Special markets also exist to provide air service to resort areas or communities isolated by topographical constraints such as mountains or water. Typical examples of these types of route structures as well as the type of patronage served for selected areas of the country are illustrated in Figure 2. Typical stage lengths flown by commuters range from less than 100 to slightly over 200 miles. The 1980 average was 110 miles for all operations. There is also an effective minimum distance that is necessary to attract a traveler from his automobile or other slower ground transportation modes to commuter air travel. This distance varies from region to region and is a direct function of trip purpose, available alternative travel modes, relative costs, and travel times. Normally, distances must exceed 50-60 miles to divert a traveler from other modes of ground transportation to air service, and may exceed 100 miles in Western regions where travelers are accustomed to driving longer distances (Reference 1).

Deregulation and Energy Influence

In the past two years, major economic and regulatory changes have brought additional shifts in short-haul airline service patterns. In particular, rising fuel costs, coupled with the Airline Deregulation Act of 1978, have prompted trunk and local service airlines to drop their short, unprofitable routes. This has led commuter airlines to expand their operations.

Figure 3 portrays the fuel usage by the U.S. commercial jet fleet for February 1980 (Reference 2). Flights of less than 500 miles accounted for 23% of the total fuel used. Flights between 501 and 1000 miles in length take another 23%. The two-engine B-737, DC-9 and BAC-111 aircraft and three-engine B-727 account for over 87% of the fuel used by the U.S. jet fleet on stage lengths of less than 500 miles. As shown in Figure 4, these jets offer less energy efficiency in short flights than in long, particularly over stages less than 500 miles. Current turboprop aircraft provide an improvement of 30-35% at 200 miles and levels equivalent to the large, long-haul widebodies as the stage length approaches 500 miles.

The dramatic rise in jet fuel price since 1973 has made the reduced energy efficiency of jet transports on short stage lengths very painful. In 1973, fuel accounted for about 25% of the direct operating cost (DOC) and was equivalent to the other elements as shown in Figure 5. By 1978, fuel had risen to 40% and by 1979, to over 50%. Fuel cost now dominates DOC for the U.S. airline fleet (Figure 5). Because fuel costs are expected to continue to dominate aircraft operating cost, increasing aircraft fuel efficiency has become the major new transport aircraft design objective.

The Airline Deregulation Act of 1978, bringing with it easier market entry and exit provisions along with the sky-rocketing fuel costs, has resulted in trunk and regional airlines improving their operating efficiency by moving their jet transport aircraft to the longer, high density routes where they are more efficient. This transition is most noticeable by the change in daily departures, as shown in

Figure 6, between August 1978 and August 1980 (Reference 3). Trunks show a significant reduction for stage lengths under 300 miles and regionals for stage lengths under 200 miles. This shift in service is creating an expanded market for improved commuter aircraft and service.

Although commuters are the smallest segment of air transportation in terms of annual passenger enplanements (Figure 7), they are the fastest growing segment of air transportation. In 1979, commuters carried 27% more passengers than the year before, and in 1980 the growth rate was 14%. They also have reached a growth where aircraft designs are being manufactured for their specific needs. This cycle occurred for the locals in the mid-sixties with the twin jets, and for the trunks in the late forties, with the long range four-engine piston aircraft.

Community Considerations

Community and passenger acceptance play key roles in continued expansion of commuter type operations. Commuter airlines, by their very nature, must be capable of operating from small community airports as well as from the large, sophisticated hub airports used by the trunk and local airlines. Many communities served by commuter airlines are small and have airports that just meet minimum requirements for conducting a commercial operation, while other communities, recognizing the value of scheduled commuter airline service, have provided excellent facilities. Among the highly desirable features at small community airports are runway lengths that do not limit safe operation at maximum certificated gross weight on hot, high density-altitude days, such as to preclude having to off-load revenue passengers in order to meet takeoff requirements. This is illustrated in Figure 8 which compares the airport performance of the 50 passenger, 4 engine turboprop DHC-7 with a 50 passenger twin-engine conceptual turbofan for current airports at an ambient temperature of 90°F. The DHC-7 can carry 50 passengers, 600 nautical miles from most of the airports while the conceptual turbofan can carry only 30 passengers and meet the performance of the DHC-7. In the past, a major problem confronting almost all commuter airlines serving large hub airports was inconvenient and obscure terminal areas, thus creating complicated and time-consuming transfer of interlining passengers. This has been improving somewhat with the changes taking place since deregulation. With the expanding growth of commuter service, the airlines and the Regional Airline Association (RAA) are particularly concerned about hub airport congestion and restrictions on commuter operations at hub airports. Figure 9 shows the FAA forecast of air carrier airports reaching saturation through the early 1990s (Reference 4). Of the 25 airports listed, 40 percent currently have significant commuter operations as indicated by the percent of total movements. For the airports at Philadelphia and Boston, commuters currently account for over 40% of the total movements.

The projected increase in airport congestion may be relieved somewhat by taking maximum advantage of the shorter runway length requirements of the small transport aircraft where it is feasible to add on additional short runway or allow Short Takeoff and Landing (STOL) aircraft operations from segments of inactive runways. A recent study (Reference 5) has indicated that this approach can provide increased capacity at some of the major airports. Another approach to relieve congestion is to provide increased point-to-point service between secondary airports with efficient small transport aircraft. This increased nonstop service will assist in reducing hub airport congestion by avoiding connections at hub airports for short-haul flights.

Low exterior noise levels are also important for community acceptance. The FAA has established certification requirements for transport category aircraft noise levels at takeoff, sideline, and approach measuring points. For twin-engine designs, the noise measuring points are 3.5 nautical miles, from brake release for takeoff, 0.25 nautical miles from centerline to sideline, and 1 nautical mile before threshold for approach. The required level is shown as the dashed lines in Figure 10 for twin-engine aircraft having takeoff weights less than 77,200 lbs., which would cover commuter type aircraft. Shown for comparative purposes are three turboprop aircraft currently found in commuter operation, the F-27, SD3-30 and the DHC-7, plus the quietest business jet, the Citation, and the quietest jet transport, the DC9-80. Since the maximum take-off weight of the DC9-80 is more than 77,200 lbs., its required levels are higher than shown in Figure 10. The study goal shown in Figure 10 represents the level the advanced technology commuter aircraft developed in NASA studies where designed to meet and is similar to the DHC-7 aircraft. These study aircraft will be described in a later section.

In order to relate levels at specific points to airport dimensions, the area of the 90 EPNL contour was estimated for the aircraft shown in Figure 10. This is shown on the left side of Figure 11 in relation to the aircraft's sideline noise level. In laying out an airport, clear zone areas are required within specified distances of the runway. The sketch on the upper right of Figure 11 represents the clear zone boundaries by dashed lines. If the area of the 90 EPNL contour (solid line) is compared with the area of the required clear zone, the amount of the contour area contained within the clear zone area is a function of the aircraft's noise characteristics and runway length. For the DHC-7, the estimated 90 EPNL contour is smaller than the clear zone area required for a 4,000 ft. runway. For aircraft with a contour area of approximately 2 square mile, which is representative of the advanced technology study aircraft, about 50% of the contour area is contained in the clear zone area of the airport.

Airports are more than a landing and take off facility for aircraft. They provide economic growth for the community because of the access they provide to the state and nation's air transportation system. Figure 12 summarizes the State of Ohio's experiences in developing 62 new community airports in the late sixties (Reference 6). The airports were considered a doorway to expanded community economic and industrial development. The Ohio Department of Development traced the benefits listed in Figure 12 directly to the 62 new airports. Adequate airport facilities are as important as improved aircraft. Most communities currently have fixed-wing facilities that meet or can be upgraded to provide excellent commuter airports. These facilities must be preserved to meet the expanding needs of the future.

Passenger Considerations

Many passengers remain somewhat nervous about flying, especially in "non-airline"-looking commuter aircraft, and appreciate as smooth a ride as possible. Unfortunately, most commuter aircraft spend a large portion of flight time in the more turbulent lower altitudes that, when coupled with generally lower wing loadings, produce a ride quality much less smooth than the large jet transport's. Seating comfort, adequate storage for coats and carry-on baggage, good ventilation, heating and air conditioning, and pressurization also contribute to good ride quality and passenger satisfaction. The requirement for a quiet interior has also grown in importance, particularly as the typical stage lengths increase.

One measure of ride quality is the vertical acceleration imparted to an airplane as it flies through a specified gust. This incremental acceleration has been computed for a number of commuters, business jets, and jet transports for a 30 ft/sec gust occurring at their normal operating speed and altitude (Reference 7). This is shown in Figure 13 as ride roughness, as a function of wing loading. The solid lines represent the variation of ride roughness with wing loading for two typical operating speeds. One represents the twin-engine jet transports; the other a typical turboprop commuter. The dominance of high wing loadings to improve ride quality to the jet transport level is readily apparent. Since frequency of encountering a gust affects ride quality, flying higher is another effective way of improving it. However, this is not possible on most of the short commuter stage lengths.

Cabin space and comfort levels have been minimal in the small two-abreast commuter aircraft. This level of comfort is being expanded considerably with the three- and four-abreast configurations now available or in development. Figure 14 compares a number of cabin convenience items for typical two and three abreast commuters with circular fuselages to a five abreast jet transport. The three-abreast interior has a clear advantage over the two-abreast configuration; and except for aisle height and pressurization level, the three abreast interior compares favorably with the five abreast jet transport.

Another factor affecting passenger acceptance is the aircraft's interior noise level. A desirable goal of future commuter aircraft is to achieve interior noise levels comparable to jet transports. Based on de Havilland data (Reference 8) shown in Figure 15, the DHC-7 achieves this compatibility in terms of "overall noise level" and "speech interference level." These are noise measures that result from weighting the frequencies in different manners. "Overall" attempts to approximate the human ear's response to sound. "Speech interference level" is a useful measure for determining the necessary vocal effort for face-to-face communication. Propeller aircraft noise characteristics are dominated by the low frequency propeller noise as shown in Figure 15. The DHC-7 follows the lower boundary compared to other propeller transports because of its slow-turning, four-bladed propellers. Future advanced commuter aircraft can achieve jet transport interior noise levels through advances in propeller design, advanced synchrophasing techniques, fuselage acoustic treatment methods, or aft-mounted engine configurations.

Technology Potential and Benefits

A series of advanced technology application studies were recently completed by several U.S. airframe manufacturers to identify the potential for continued improvements in future commuter aircraft. Studies by Cessna Aircraft, General Dynamics (Convair Division), and Lockheed-California looked at all new designs to meet specific design guidelines, while a Beech Aircraft study looked at derivatives of a near-term 19 passenger design. References 9 through 12 present the results of the studies in detail.

Figure 16 shows the 30 passenger designs of Cessna, General Dynamics, and Lockheed. The Cessna design is a very conventional arrangement with a cruise speed slightly above the best current commuter aircraft. The use of bonding and composites in some primary and secondary structures improved performance and economics. Advances in propellers, engines, and aerodynamics improved fuel economy and DOC. The Cessna design did not meet the interior noise goal.

The General Dynamic and Lockheed designs utilized aft-mounted engine arrangements to meet the interior noise goal of 85 dB overall sound pressure level and make the acoustic treatment of the fuselage largely unnecessary. These two designs also incorporated high-lift, low-drag wing designs to get relatively high wing loadings and improved ride qualities. They also used composite structures more extensively and some active control technology. The Lockheed design cruised at Mach 0.6 instead of Mach 0.5 of the Cessna and General Dynamics designs.

The Beech design, which is not shown, was very conventional, like the Cessna design. The Beech study maintained the fuselage of the current 19 passenger design and incorporated improved engines, propeller and advanced composite wing for their advanced technology derivative.

Figure 17 summarizes the projected potential of advanced technology on economics, fuel efficiency, ride quality, and noise for the manufacturers' study aircraft. The comparisons also include Cessna's 19 passenger design and Lockheed's 50 passenger design. The spread in the potential improvements resulted because the baseline technology levels and the projected technology advances differed for each contractor. The improvements in DOC for a 100 nautical mile trip with fuel at $1 per gallon ranged from 15 to 24 percent. Fuel efficiency in terms of seat nautical miles/gallon on a 100 nautical mile trip improved by 32 to 65 percent. Ride quality for the high wing loading General Dynamics and Lockheed designs were within 8-10 percent of the DC-9 transport. All designs could achieve a 90 EPNL airport noise contour of one square mile or less, and the aft-engine arrangements were attractive in providing jet transport interior noise levels coupled with higher cruise speed capability.

Through these NASA-sponsored advanced aircraft studies, we see the potential for continuing great improvements in small transports—improvements the U.S. will need to ensure that commuter air transportation continues to grow and provide the necessary rapid transportation to the smaller communities across the land.

Concluding Remarks

The air transportation system has four critical elements: the air vehicle; the airport; the airway; and the intermodal transfer. They all play critical roles in providing an efficient system. The airport is the link between transportation in the air and on the ground; it should be located, designed, and operated to meet the needs of the people who use it, the air service mission to be performed, and the aircraft that will operate to and from it. For the commuters, this means convenient suburban, urban, and small community airports with reliable, safe service to connect to the major hubs. The airports can be good neighbors and will contribute to community growth.

The second generation of commuter aircraft currently under development will provide significant gains in community and passenger acceptance. However, the potential for even more improvements exists. Recent NASA-sponsored studies have identified the potential for substantial improvement in fuel efficiency and passenger acceptance at reduced operating costs. Such aircraft improvements will do much to ensure future growth of air travel and preserve our mobility.

