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ANALYSIS OF FLIGHT EQUIPMENT PURCHASING PRACTICES OF REPRESENTATIVE AIR CARRIERS

Final Report

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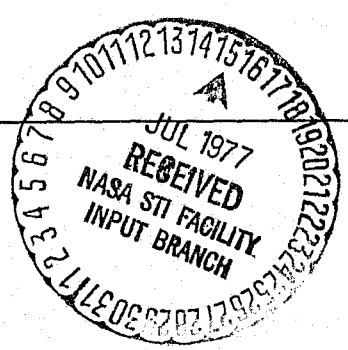

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1. INTRODUCTION

This study, "Analysis of Flight Equipment Purchasing Practices of Representative Air Carriers," was funded by the National Aeronautics and Space Administration (NASA), and conducted by Gellman Research Associates, Inc. (GRA).

The principal intent of this study was to ascertain the detailed process through which representative air carriers decide whether or not to purchase flight equipment. The secondary purpose of the study was to examine the practices and policies of air carriers in retiring surplus aircraft.

Part of NASA's charter is to advance the state of the art of aeronautical and space technology. It is in the public interest that commercial air carriers operate the most profitable and efficient aircraft. The objectives of NASA and the needs of the carriers should mesh at some point, since greater knowledge of the manner in which a product is evaluated by the carriers can alter the course of individual technological development by NASA and the manufacturers.

The handshake agreements between a Donald Douglas, Sr., and a Bill Patterson, a Bill Allen and a Juan Trippe, the Gross Brothers and an Eddie Rickenbacker are on their way out where major decisions are concerned. Where the introduction of new technology might well in the past depend upon the agreement of one or two men, there is a tendency to replace such practice with more formalized procedures.

Based upon previous experience, however, GRA knew that few, if any, of the carriers had proceeded to the point of using fully developed and documented, formal decisionmaking systems to reach flight equipment investment decisions.

Observations and Conclusions

The results of analyzing the flight equipment investment decision process in ten airlines have permitted the following observations and conclusions to be made:

(1) For the airline industry as a whole, the flight equipment investment decision is in a state of transition from a wholly informal process in earliest years to a much more organized and structured process in the future.

The transition will likely continue for some time to come and may not be completed for several more decades, if ever. In part, the transition to formalism grows out of the increased size of the market served by air carriers as a whole, the maturation of that market and the increased size of individual air carriers--all trends which should continue.

(2) Individual air carriers are in different stages with respect to the formality and sophistication associated with the flight equipment investment decision.

There remains a wide difference between carriers in this regard. For some (usually smaller) carriers,a handshake deal between the presidents of the carrier and aircraft manufacturer is still the decision process. For others, the process is more complex and is even beginning to become highly structured.

(3) The least formal decisionmaking "process" is found in air carriers characterized by relatively small size and by a dominant, highly entrepreneurial chief executive.

While there is every expectation that carriers of this type will ultimately become larger and undergo changes such that the flight equipment investment decision becomes more formalized, it is also likely that for many years to come there will be some airlines where any significant formalization of the flight equipment investment decision will be eschewed.

(4) The most highly structured and complex flight equipment investment decisionmaking processes are found in carriers characterized by substantial size and recent relative financial stability and well-being.

Most certificated or scheduled air carriers probably aspire to be characterized in this way and some will make it. Still there is no guarantee that the list of such airlines will remain constant either as to number or name.

(5) At present, most air carriers are in the position that their flight equipment decisionmaking calculus is severely constrained either because of their relatively small individual demand for aircraft or because of inadequate financial performance, or both.

It is likely that this situation will persist indefinitely especially if there is no significant "regulatory reform" introduced.

(6) From the carrier side, new-aircraft sponsorship will be forthcoming only from airlines which require a large number of identical aircraft and which are in a relatively strong financial position.

Joint sponsorship of a new type of aircraft is not precluded but both need to be "well-heeled." It is possible that the carrier capable of sponsorship may not include those with a complete range of aircraft

needed by airlines as a whole. Therefore, it is possible that there will be a developmental imbalance with respect to the aircraft that sponsoring airlines require and those the other carriers need.

(7) Financial condition is the single most important determinant of how an airline's flight equipment investment decision is structured.

The greater a carrier's financial strength, the more technological or aircraft type choices it will have because the decision for weaker carriers will very often hinge upon the financial terms offered by the aircraft producers rather than upon other aspects of the decision, including those related to technology. Therefore, it is reasonable to expect the sophistication brought by airlines to the flight equipment investment decision to vary directly with the carrier's present and anticipated economic strength.