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FIGURE 1: COMMUTER OPPORTUNITIES TO RESOLVE TODAY'S PROBLEMS AND PROVIDE BETTER AIR SERVICE

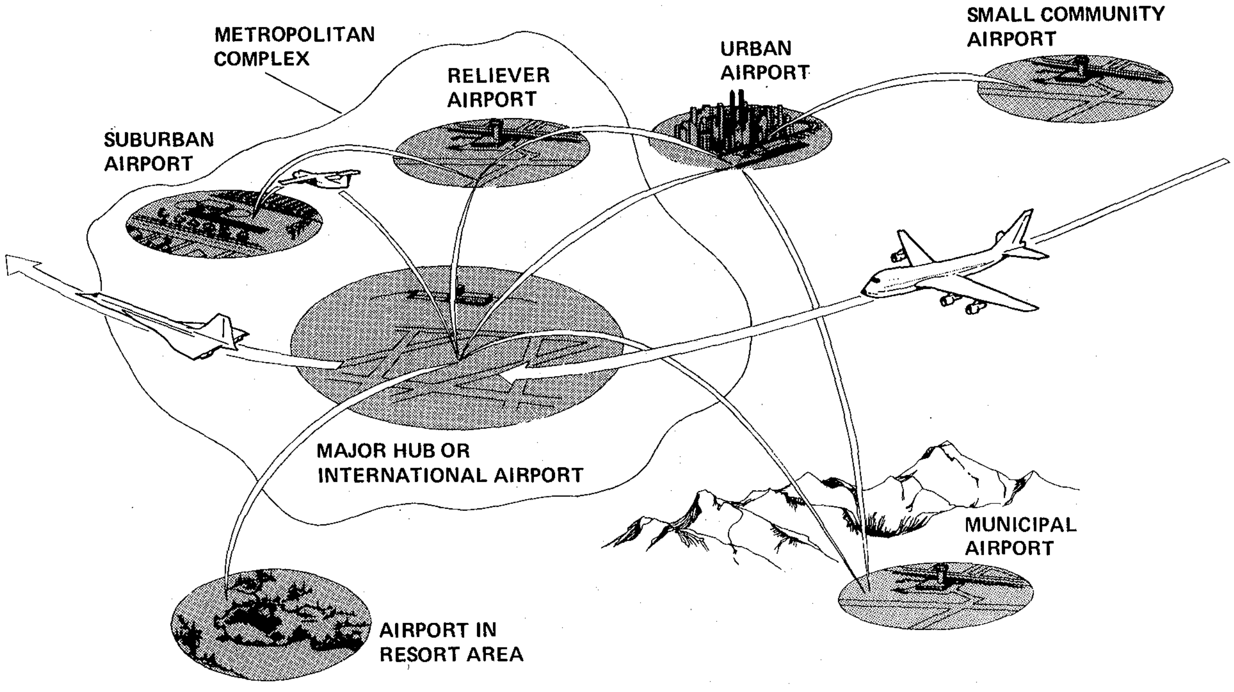


FIGURE 2: TYPICAL COMMUTER ROUTE STRUCTURES

TYPE ROUTE	AIRLINE	PREDOMINANT PATRONAGE
HUB AND SPOKE (INTERCITY)	RANSOME (PHILADELPHIA/ WASH., DC)	O AND D*
	AIR ILLINOIS (SPRINGFIELD-CHICAGO)	O AND D
HUB AND SPOKE (INTERCITY)	METRO AIRLINES (HOUSTON/DALLAS-FORT WORTH AREA)	INTERLINE
HUB AND SPOKE (INTRAURBAN)	GOLDEN WEST (LOS ANGELES AREA)	INTERLINE
HUB AND SPOKE (RECREATIONAL)	KEY AIRLINES (SALT LAKE CITY-SUN VALLEY)	INTERLINE
	ROCKY MOUNTAIN AIRWAYS (DENVER COLO-SKI RESORTS)	INTERLINE
	SIERRA PACIFIC (CALIF.-SKI RESORTS)	INTERLINE/O AND D
LINEAR (INTERCITY)	AIR WISCONSIN (WISCONSIN-MINN/CHI)	INTERLINE/O AND D
	CASCADE (EAST. WASH.-SEATTLE/PORTLAND)	INTERLINE/O AND D
	SKY WEST (S.W. UTAH-SALT LAKE CITY)	O AND D
LINEAR (RECREATIONAL)	AIR WISCONSIN (NORTHERN WISC)	O AND D

*O AND D – ORIGIN AND DESTINATION (NON-INTERCONNECTING PASSENGER

FIGURE 3: JET TRANSPORT FUEL USAGE DISTRIBUTION:
U.S. SCHEDULED CARRIERS, DOMESTIC AND INTERNATIONAL OPERATIONS: AVERAGE DAILY USAGE-FEBRUARY 1980