(8) The inventory of aircraft on hand (or on order) is frequently an important determinant of a carrier's overall financial strength and liquidity; this is more often the case with smaller and/or less successful air carriers than with the large, highly profitable ones.

Certain types of aircraft (or aircraft production line positions) can readily be converted to cash at any time. Such aircraft (and some others, as well) often are used as trade-ins on new aircraft, which effectively enhances a carrier's financial picture and its ability to order new units. The role of used aircraft in the process of innovation in transport aviation has never been fully explored despite its obvious pivotal relationship to that process.

(9) It is highly unlikely there will be a prolonged period when there are no air carriers capable of playing a new aircraft sponsorship role.

Even during the recent period of stress for airlines, several carriers possessed the ability to arouse the interest of the manufacturers in new type aircraft if such carriers had seen the need for such developments to meet either new or enlarged market opportunities which could be addressed most profitably through exploration of new types of aircraft.

(10) As aircraft are depreciated over longer periods, as aircraft replacement cycles lengthen, and as environmental and energy considerations become more important, aircraft component retrofit programs increasingly compete with new aircraft purchases for airline capital resources.

Major retrofit programs require substantial resources and can be expected to limit investment in new aircraft to some extent. Still, significant new technology can be embodied in retrofits of many types.

(11) With the flight equipment investment decision becoming more formalized and sophisticated, the engineering evaluation process takes on increasing importance.

This is true even though the engineering evaluation may be decoupled from the actual aircraft acquisition decision--the decision which sets the timing of the addition of capacity for the airline. Engineering evaluation is especially important in carriers sponsoring aircraft development and often determines what innovative technology will be embodied in new aircraft.

(12) Air carriers generally feel that aircraft producers do not understand sufficiently the process underlying the flight equipment investment decision.

According to many airline executives, the more complex the decision process, the less accurately it is perceived. This results in serious misallocations of marketing resources by aircraft manufacturers and often delays the introduction of new and advanced aircraft technology.

2. METHODOLOGY

Introduction

It was believed that air carrier equipment decisions are primarily influenced by the certification category of the carrier.[1] The carriers were therefore grouped according to their CAB classification as found in the CAB Handbook of Airline Statistics, 1973 edition. Within each group, carriers were ranked according to significant equipment decisions which they made, as identified in a review of their recent history (1960 to date). A review of authoritative trade publications, airline reports and CAB form 41, Schedule B-43 was made to identify decisions involving:

- first sponsorship of new aircraft,
- initiation of a large quantity fleet purchase,
- the evaluation, purchase and operation of foreign aircraft,
- major alteration of an existing design,
- unique fleet composition,
- unique financial history which impacted or was impacted by fleet composition,
- accommodation of unusual route requirements.

Representative carriers from each group were then selected for detailed interview.

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[1] All-cargo, domestic trunk, international, local service, etc.

Carrier Selection

Figure 2.1 lists all the certificated U.S. carriers except helicopter operators.

Part I shows the air carriers the investigators felt should be included if at all possible.

These carriers were ranked in order of their importance to the overall study, as determined by GRA. The carrier's recognized standing within the industry was used as a basis for the ranking, coupled with historic flight equipment operations.

Part II lists all the remaining certificated carriers, in alphabetical order, for secondary consideration. Asterisks identify those airlines having equipment purchasing histories and/or requirements that would be considered first.

Interview Construction and Testing

To capture the decision process at individual airlines and to assure uniformity in questioning and answers, a standardized interview was devised (Appendix A).

The interview was structured to identify initially the carriers' corporate organizational structures. This would provide familiarity with departments, functions and titles that could be discussed during the course of the interview.

In interviews, carriers would be asked to outline a hypothetical or actual equipment acquisition exercise and rank each of several selected criteria as to their importance in the decision process. Carriers were encouraged to include any criteria not suggested by the interviewer.