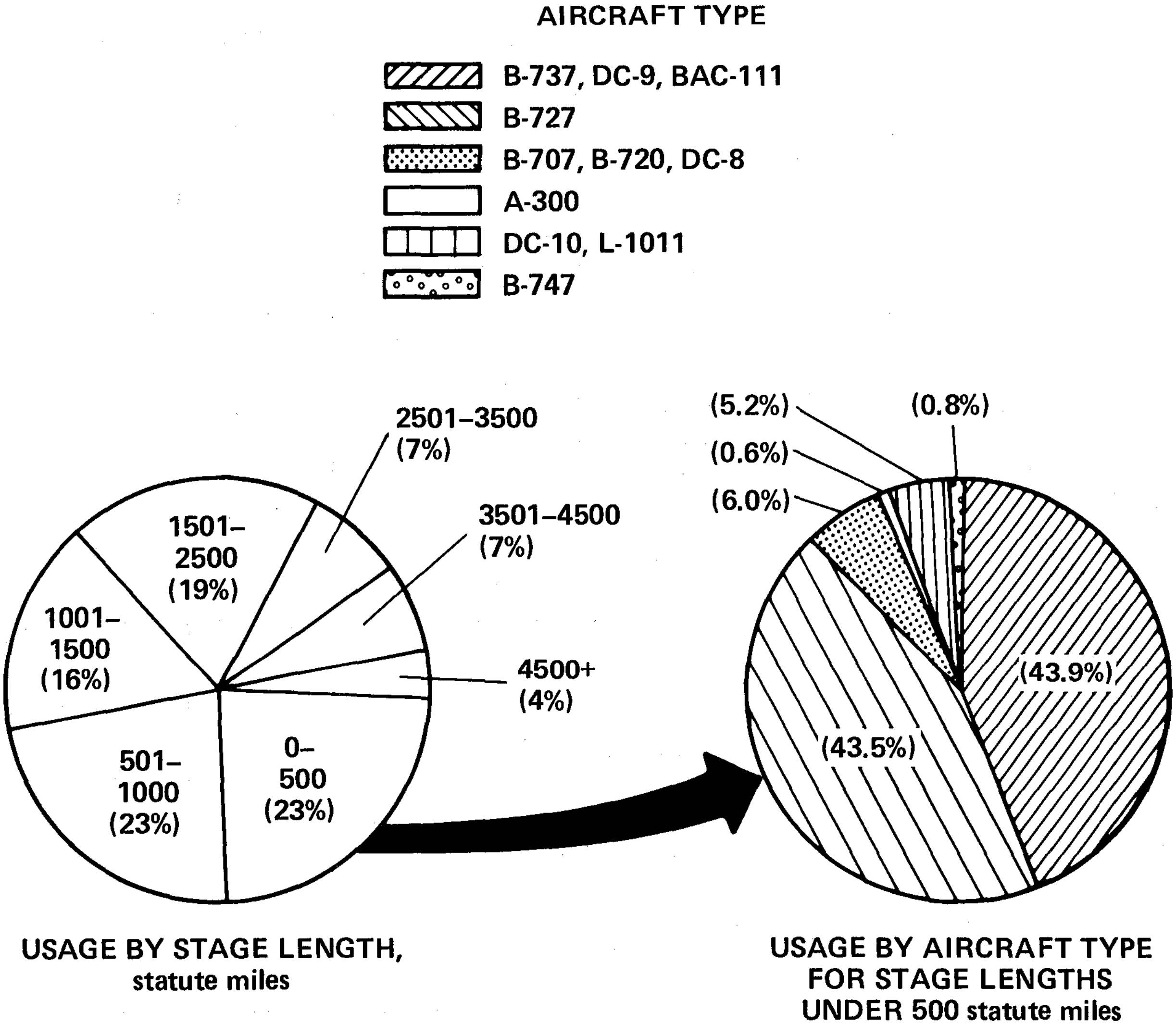


FIGURE 4: AIRCRAFT ENERGY EFFICIENCY VERSUS STAGE LENGTH OF AIRLINE OPERATION

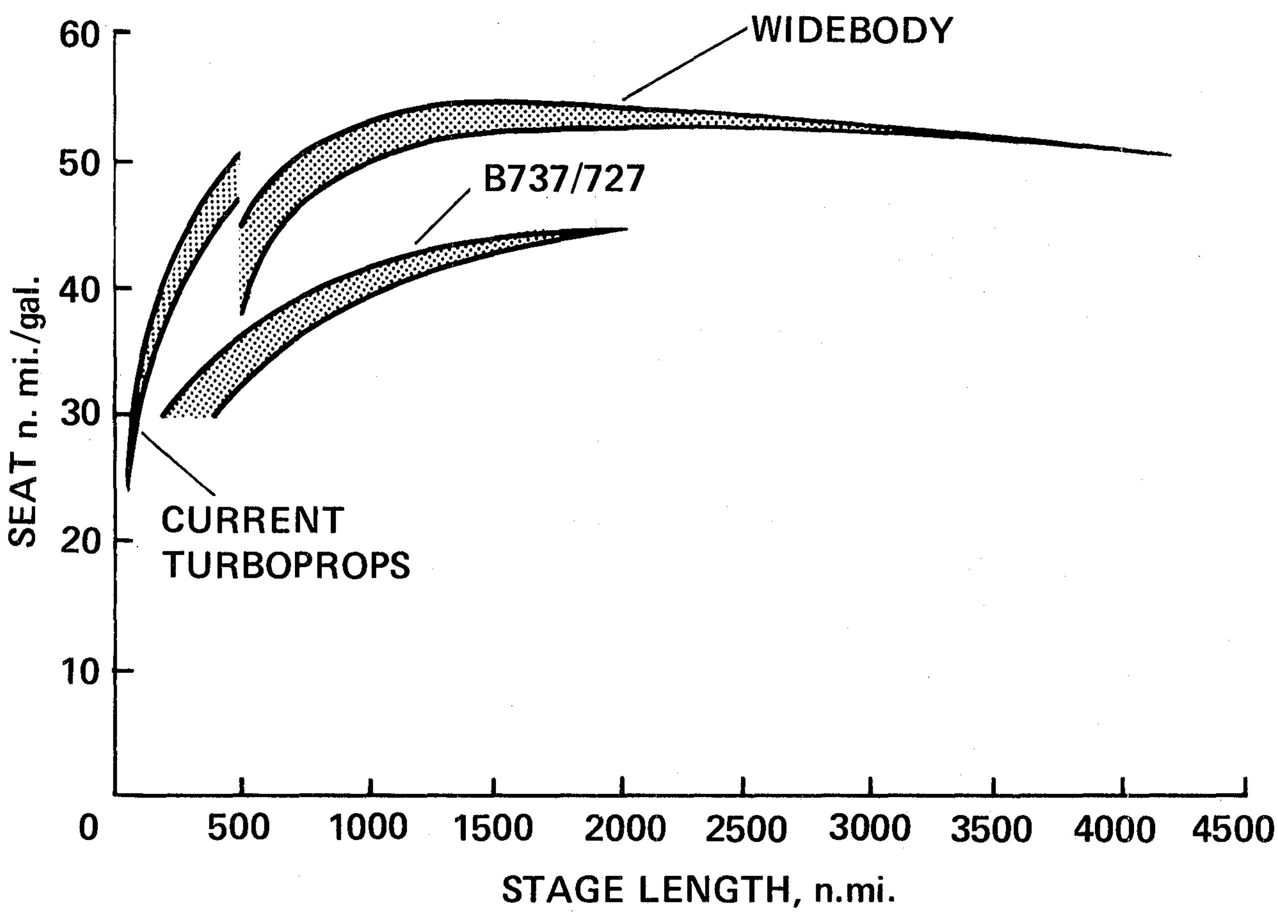


FIGURE 5: INFLUENCE OF FUEL PRICES: DIRECT OPERATING COST ELEMENTS

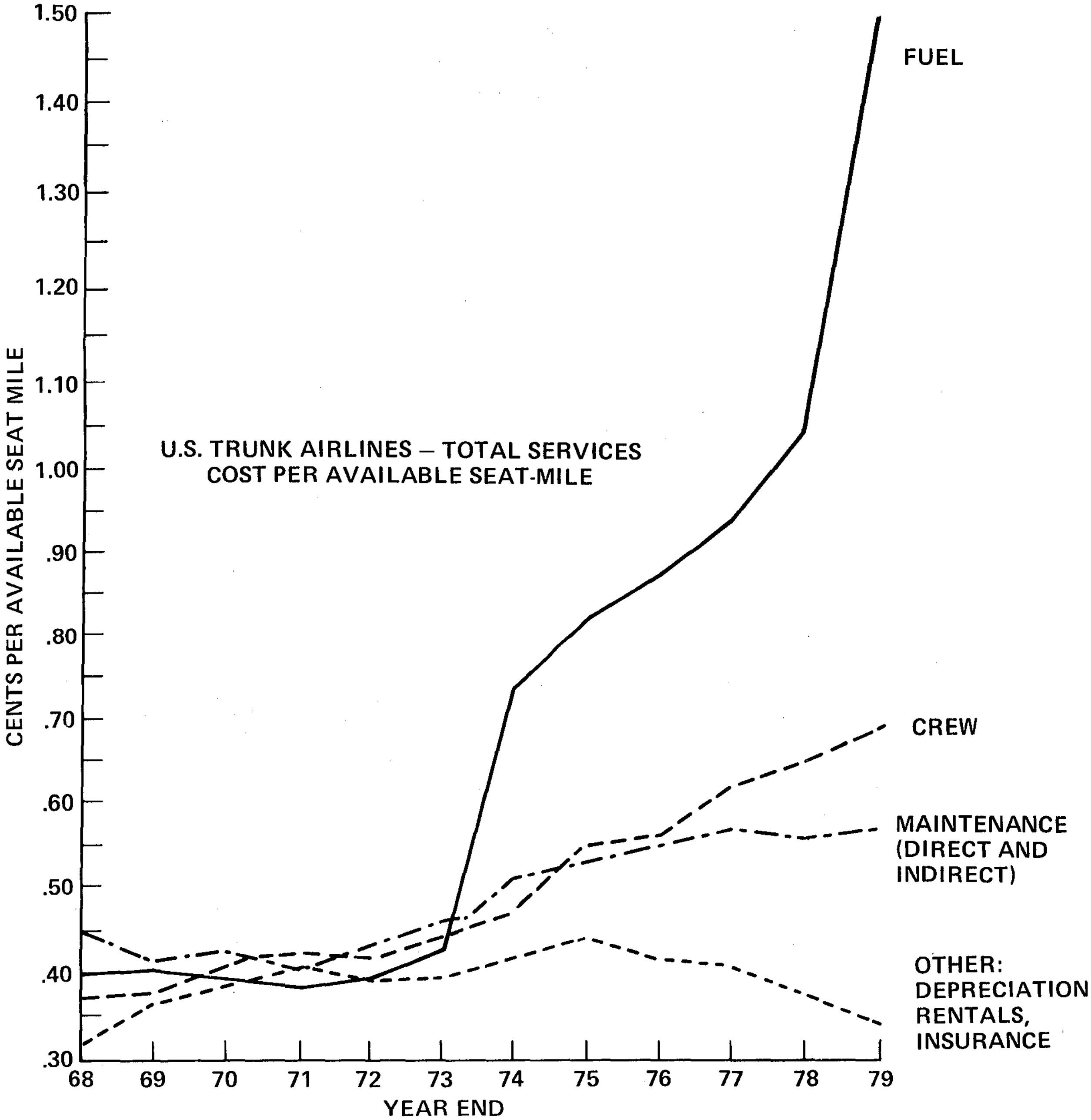


FIGURE 6: NET CHANGE IN FREQUENCY BY STAGE LENGTH:

AUGUST 1978 TO AUGUST 1980

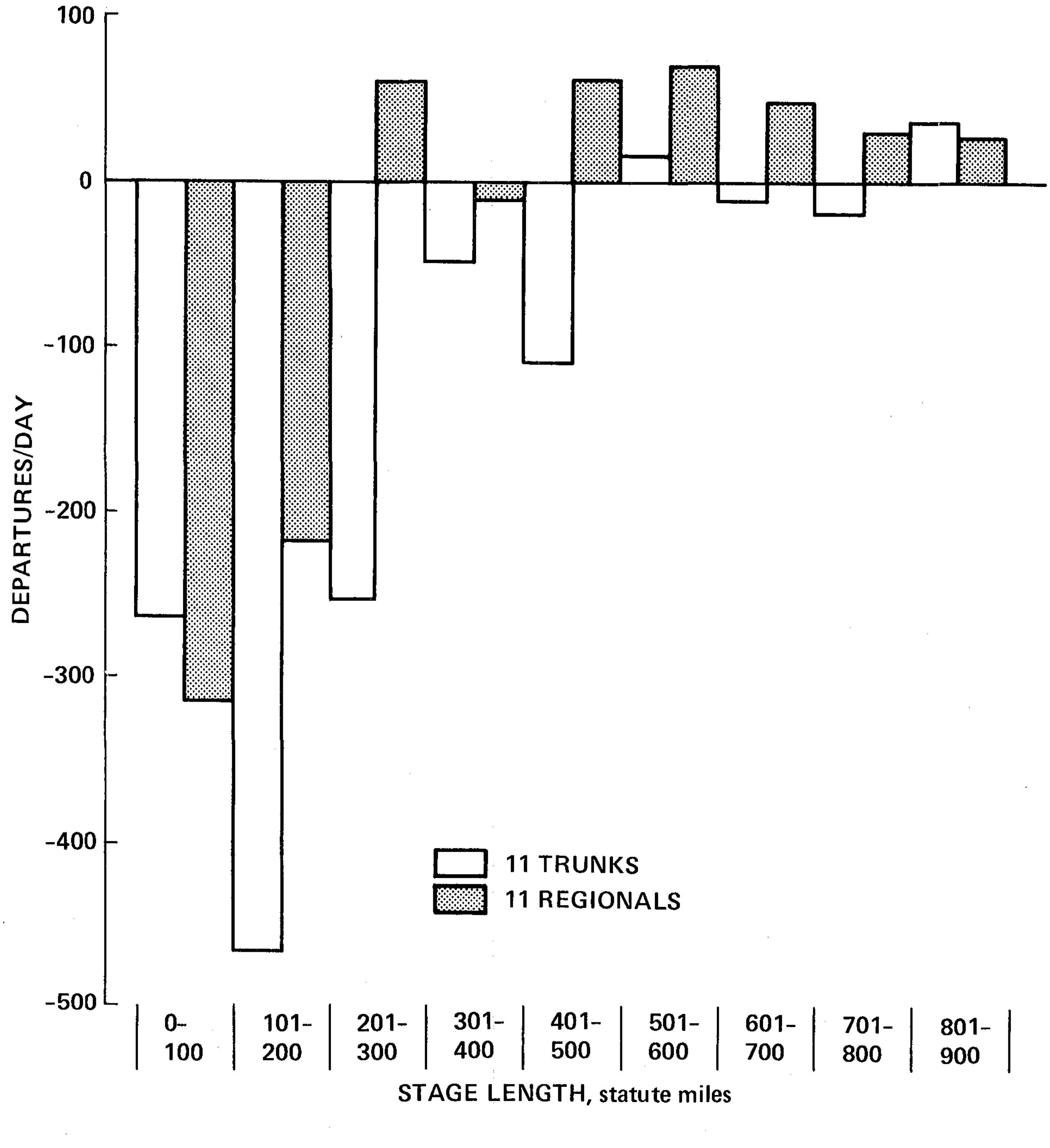


FIGURE 7: HISTORY OF GROWTH OF U.S. COMMERCIAL AIR PASSENGER TRANSPORTATION

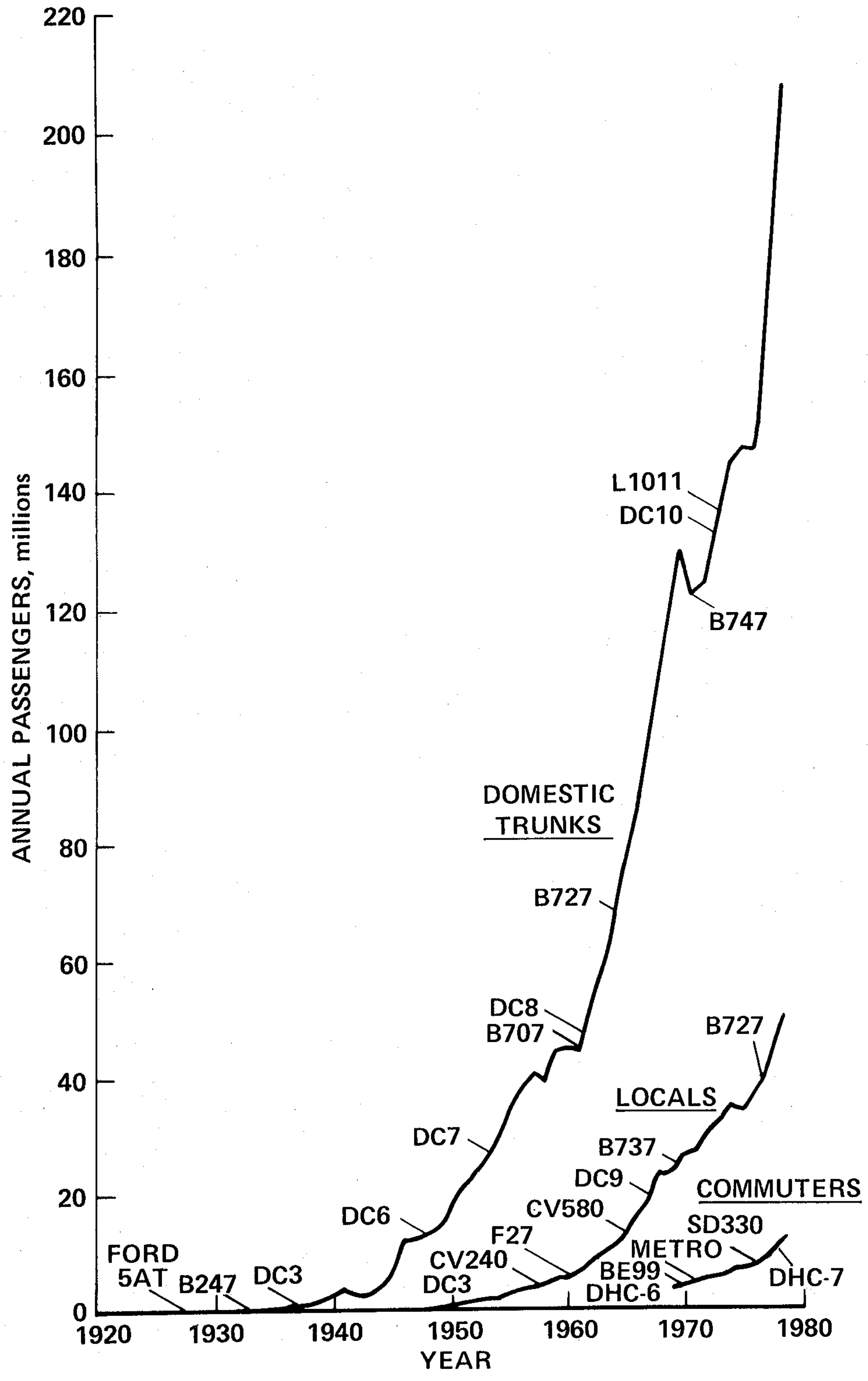


FIGURE 8: AIRCRAFT PERFORMANCE IN RELATION TO AIRPORT CHARACTERISTICS

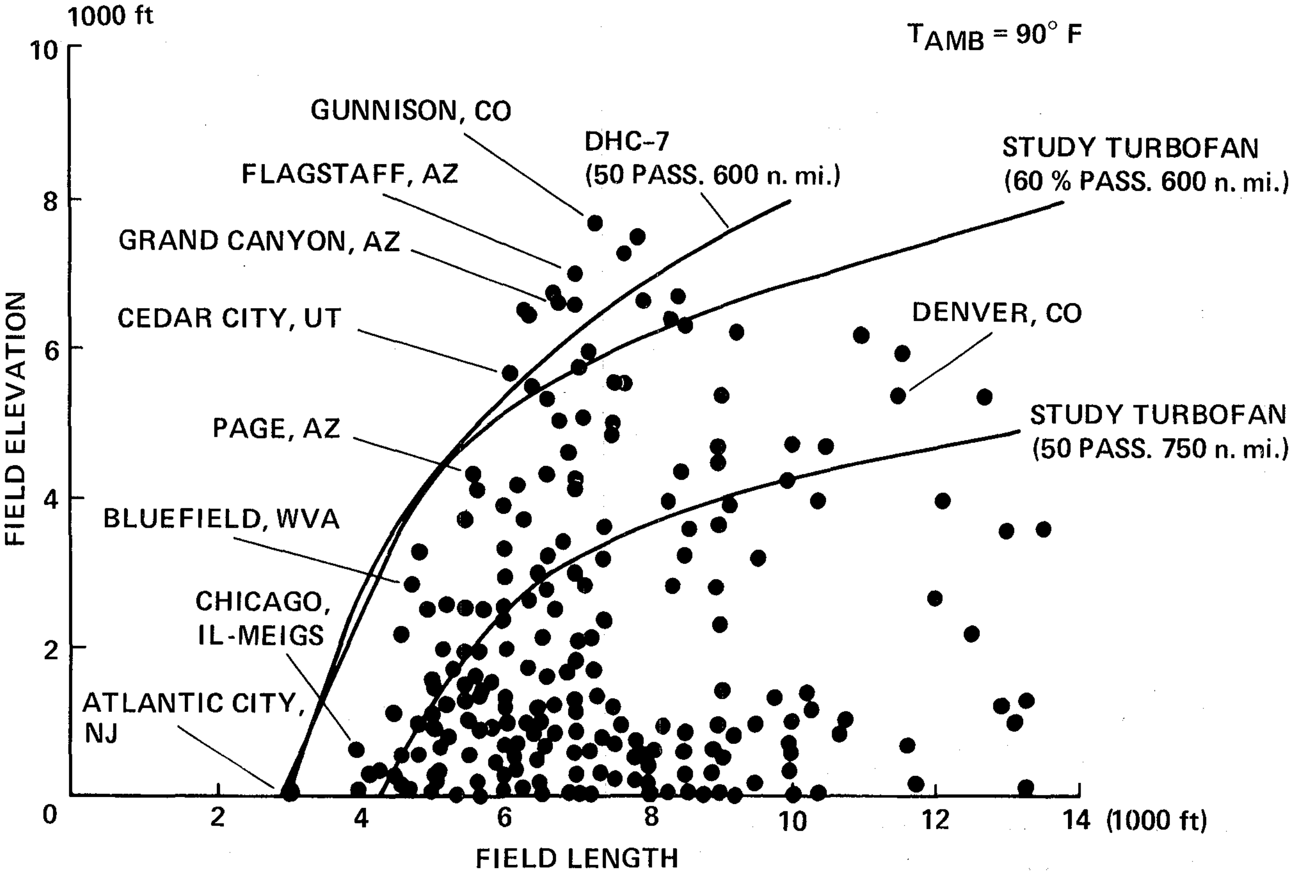


FIGURE 9: FORECAST AIR CARRIER AIRPORT SATURATION:
YEAR IN WHICH BUSY-HOUR OPERATIONS EXCEED PRACTICAL IFR CAPABILITY

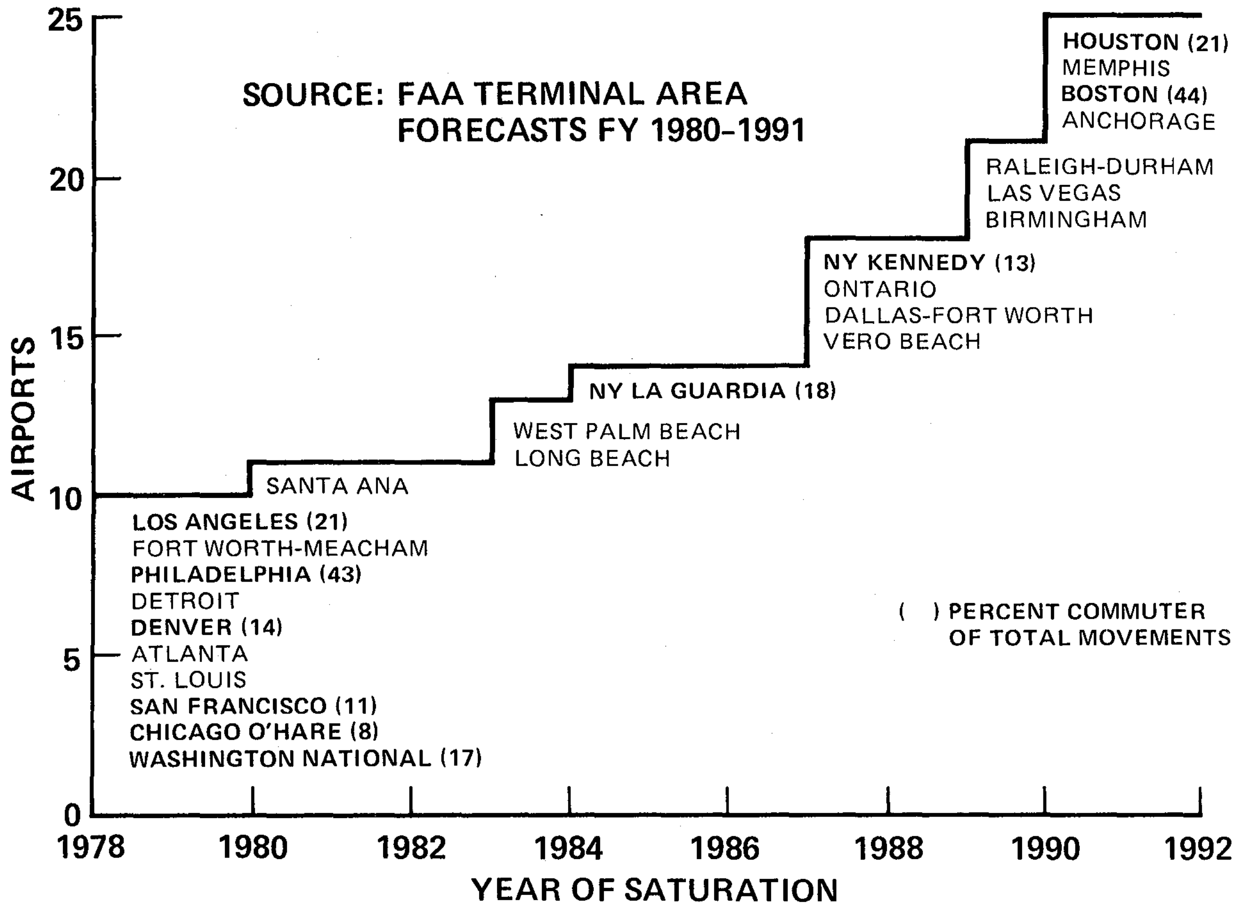


FIGURE 10: AIRCRAFT PERFORMANCE IN RELATION TO EXTERNAL NOISE LEVEL STANDARDS

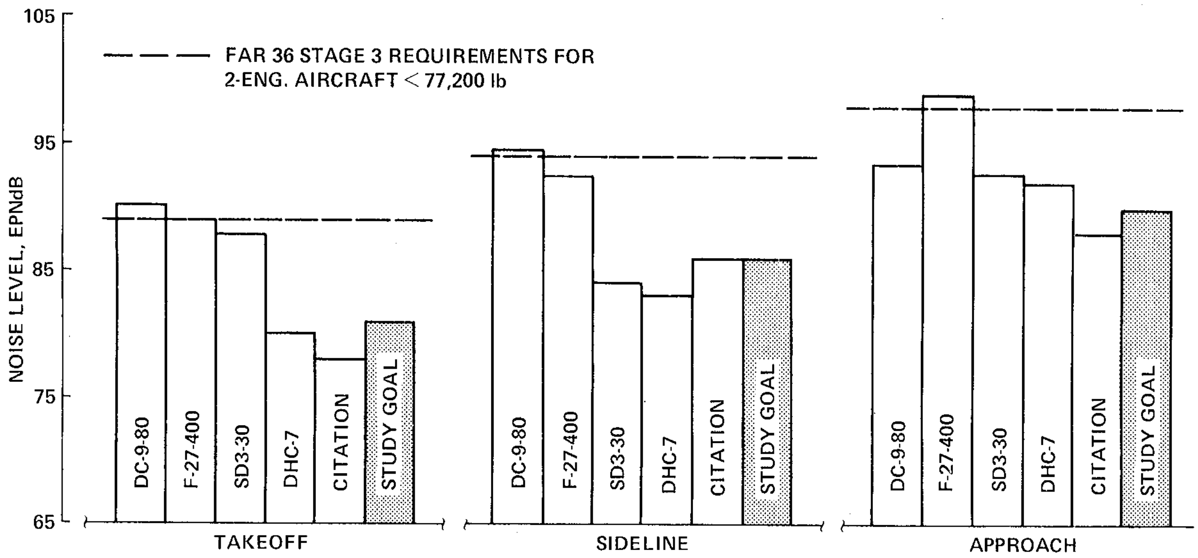


FIGURE 11: AIRPORT NOISE CONSIDERATIONS

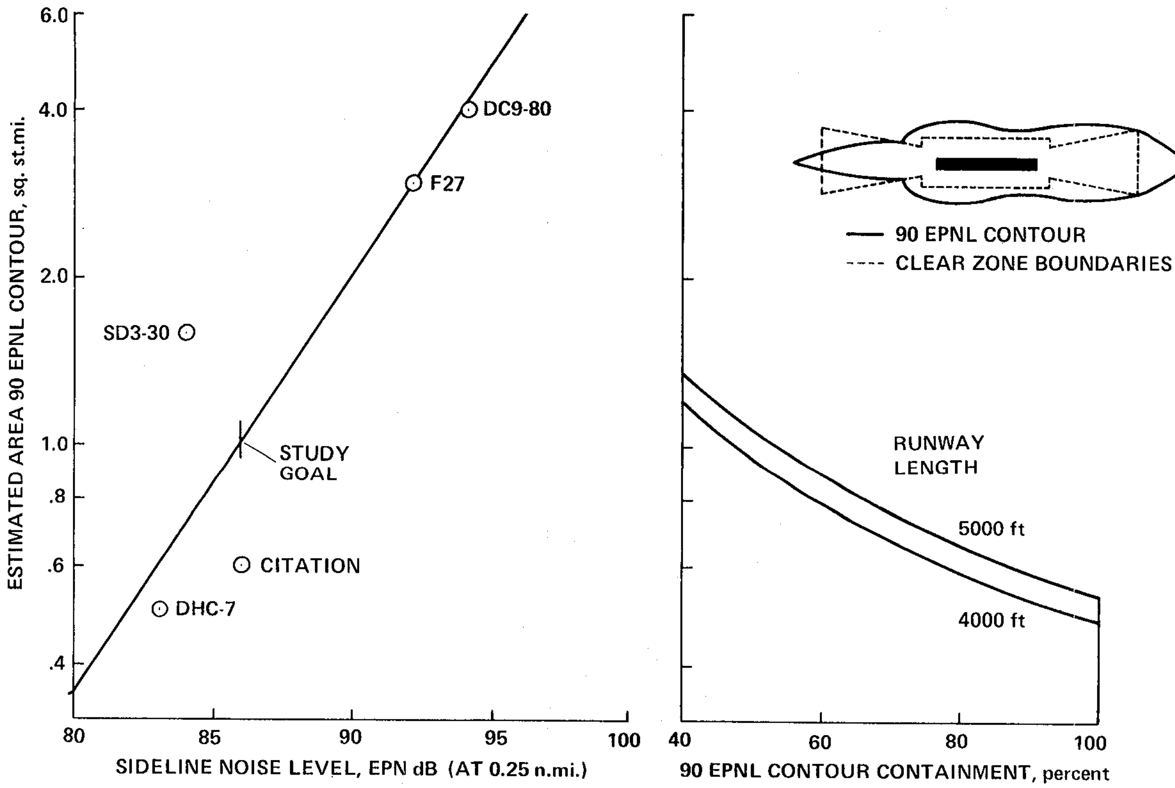
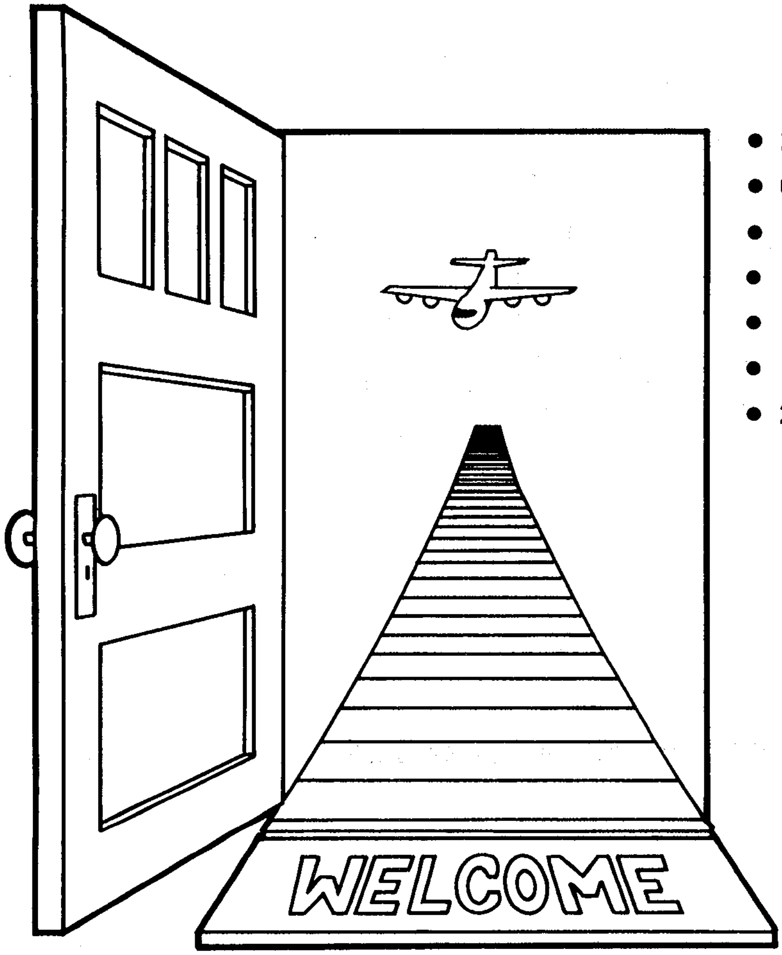


FIGURE 12: STATE OF OHIO: BENEFITS FROM 62 NEW AIRPORTS



- 20 NEW INDUSTRIAL PARKS
- 60,000 NEW JOBS
- 1500 MANUFACTURING FIRMS
- LAND VALUES INCREASED
- RETAIL TRADE EXPANDED
- 1 BILLION IN CAPITAL INVESTED
- 250 MILLION PERSONAL INCOME RISE

YOUR COMMUNITY FRONT DOOR –
A HIGHWAY 4,000 FEET LONG AND
75 FEET WIDE

FIGURE 13: RIDE ROUGHNESS FACTOR FOR AIRCRAFT:

30 ft/sec GUST

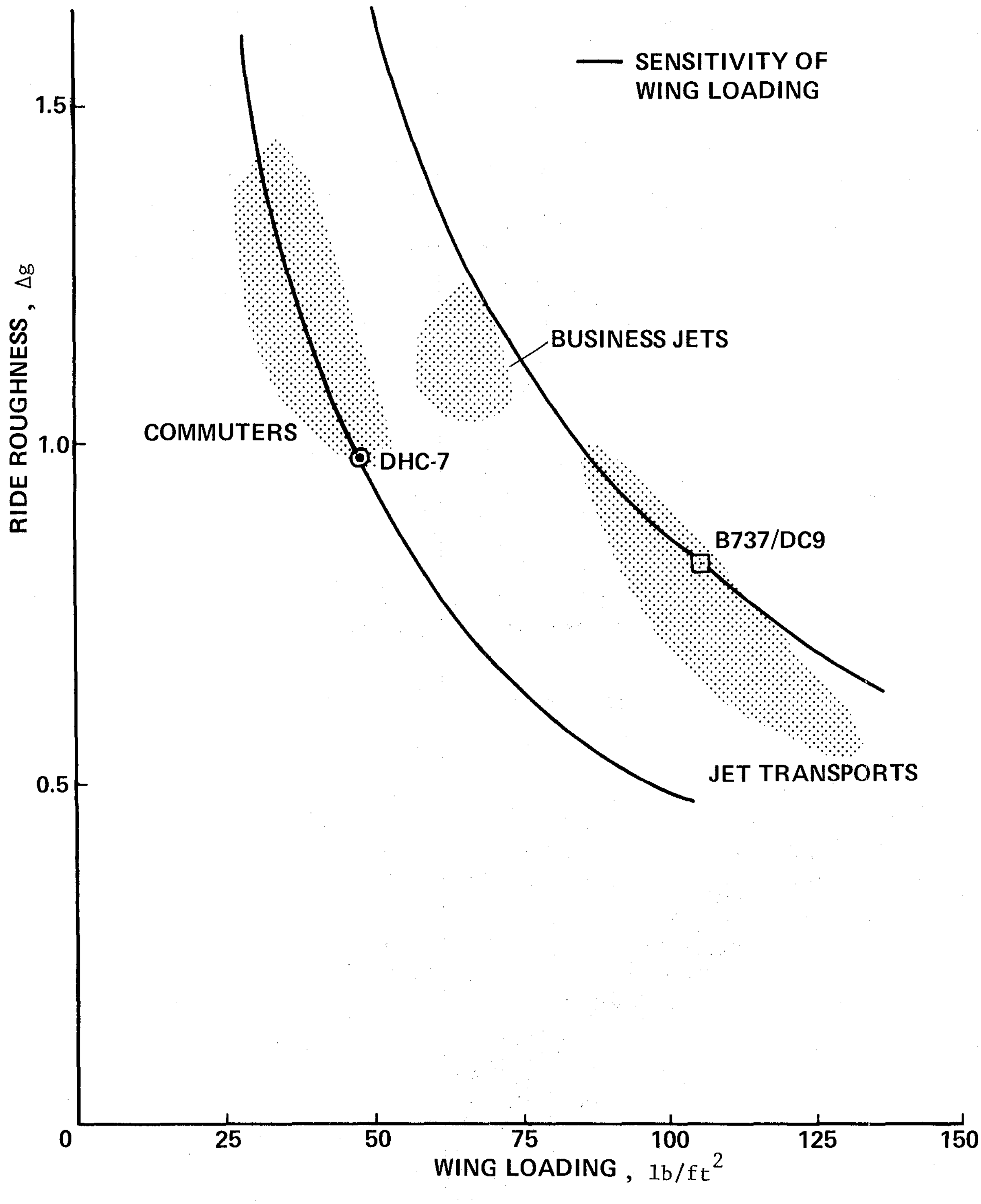


FIGURE 14: COMPARISON OF AIRCRAFT CABIN CONVENIENCES

CABIN CONFIGURATION	CABIN DATA					LAVATORIES	
	SEAT WIDTH, in.	SEAT PITCH, in.	MINIMUM AISLE WIDTH, in.	AISLE HEIGHT, in.	CABIN PRESS., psi	NUMBER	PAX/LAV
19 PASSENGER 2 ABREAST COMMUTER	18	30	14	57	6.0	–	–
30 PASSENGER 3 ABREAST COMMUTER	18	32	18	72	6.0	1	30
110 PASSENGER 5 ABREAST JET TRANSPORT	17.5	33	19.5	80	7.45	3	31

AIRCRAFT	BAGGAGE ALLOWANCES PER PASSENGER				CLOSET SPACE	
	PRELOADED	UNDERSEAT		OVERHEAD	TOTAL LENGTH, in.	LENGTH/PAX, in.
	VOLUME, ft^3	VOLUME, ft^3	SIZE, in.	VOLUME, ft^3		
19 PASSENGER 2 ABREAST COMMUTER	5.8	.8	5x14x18	–	–	–
30 PASSENGER 3 ABREAST COMMUTER	8.3	1.7	9x16x20	.95	24	.80
110 PASSENGER 5 ABREAST JET TRANSPORT	8.1	1.8	9x16x21	.98	80	.73

FIGURE 15: AIRCRAFT INTERIOR NOISE LEVELS

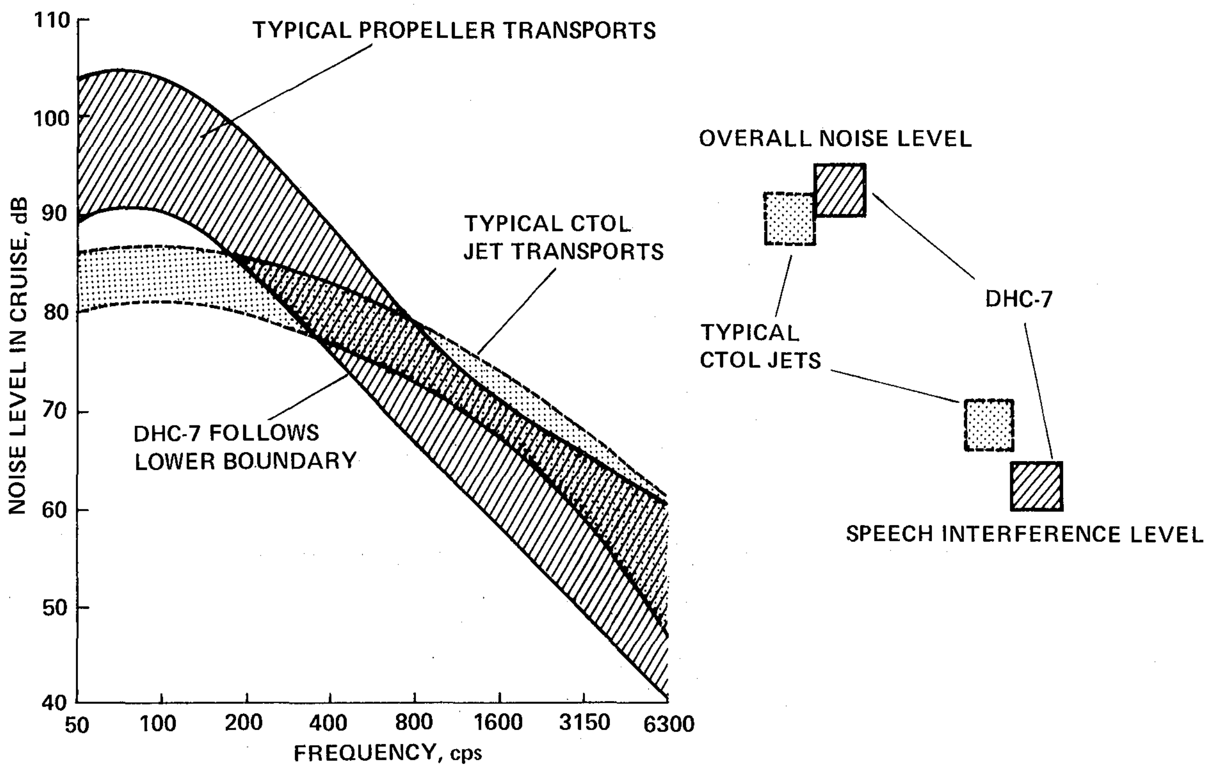
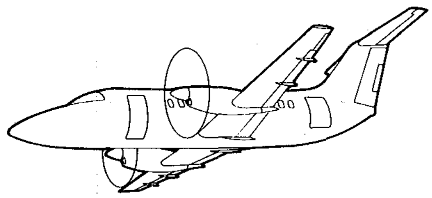
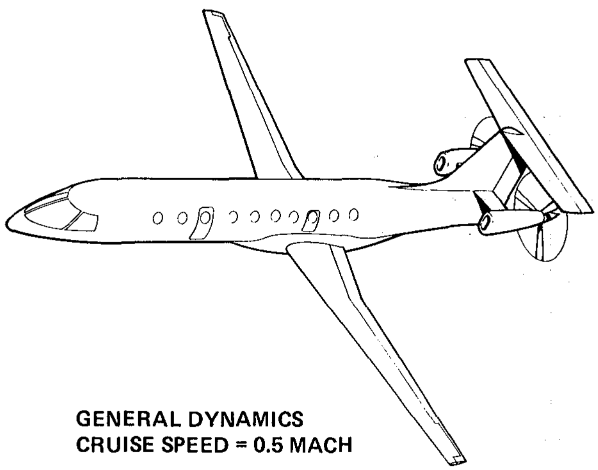


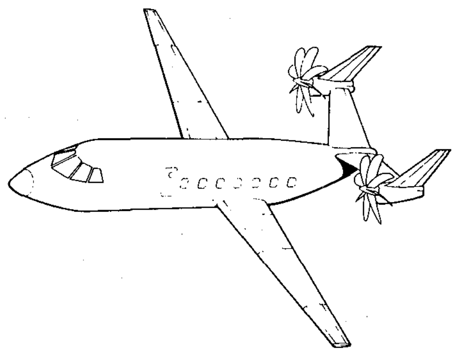
FIGURE 16: ADVANCED TECHNOLOGY SMALL TRANSPORT AIRCRAFT DESIGNS: 30 PASSENGER



CESSNA
CRUISE SPEED = 0.5 MACH

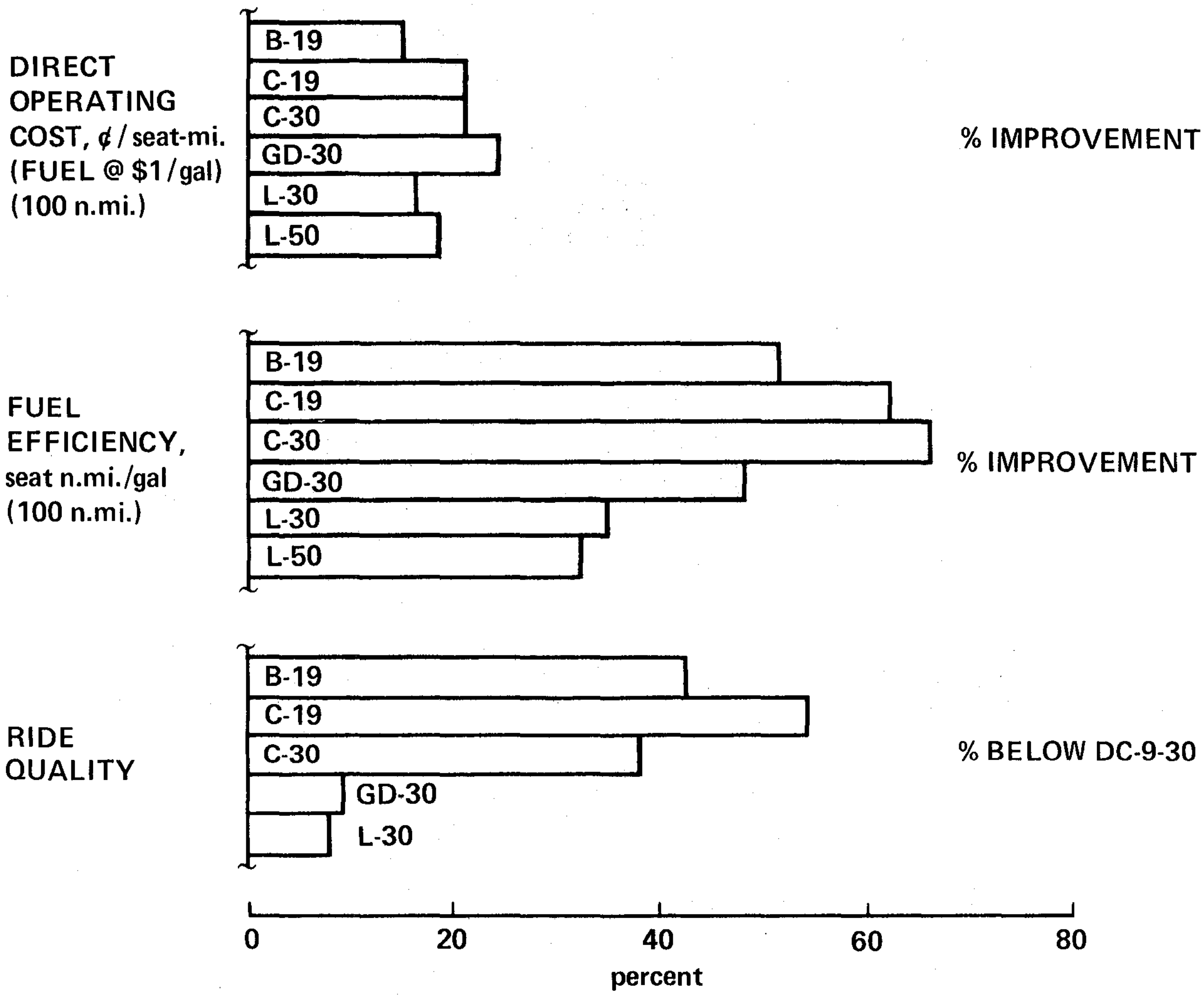


GENERAL DYNAMICS
CRUISE SPEED = 0.5 MACH



LOCKHEED
CRUISE SPEED = 0.6 MACH

FIGURE 17: ADVANCED TECHNOLOGY BENEFITS



NOISE 90 EPNL CONTOUR ⩽ 1 sq. mi.; JET TRANSPORT INTERIOR

INTERMODAL REQUIREMENTS

Christopher Brittle
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Introduction

What can regional agencies do to assist in the development of the commuter air transportation system? Prior to airline deregulation, it is fair to say that little attention, if any, was given in regional airport systems planning to the specific needs of the commuter airline industry. At the regional level, our only awareness of commuter airline needs was provided by an occasional report concerning the plans for a new commuter airline or the more frequent report about another commuter airline that had vanished from the San Francisco Bay Area skies.

Despite the travails of the commuter airline industry, there has been a continuing presence in the Bay Area since the late 1960's. Because of the unique airport system in the Bay, the area's geographic characteristics, and the availability of quality planning data, this area has been featured in a number of technical studies dealing with STOL aircraft and the potential for intra-regional commuter aircraft operations. None of the more exotic concepts involving downtown and neighborhood STOL ports has come to fruition; however, a basic system of feeder service to the large commercial airports has proved to be a successful formula for some operators. This service seems to be most successful when the distance from the community being served to the Bay Area commercial airports is at least 50 miles and when there is significant congestion over surface routes to these airports.

Of course with airline deregulation, we have seen the birth of the essential air service program and tremendous growth in the commuter airline industry. As of April, 1981, there were 11 such carriers serving the Bay Area providing service to such cities as Sacramento, Monterey, Stockton, Santa Rosa, and Santa Barbara. The number of annual commuter airline operations at San Francisco, Oakland, and San Jose airports has increased from 53,000 operations in the first quarter of 1979 to 84,000 in the first quarter of 1981 (See Table 1 and Figure 1). Due to the decline in operations by the major and national carriers, commuter operations now form 20% of all air carrier operin ations the Bay Area compared to 12% at the end of 1976.

What should regional planning agencies such as the Bay Area's Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG) be doing to plan for the future needs of this industry and how can we help foster its development within the overall air transportation plan for our region? By way of answering these questions, this paper will focus on the following areas:

- General Airport System Planning Considerations
- Land Use Planning - Protecting an Endangered Species (Airports)
- Airspace Evaluations and the Need for Reliever Airports
- The Ground Transportation Interface

TABLE 1: TOTAL ACTIVITY FOR THREE BAY AREA AIRPORTS

Running 12 Month Activity Level				
Year	Quarter	On & Off Passengers	Certificated Air Carrier Operations	Commuter/Air Taxi Operations
1976	1	21,265,100	—	—
	2	21,802,900	—	—
	3	22,152,800	—	—
	4	22,390,400	375,340	50,160
1977	1	22,639,100	381,340	52,650
	2	23,030,660	377,640	54,530
	3	23,713,000	375,890	57,760
	4	24,464,600	370,990	62,000
1978	1	25,502,600	366,797	61,810
	2	26,146,200	363,690	62,860
	3	27,185,100	369,060	59,990
	4	27,706,700	374,310	55,540
1979	1	28,323,000	380,750	52,570
	2	28,843,900	367,450	53,510
	3	29,088,400	364,980	56,750
	4	29,442,500	356,640	61,960
1980	1	28,358,000	345,400	67,450
	2	28,082,000	351,680	74,610
	3	27,363,000	337,780	80,090
	4	26,632,400	325,950	83,270
1981	1	25,923,200	321,590	84,220

Source: Airport Activity Records: San Francisco International Airport, Metropolitan Oakland International Airport, and San Jose Municipal Airport.

General Airport System Planning Considerations

Regional airport system plans need to take a broad view of the future role of the commuter airline industry and incorporate basic policy statements in their plans. For many years the major advocate for commuter airlines in the Bay Area has been the general aviation community. Commuter carriers often interfaced well with the facilities at general aviation airports but found it difficult to operate at the large commercial airports due to lack of counter space, a shortage of gates for their aircraft, awkward security arrangements, etc. Airport master plans are normally submitted to the regional agencies for review under OMB Circular A-95. Since regional agencies review airport master plans for consistency with their own plans, one basic requirement would be for the major commercial airports to specifically consider the needs of commuter airlines in the preparation of their master plans. This requirement would foster a longer range view of commuter needs as opposed to the current situation in which needs are handled almost as an after thought.

Policies can further provide a basis for regional advocacy. A recent example comes to mind that shows how this can work. This example relates to the position that several small transit operators (typically using vans rather than the larger buses) found themselves in at one of the Bay Area airports. The regional plan strongly advocates transit service development at the commercial airports and contains some very specific objectives relating to transit ridership goals. When it appeared that these operators were being discriminated against in terms of their financial and operating requirements at the airport, the Metropolitan Transportation Commission intervened in their behalf and a successful resolution of the issues was ultimately reached.

In order to raise the visibility of commuter airlines in regional and local plans, the operators, industry, and the technical community must make an effort to educate the planners. The educational process is obviously a major goal of this conference. Planners can then become a resource for local communities that are evaluating potential commuter airline service. Information on aircraft noise levels and powerplant emission characteristics is essential. Planners need to know when proposed noise limits at an airport may adversely affect that airport's ability to accommodate existing and future commuter aircraft. The more we planners know about what is ahead in technology, the better the service we can provide in disseminating information and evaluating airport planning and operational decisions.

Finally, it is necessary to keep good information on how much traffic the commuter airlines are carrying and to make this information available on a city-pair basis. In order to develop regional plans, some judgments will ultimately be required about the importance of commuter airline needs relative to other systemwide concerns, such as airspace utilization and mounting user delays. The best method to establish the importance of reserving airspace for commuter airlines is to show the value of the service in terms of the number of passengers transported.

Land Use Planning—Protecting an Endangered Species (Airports)

Continuing with the basics, it goes without saying that the commuter airlines will need airports and that airports everywhere are under tremendous political pressure. Protecting existing airports is the name of the game and building new airports is only a dim glimmer in a few planners' eyes. The commuter airline operator adds very little to the noise problem at the larger jet airports and is probably a welcome relief to nearby communities, especially when the commuter carrier replaces a jet service. The problem is more one for the smaller general aviation airports, where the commuter operator is suffering the misfortunes of years of inadequate land use planning. His noise may be perceived as being louder than existing aircraft using the airport. But the problem is probably not that the aircraft is that much louder, but the communities have encroached right up the airport boundaries. The tremendous need for urban housing is such that in the Bay Area, airports that heretofore were considered "protected"—those that are on the shoreline of the Bay or in more rural portions of the Bay Area—are experiencing urban encroachment. Further, if the airports themselves are not encroached, the flight patterns will surely disturb some residents even though these people are located well away from the airport.

Figure 2 shows airports in the Bay Area that are either totally encroached by housing (E), partly encroached (PE), or threatened with encroachment (T). Airports whose flight patterns have tended to bother people are shown with an (FP). Several disconcerting trends include the erection of tall structures in the vicinity of airports or in the flight pattern themselves and the expansion of residential communities near airports as part of local plans to constrain airports or at least increase public pressure for greater control over airport operations.

There are several positive approaches regional agencies can take in these situations. Regional agencies receive local development plans through the A-95 review process and can work with local commissions (such as mandated airport Land Use Commission in California) to suggest modifications to the project to make it compatible with airport operations. Since this approach relies on the persuasive power of the regional agencies, there is no substitute for having elected officials on regional aviation policy committees. There are several instances in the Bay Area where these officials have been instrumental in developing compromises in situations that would have adversely affected the future of an airport. When attempts to convert incompatible land uses to compatible land uses fail, the "last resort" approach is one of requesting that local jurisdictions require developers to grant noise and avigation easements to the airport proprietor to reduce the future liability of the airport.

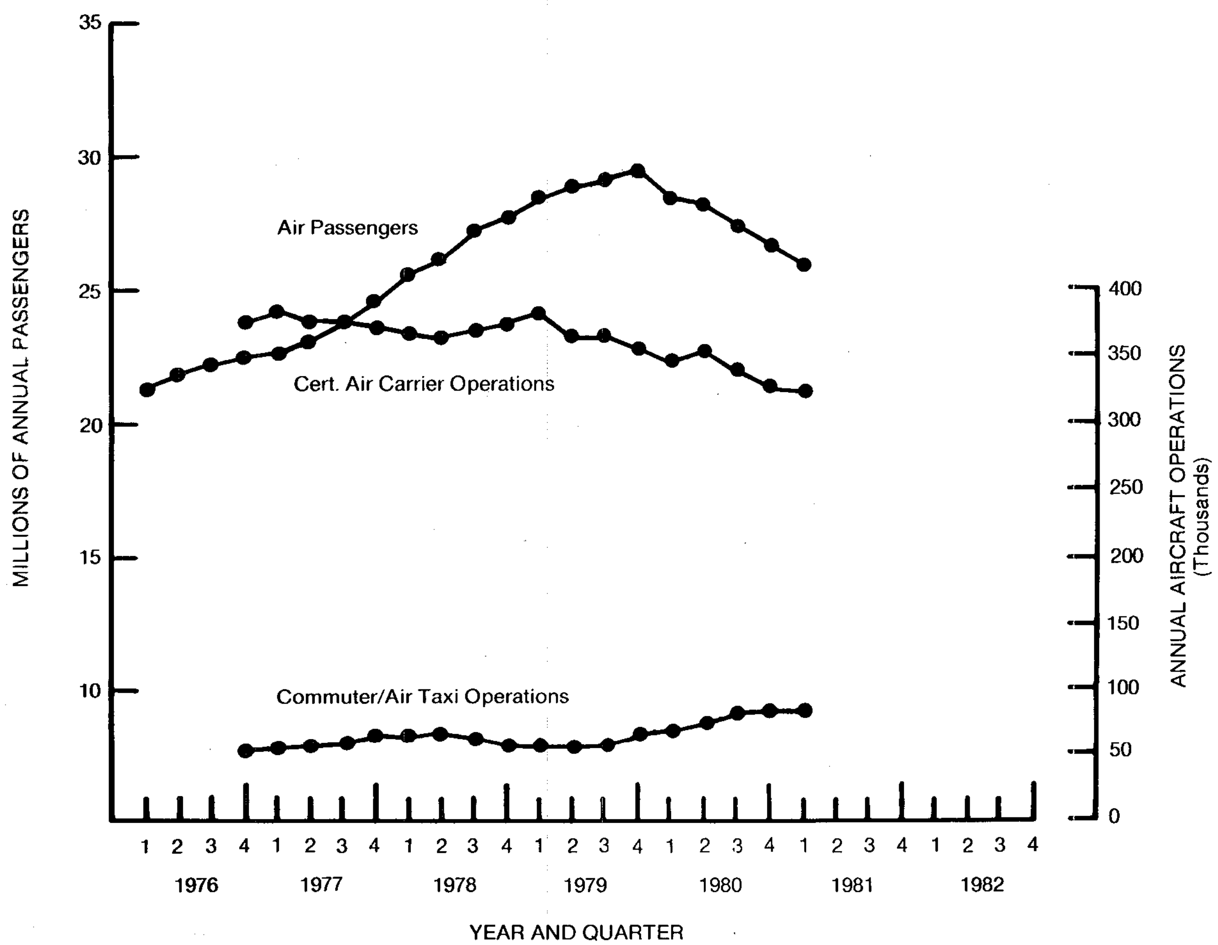
A second major role regional agencies can play concerns the programming of airport improvement funds. Although the MTC does not directly allocate funds for either air carrier or general aviation airports, MTC does prioritize projects for State funds (which it is required to do under State law, and Federal funds (which it does in an advisory capacity) involving general aviation airport projects. Next only to safety projects, the Regional Transportation Improvement Program places the highest priority on acquisition of airport approach areas to protect airports from future encroachment. This approach, of course only works when an option is still available and is proving very costly as land values appreciate.

Airspace Evaluations and the Need for Reliever Airports

A very "in" topic these days is how to allocate scarce airspace capacity at the high density airports, and, in particular, how much of this capacity should be allocated to commuter airlines considering the "public convenience and necessity" associated with their service. Beyond this current dilemma lies a much larger issue concerning long range airspace capacity requirements. Not surprisingly, airspace modeling performed in the Bay Area shows that future delays are significant when we attempt to accommodate all users. What is needed is a rational game plan for the use of airspace to maximize the public benefits and minimize costs to the air transportation industry as a whole. No matter how congested the airport system becomes (remembering that the Bay Area has three major commercial airports), I personally do not see the scenario whereby jet-powered STOL aircraft are quietly whisking passengers in and out of general aviation airports to relieve congestion at the major commercial facilities. There are just too many public policy problems with this scenario. For their part commuter airlines will, by large, probably remain at the large airports because of the need for visibility and because the interline passenger will continue to be part of their bread and butter operation.

Instead, our planning studies have concluded that a two-tiered approach is probably more workable. First, develop a reliever airport system to attract general aviation aircraft away from the large commercial airports. The attraction of smaller general aviation aircraft away from the large airports should provide sufficient capacity for both the major and national carriers as well as the commu-

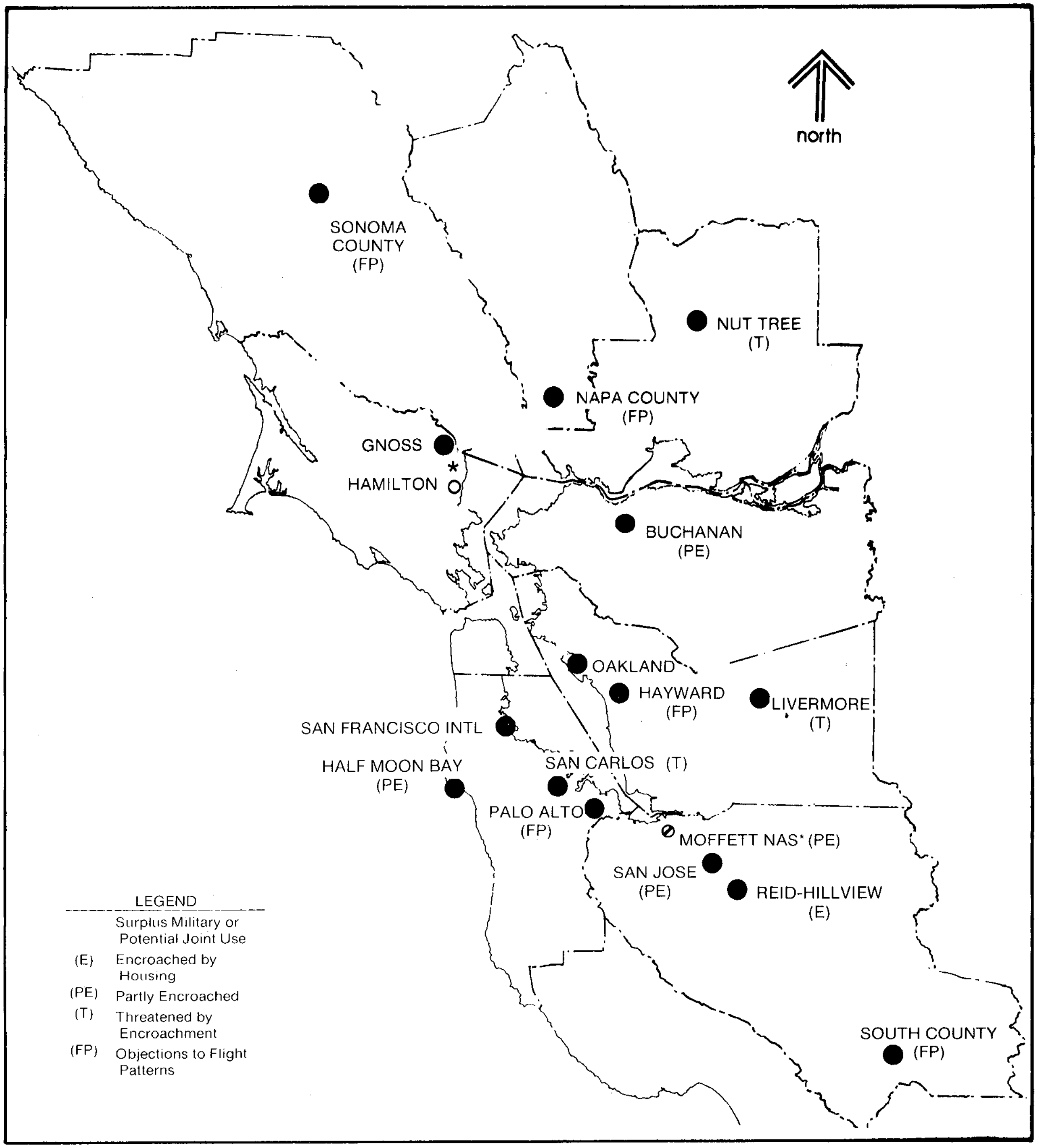
FIGURE 1: TOTAL BAY AREA AIRPORT ACTIVITY



ter carriers for a number of years. Second, explore the feasibility of separate commuter airline procedures, (particularly for STOL operations) and airfield facilities at the large commercial airports to facilitate operations independent of the large jets.

Reliever airports are defined in regional planning as those airports that can *actually* cause a traffic diversion from an air carrier airport. Ideally these airports should have a precision instrument landing system for use during inclement weather. Reliever airports can also relieve the

FIGURE 2: MAJOR GENERAL AVIATION FACILITIES IN SAN FRANCISCO BAY AREA



larger airports by accommodating VFR or IFR training activity or general aviation aircraft parking demand that would otherwise have to be accommodated at an air carrier facility. In the Bay Area, the MTC is supporting the retention of Hamilton AFB, a surplus military base, as a general aviation reliever airport in opposition to local plans. Because of the attributes of this airport our agency is currently embroiled in costly litigation with the federal government over the disposal decision for Hamilton AFB, which in our opinion, did not preserve an airport option. (It is interesting to note that the whole Hamilton AFB issue initially revolved around a discussion of whether limited jet air carrier service should be provided at Hamilton AFB; however the alternative of using Hamilton AFB as a reliever general airport has not resulted in any less opposition). An additional way in which the region supports reliever airport development is through the prioritization of airport improvement funds for general aviation airports. All things being equal, reliever airports will receive a higher funding priority to encourage their use, compared to other general aviation airports.

Safety

Although the regional agencies have no direct role in providing facilities and equipment to make airports safer, there are "spin off" issues in which we do become involved. Commuter airline operations demand adequate navigational aids at general aviation airports so that schedules can be carried out reliably and safely. Bay Area airports that have handled commuter airline activity have had either a precision instrument landing system or, as a minimum, an instrument approach. The regional plan supports the upgrading of instrumentation capabilities at those airports that have served commuter carriers or have the potential to serve commuter carriers, with specific plan notes addressing the need for improved navigational aids.

Discussions with local officials sometimes become involved in whether there is a "hidden agenda" for major air carrier service with improved navigational aids, and regional planners can assist in explaining the safety needs for commuter operations. There may also be land use issues relating to whether a larger approach area should be protected or whether densities should be adjusted in the environs areas. Again regional agencies can be a resource for these kinds of questions. Several general aviation airports in the Bay Area are candidates for improved instrumentation and installation of this instrumentation will help commuter operators in the future.

The Ground Transportation Interface

I know of few airport design problems that have received as much bad press as the ground transportation systems that connect our airports to the major cities. As one magazine put it recently, "The skies may be friendly, but the ground can be downright cruel". There is a manifest expectation that things on the ground should work as quickly and smoothly as things in the air and this logic is sometimes followed by a statement that if we don't watch out ground transportation problems will discourage people from flying altogether.

While I do not agree with all aspects of this argument, I do believe that if there is a real effect on a person's decision to travel by air or not, it will be experienced by the commuter airlines. These airlines are often competing with the car on trips between 100 and 200 miles, and excessive transportation time from a metropolitan airport to wherever the passenger is ultimately destined in an area can be a major impediment to air travel. Thus, while the problem is common to all air travelers, it is more intimately linked to the future of the commuter carrier.

The problem is certainly regional in nature and is an appropriate area for regional planning agencies to become involved. A considerable amount of attention has been directed at this problem in the Bay Area through special airport task forces and, of course, through numerous studies. Without belaboring the point, the main ideas that are currently being pursued include better connections from each airport to regional transportation services, better transit information at all airports, preferential transit lanes to convey passengers around bottlenecks on the highway and inside the airport property, and expanded express service to areas more than 15 miles from an airport (where these services would offer a major advantage).

If airports really get jammed up in the Bay Area, it might be worthwhile developing one of the large commercial airports in such a way as to cater to the commuter airlines. Oakland Airport would have several advantages in this regard. First, Oakland is functionally divided into a North and a South Field, with full runway instrumentation at both fields. The North Field would be well suited to commuter airline activity and there is excellent transit access to the BART rail system just 3 miles away. From BART it is possible to get to most any part of the region. For the interlining passenger, it will be necessary to provide some link to San Francisco airport, such as via a high speed water taxi. This type of service was tried in the late 1960's and could be reinstituted if the demand warranted. Of course, if traffic really grows, Oakland Airport will have its own complement of domestic flights and many transfers could be made directly at Oakland.

One final point needs to be addressed, and that is the concept put forth in some literature concerning an *intra*-regional system for commuter airline service. This system, it seems, would cater to the executive who lives in the fashionable suburbs of the northern part of the Bay Area but must commute 20 plus miles on a daily basis to his semiconductor plant in the southern part of the Bay Area. The idea here is that as bottlenecks develop and get worse on the highways there will be a market for "air transit". At the risk of sounding unenlightened, I don't see this happening on any large scale basis. Although there may be room for certain longer distance flights between general aviation airports and between certain Bay Area cities with a strong community of interest, air transit is a long way off. The reason for this conjecture is threefold; 1) economics, 2) lack of demand, and 3) inability to provide adequate ground transportation links at the origin/destination airports. The first two points do not require detailed explanation. The final point though is aimed at the issue of what a regional transportation system can and cannot be expected to provide. One thing it cannot provide is direct service to and from general aviation airports and multiple destinations in surrounding areas. Persons using commuter air transit would most likely have to use rental cars or have a company car or an acquaintance pick them up at the airport in order to complete their trip. Where these airports fit neatly into a local transit schedule, I'm sure the service could be provided.

Conclusions

This paper is not intended to offer an exhaustive review of commuter activity in the Bay Area, but to suggest different levels of involvement for regional planning agencies as the commuter air transportation system matures. Our role will be to monitor growth in the commuter airline industry, to try and anticipate future needs, and to translate these needs into effective policies that can support the industry's development. Regional agencies and staff, when properly informed through conferences such as this, can disseminate information about the industry and can work with commuter operators to resolve local problems. The most significant role will be to continue to encourage rational land use planning around general aviation airports in order to preserve future options as the commuter system develops. Additionally, regional agencies should continue to evaluate future airspace needs and plan for ways to accommodate commuter growth within the regional airport system. Continuing efforts must also be directed at making the airport ground transportation system more efficient so that this aspect of the air passenger trip will not become a major determinant in the selection of air versus ground transportation in commuter short-haul markets.

AN AIRPORT MANAGER'S PERSPECTIVE

O.N. Ford
District Manager
Monterey Peninsula Airport District

Introduction:

In the past three days, many presentations have been made covering all aspects of the environment, aircraft technology, community transportation planning, the rule-makers and their controls, and numbers of other related subjects. One other area must not be overlooked; after the commuter aircraft are built, the government planners have planned, and the rule-makers have ruled, the game has to be played; and where is it played? This is where the airport enters into the picture for, without a place to do all of this, the whole process would be an exercise in theory only.

So, as an airport operator of a small hub, servicing both large air carriers and commuter aircraft, I would like to present some observations from the airport side of the fence. It seems that most everything we are talking about either came about or expanded after the federal Deregulation Act of 1978, so it seems appropriate to start from there.

1. What has deregulation done to the small or medium hub airport in the way of replacing service by major carriers with commuter air service?
   a. Starting with Monterey Peninsula Airport as an example, let us look at our status in 1978 just prior to deregulation.
      (1) Monterey was then served by four major airlines providing 44 turbo jet flights daily with 5,000 available seats. This service resulted in 700,000 in and out passengers for that year.
      (2) Following deregulation, two of the major carriers departed Monterey and traffic for 1979 decreased by over 200,000 passengers.
      (3) In late 1979 and early 1980, three commuter airlines commenced operation at Monterey, resulting in a total of 80 flights daily to 14 cities in California and Nevada. However, this provided only 4,000 daily seats, due to the smaller sizes of the commuter aircraft. Load factors also decreased to below 50%, due to a combination of reasons such as customer resistance to smaller aircraft, increased fares due to high fuel costs, and reliability problems with the commuter airlines.
      4. Now in 1981, at Monterey, the situation has stabilized in that the larger of the three commuters has finally improved its system and operations for better efficiency, and this one commuter has carried over 140,000 passengers in and out of Monterey to date. However, overall passenger traffic, while gradually increasing, has not regained anything near the pre-deregulation levels. So, in summary, we can say that deregulation has given us a severe jolt, but one that we are living with due in part to the service, but it is still less reliable; passenger traffic is down, travel is more expensive than previously, and the aircraft are smaller, but quieter. Records indicate that, after a shaky start, commuter airlines are as safe as other air carriers.
2. What then are some of the present problem areas, and possible solutions for future planning for commuter services at small and medium hub airports?
   a. Physical problems exist, both on the air side (runways, ramps, taxiways) and on the land side (terminals, baggage, security, car parking), at most airports. At the time of construction, little or no thought was given to the integration of commuter size aircraft for the mutual benefit of both in utilizing interlining, baggage handling, security inspection, and many other related functions. As a result, most airports either have instituted temporary or use make-shift commuter areas near existing terminals. In the case of some airports, the terminal facilities are used for commuters, but were not designed for such use, resulting in crowding and other customer or commuter airline inconveniences. Let us discuss these problem areas individually and in more detail.
      (1) In future airport planning, consideration should be given to making available certain runways and taxiways that can be used by commuters to avoid congestion with the larger airline aircraft. This has had some limited usage at eastern airports, and offers the advantage of allowing commuter aircraft, when operating in conjunction with R NAV route structures, a flexibility of traffic control even under IFR conditions.
      Parking ramp facilities are presently designed for large aircraft using loading tunnels or bridges; these do not match up with existing commuter aircraft. Thus, when commuters integrate at the larger hubs they usually are parked in an awkward situation, resulting in passengers enplaning or deplaning up or down steps, and through back or side entrances.
      When commuter facilities are not planned as part of the main terminal area, it makes such required services as baggage handling, interline transfers, and security screening measures difficult, or a duplication of effort and, at the very least, results in increased costs to both airport operators and commuter airlines. Thus, future airport construction planning must recognize the existence and

continued presence of the commuter and, in conjunction with commuter airline planners, include facilities in the main terminal areas that meet the commuters' needs.

(b) Airports with commuter airlines find problems exist in the financial picture due to reduced revenues from the lighter weight commuter aircraft. This is an insidious problem because raising landing fee rates to restore revenues to pre-deregulation levels limits commuters in their efforts to generate a profit, or even stay in business. This same financial problem raises itself in connection with counter, baggage, and other square foot rental rates for commuters. When the airport operator loses a major carrier, the rental revenue for that vacated space is often at a rate that the struggling or beginning commuter cannot afford. Another recurring financial aspect of relations between airport operators and commuters is the problem of financial reliability. Experience, mostly bitter, has shown great instability among commuters, particularly in payments for obligations. Consequently, almost all airport operators require fairly large deposits based on some particular formula, i.g.: first and last month's rent, two to six months' landing fees, etc. At Monterey, we require first and last month's rent plus an open deposit of $2,500 cash. This came about after a series of commuters failed and left owing various amounts.

What are the answers to future relations and planning to avoid such problems? First and foremost are complete understanding and coordination between the airport operator and the commuter prior to commencing operations. These understandings should be in writing and include:

(1) All certification and documents needed by the commuter airline to legally operate.

(2) A full and complete financial statement of the commuter airline.

(3) Operating plans, route structures, market determination and load factor requirements for a break-even operation initially, and a financial plan and ability to survive until load factors generate a profit.

(4) How interlining, baggage transfers, lost luggage, air freight, and other similar matters will be handled.

(5) A plan for required spaces in terminal, and associated baggage, security areas, ground handling equipment space, such plan to be matched to the rental rates for current square footage at the airport; and how such rates are adjusted for inflation, annual review, etc.

(6) A listing of aircraft equipment to be used, how and where it will be maintained, and arrangements for fueling support. Pilot qualifications, numbers, and training facilities required should also be included.

(7) A complete understanding of what the noise abatement situation at the particular airport is, including ground run up procedures, any limitations on departure or arrival procedures, or times of operation.

(8) Insurance and liability requirements pertaining to the particular airport must be included.

Preliminary arrangements similar to these will result in avoiding misunderstandings, and in many cases eliminating potential commuter tenants that would obviously not be able to successfully remain in business.

3. Perhaps the major benefit derived at most airports from commuter airlines is the immediate reduction in noise impact on the surrounding communities. Most of all of the late generation turboprop commuters, with the de Havilland Dash 7 being a prime example, operate at lower levels than FAR 36 requirements. This benefit is particularly true in the air phases of operations, and is one that planners, both for public agencies, and aircraft manufacturers can take advantage of in adapting the commuter to most communities. This does not mean that noise problems do not exist in connection with this type of aircraft. Even the Cessna 150 can become an "irritability" problem frequently. It does mean that, with proper planning and continuation of technical improvements in commuter aircraft, the commuter airline can provide service in areas that soon would be totally prohibitive to the turbo-jet aircraft.

Again, in airport planning, steps must be taken to include facilities for ground run up and maintenance quiet areas for turboprop aircraft. Even though quiet in the air and during take-off and landing phases, the commuter turboprop can be a serious noise generator during ground run ups. At Monterey, with a home based large commuter, this has been a major problem. In view of the size of the aircraft, it would seem relatively simple for commuter aircraft manufacturers to develop small portable sound-containing devices for their aircraft. These could be developed and made operational at a fraction of the cost of sound-proofed hangars or other similar buildings.

Conclusion:

In summation, let us look at the problems and benefits provided now and in the future by commuter aircraft:

Commuters have to overcome the problems of reliability and customer reluctance due to size.

Commuters need better facilities at present and proposed airports, they need to be fully integrated as part of the airline system, from baggage to security, to interlining, to scheduling.

Commuters need a way to develop and maintain financial stability, and be able to make an efficiently operated airline show a profit.

Commuters are here to stay and are a means of providing essential air transportation to communities that otherwise would not have it.

Commuters are quiet and offer airports a means to stay in business in spite of community opposition to noise.

All of this can be done by coordinated effort of all concerned agencies, public planners, airport operators, commuter airlines, and manufacturers.

A PLANNER'S PERSPECTIVE

Dan F. Nelson
Aeronautical Planning Engineer
Utah Department of Transportation

Commuter Airline Needs For Larger Aircraft

The commuter airline industry currently provides service to over 600 airports throughout the United States. The type of equipment used ranges from single engine, single pilot aircraft to large, jet aircraft capable of carrying 85 passengers.

Most commmuter airlines have had relatively humble beginnings, and even today the start-up of a commuter airline often begins with a few people's dreams and a leased or rented aircraft. Usually, the start-up operation utilizes aircraft designed for general aviation use, not for continuous day after day commercial operation. This is because general aviation aircraft are more readily available and much less expensive to purchase.

A few years ago, the best aircraft available for commuter operations in high altitude, low density markets included such aircraft as the Piper Chieftain, the 400-series Cessnas and various Beech models. Today, little has changed; however, those commuters who have been successful enough to obtain equipment loans or purchase larger aircraft have gone into such equipment as the Swearingen Metroliners, the de Havilland Dash 7's, or comparable equipment.

The new generation of aircraft is excellent, providing much better fuel and maintenance efficiency and designed for commercial rather than general aviation operations; however, a changing environment, fosted by deregulation has placed new demands on commuters for even larger equipment. The Civil Aeronautics Board has made essential air service determinations for points throughout the United States, usually designating one or more hubs for each essential air service point and specifying the number of required seats to each hub. Many markets have historically been served by regional carriers with 406 subsidies, but the Reagan Administration is presently attempting to eliminate the 406 subsidy program in September of this year. Even if the attempt is unsuccessful, the cost plus incentives presently paid to regional carriers as an incentive to stay in the market will be reduced to cost only reimbursements in January, 1983, and by 1985 all 406 subsidies will be eliminated. Many of the 406 markets will eventually be subsidized under the provisions of Section 419 of the Airline Deregulation Act of 1978. The 419 subsidies will be substantially less than 406 and will last only through October, 1988. In those markets where 419 subsidies are to be provided, the Civil Aeronautics Board has determined the level of replacement service to be provided. Often, the number of seats to be provided are comparable to what is currently provided by the regional service carrier.

Let's take a hypthetical case of a community currently receiving service by a regional carrier providing 100 seats per day each direction to each of two hubs. The regional carrier easily provides the 100 seats by providing 2 round trips per day to each hub with a Convair 580 aircraft. However, if replacement service were to be provided by a commuter flying 9-passenger Piper Chieftains, the commuter would have to make 9 flights each direction per day to each hub. Even the commuter flying 19-passenger Metroliners would have to fly 6 round trips per day to each hub. Where commuters must provide replacement service such as this, equipment with a capacity of 25 to 40 passengers would be more appropriate and the commuter could provide excellent frequency of service for the community. The problem is that this size aircraft, with the capability to serve many of the high altitude markets, has not yet been developed.

Three aircraft manufacturers have announced they will have aircraft available by 1984 that will accommodate 30 to 50 passengers. They include the 34-passenger Saab/Fairchild Commuter, the 30-passenger Embraer Brasilia, and the 32-passenger de Havilland DHC-8. Although it is anticipated the new equipment will be available by 1984, it is difficult to assess how these proposed new aircraft will actually perform, especially for the high altitude markets typically found in the non-coastal states west of the Rocky Mountains. Some of the markets will require the new equipment to fly stage lengths of over 200 miles while other markets involve only 50 mile legs. Often, special cargo requirements present problems such as provisions to carry skis or other non-standard equipment. Another requirement is the ability to perform at minimum enroute altitudes of over 14,000 feet MSL and operate on runways often located at elevations above 5,000 feet MSL.

Weather becomes a problem for non-pressurized aircraft operating in areas with minimum enroute altitudes above 10,000 feet MSL as the majority of severe icing conditions occur between 10,000 and 18,000 feet MSL forcing aircraft to climb above the 15,000 MSL altitude where passengers must be provided supplemental oxygen unless the aircraft is pressurized.

In the past, the majority of aircraft compatible for commuter use have been designated to operate at or near sea level. It is hoped the new generation of aircraft will be able to serve the other half of the market and provide the same level in comfort and safety the traveling public expects from trunk and regional carriers.

CLOSING SESSION

Williard Stockwell, Conference Co-Chairman and APA Transportation Planning Division Chairman

I think we've gone through a long conference, and I know that you're tired. I know that I am. I want to just make a couple of comments before we finish. Many of you didn't participate in last night's drafting sessions, and it wasn't as well organized as I intended it to be. Some things just didn't come off as I had planned. We could have achieved the work in a much shorter period of time, if I had anticipated some of the physical limitations of the room and support materials.

But it was a success, mainly because of the very superb talents of the people that were involved. You know, when you really get a bunch of professionals together and you confront them with a problem, they're usually resourceful enough to say, okay, we can do it this way, too, and that's what happened.

They found a way to adjust to the problems although it was somewhat frantic for the first quarter hour. But it got done, and I am very proud of the product, and I hope you are, too.

I'd like, before I give up the podium, to recognize Jay Christensen of NASA, who is, if you don't know it, the guts of the whole thing. He is the one that suggested the Conference and kept pushing it and putting it together. He stayed with it, and, I think, has agonized over it more than anyone.

I appreciate what Jay has done for this Conference, and I can assure you there wouldn't have been a Conference without him. He has also had excellent support from NASA, and as I've said to you before, I have never been more impressed with a group of professionals—engineers, scientists, and administrators, as I am with the NASA people. It's been a pleasure for someone like me, coming from local government, to have this experience. It's been exciting for me. The payoff was Tuesday at the Air Show.

Well, I don't think very many people in the country even realize that there is an aeronautical part to NASA. I'm sorry to say that, folks, but you don't get the publicity. It's the Columbia coming through the atmosphere, and the satellites photographing Saturn, that get the press.

But yet, Tuesday's Air show was terribly exciting. Those aircraft, the Tilt Rotor and the QSRA—they are really something. If somehow NASA had the budget to show those aircraft around the country, I think that NASA's budget for that kind of research and develpment would be easily increased.

Thanks also to the industry representatives for providing rides to our transportation planners on helicopters. We were very impressed. You can be sure I will be telling the transportation planners about it at our next national Conference in Dallas in May of 1982. I plan to present a paper on what we accomplished here. Perhaps, with some help from the helicopter industry, we can demonstrate the utility of helicopters at that Conference.

One of the most important people in last night's drafting session was a secretary that works for John Zuk of NASA/Ames. She has also assisted Jay Christensen through the last several months of Conference preparations—Mrs. Kathy Burdett.

She started typing last night at ten p.m. She didn't finish until three a.m. and hardly got up from the word processor—five straight hours, plus excellent support throughout the entire Conference, and we all owe her our thanks.

Also, I don't know whether Glen Gilbert is here or not, but the Helicopter Association International has supported and worked on this Conference from the very beginning. Jim Freund, who is with VITRO, and Bob Winick were a couple of the most productive people in helping to put together the final product last night, and I appreciate you guys very much.

I have one more comment having to do with the Conference photos. Please contact Mr. Jerry LeBeck of Trend Studios in Monterey if you'd like a photographic record of the Conference.

I want to say that the planners that were attracted to participate in this Conference are some of the best in the United States. Without bringing in the top guys, we couldn't have assisted and produced like we did. Certainly, I'm only as good as those that supported me, and I've had support from the very best. I had faith that I could get this job done because I knew that quality of the people involved. I'd like to give a hand to the guys that assisted me. Thank you.

Gerald Kayten
Deputy Director
Aeronautical Systems Division, NASA

I just wanted to say, one of the projects that NASA has been considering for a long time is called SETI. It's the Search for Extraterrestrial Intelligence, and it's a scheme for listening to the universe, on the conviction that there must be somebody out there, and sooner or later we'll hear about them.

I was thinking the other day that we're sort of in the same boat on a lot of this rotorcraft and commuter aircraft research. We keep working ourselves on it, with a lot of enthusiasm among the troops, but every now and then, you can't help but wonder, is anybody out there that really cares?

And I think this session, if it's done nothing else, has provided a tremendous amount of morale boost for us and our people, because it is pretty obvious that there are people out there, like yourselves, who really want and really need, and are probably going to use some day, the products of our labors, so, apart from thanking everybody for helping us get the smarts that we need, that are going to come out of this report, I just wanted to express our appreciation to all of the people that worked to make it happen, and particularly those that brought in the planners and the local government people that we never get to reach otherwise. I thank all of you.

Jay Christensen, Conference Co-Chairman
Special Assistant to the Chief
Aeronautical Systems Division
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Well, we'd just go on forever talking about how grateful we are for the many organizations that participated, but I personally had to express that.

The thing that really impressed me is the level of management that we had, at all levels, in those working sessions, and the way people stuck in there and got the discussions—got involved, so that was significant, in terms of their interest, and I'm sure significant in the outcome of what we have here now.

With reference to the APA, every planner I have met, really, has impressed me significantly. Bill really has got the best planners here, and we really do appreciate that outstanding job. It's just one of a kind. Maybe it won't happen again quite this well. I suspect that, with this kind of a quality meeting—I hope there is something that comes out of this that will be carried on, and we can take advantage of the momentum, and the interests and the relationships that we have established here.

Perhaps that's the most important, and these take place not in our conference sessions, but around the tables, and at the dinners. And I've seen some of those grow significantly since I've gotten into this, and I think that's a tremendous product that we have already gotten out of this Conference.

I'd like to just mention a little bit about Bill's contribution. Without Bill, this couldn't have happened, and I'm genuine—I'm not trying to mirror what he said. His organizational ability and his personal interest in this is the key reason that we're here, and have this opportunity to interchange at this kind of level.

He is a professional planner for the City of Wichita. That's where he gets paid, and that's how he makes his living. He is an elected official in the APA, and he doesn't get paid by them at all.

Every activity that he has been involved in here is on his own time. He is here on annual leave, basically on his own time, to support this Conference, and I just can't think that you can ask for more dedication than we have had from Mr. Bill Stockwell.

(Applause.)

And thank you very much, and I assume that we are adjourned.

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16. Abstract

The Monterey Conference brought together for the first time a representative group of planners and public officials from all levels of Government, and a select group of rotorcraft and commuter aircraft manufacturers, operators, and researchers to exchange viewpoints on planning for rotorcraft and commuter air transportation. After an intensive series of presentations and working group meetings, several major points were resolved which should be adopted in a plan to improve air transportation. These included: (1) Developing an aggressive, new national aviation policy to provide the means for bringing the benefits of advanced rotorcraft and commuter aviation technology to the citizens of the U.S. within a reasonable time; (2) Planning comprehensive urban transportation systems that will fully integrate rotorcraft and commuter aviation plans with land use and other transportation plans so that maximum advantage is taken of air-transport opportunities; and (3) Providing a continuing forum for planners and technologists to work toward the achievement of the Monterey Conference Resolutions.

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