Figure 2.1-Part I

Certificated Carrier Selection

Primary Candidate Air Carriers

Carrier	Category	Remarks
Pan American World Airways	International	Traditional first buyer. Only designated U.S. international carrier.
United Air Lines	Major Trunk	Largest fleet. Significant first buyer. Operator of foreign aircraft.
American Airlines	Major Trunk	Historic first buyer. Operator of foreign aircraft.
Trans World Airlines	Major Trunk	Historic first buyer. Substantial follow-on buyer.
Eastern Air Lines	Major Trunk	Significant first buyer. Substantial follow-on buyer.
Northwest Airlines	Trunk	Historic follow-on buyer with custom options. Noted for conservative fiscal policies, equipment purchasing practices and strong financial record.
Allegheny Airlines	Local Service	Largest local service operator. Substantial operator of previously owned aircraft and upgraded fleets by major modifications. Operator of foreign aircraft.
Braniff International	Trunk	Unique and varied route requirements. Pioneering strict fleet standardization.
Flying Tiger Line	Cargo	Traditionally modifies standard designs to achieve higher lift capacity than any other carrier and historic follow-on buyer with custom options. Buyer of previously owned and proven aircraft. He operated foreign aircraft.
Overseas National Airways	Supplemental	Buyer of previously owned or follow-on buyer of proven aircraft.
Hawaiian Airlines Aloha Airlines	Local Service	Competitive route structures. Historically purchased competing designs simultaneously.
Delta Air Lines	Trunk	Historic first buyer. Noted for conservative fiscal policies, equipment purchasing practices and strong financial record.
World Airways	Supplemental	Follow-on buyer. Traditional operator of aircraft from one manufacturer.
Trans International Airline	Supplemental	Traditional follow-on buyer of available proven aircraft designs or previously owned aircraft.
Saturn Airways	Supplemental	Follow-on buyer or buyer of previously owned aircraft.

Figure 2.1-Part II

Secondary Candidate Air Carriers

Carrier	Category	Remarks
Airlift International	Cargo	
Air New England	Other Carrier	
Alaska Airlines	Other Carrier	
Aspen Airways	Other Carrier	
Capitol International Airways*	Supplemental	Follow-on buyer or buyer of previously owned aircraft. Prepared significant in-house modifications.
Continental Air Lines*	Trunk	Market innovator. Traditional follow-on buyer with significant custom options.
Evergreen International	Supplemental	
Frontier Airlines	Local Service	
Hughes Airwest*	Local Service	Formed from three local carriers with diverse types of fleets.
Kodiak Western Alaska Airlines	Other Carrier	
McCulloch International Airlines	Supplemental	
National Airlines	Trunk	
North Central Airlines	Local Service	
Ozark Air Lines*	Local Service	Significant operator of foreign aircraft and varied types now operating more standardized fleet.
Piedmont Airlines*	Local Service	Follow-on buyer. Substantial user of foreign aircraft.
Reeve Aleutian Airways	Other Carrier	
Seaboard World Airlines*	Cargo	First and follow-on buyer. Operator of foreign aircraft.
Southern Air Transport	Supplemental	
Southern Airways	Local Service	
Texas International Airlines	Local Service	
Western Air Lines	Trunk	Significantly different route awards twice changed fleet type requirements.
Wien Air Alaska	Other Carrier	
Wright Air Lines	Other Carrier	

*Notes: The secondary candidate air carriers are listed in alphabetical order. Those carriers that would be first considered are identified by an asterisk.

After decision criteria were identified and ranked, carriers were asked to order sequentially the specific steps in the decision process. By linking these steps in order, the decision process would be identified and flow charts constructed of each carrier's equipment acquisition decision process.

One carrier was selected from the candidate list to allow testing of the interview technique. Full interview effort was not scheduled until the initial interview results were received by the team.

From the initial taped interview, a written transcript was prepared and evaluated. Follow-up sessions by telephone were made with the initial airline for additional data or data clarification.

Having thus assured the compilation of valid data from the interview technique, remaining carriers identified for in-person interviews were contacted and interviews scheduled.

Individual Air Carrier Interviews

The next step in the process was to identify the individuals at the corporate level, within the air carriers, whose management functions include: being the decisionmakers, providing major inputs to the decision process, analyzing inputs to the point immediately preceding the decision. In general, these include:

- fleet planning,
- marketing,
- engineering,
- finance,
- chief executive officer.

The investigators set up and conducted interviews with the appropriate management personnel of the major trunk carriers.

From the concluded interviews, purchasing decision processes were constructed for the individual carriers (Section 4).

Analysis

Individual carrier variations within the framework of the decision process were analyzed to establish the treatment of different components. The study team identified significant differences to determine if exceptions existed requiring "plug-in" modules to the general model. Though individual carrier nuances are not identifiable within the general process, important requirements of particular carriers are included as they impart unique treatment of particular elements.

Generalized Process

Having thoroughly explored the many elements of the air carriers' equipment acquisition decision process, the study team synthesized the various processes to develop an inclusive decision process flow outline. This synthesis resulted in one decision process flow applicable to all carriers, accommodating their various requirements.

The resultant process flow was reviewed with the air carriers as time permmited to allow for comment on its validity and applicability. Actual experience from recent air carrier exercises was elicited to test the structure and content of the decision elements.

3. THE AIRLINE EQUIPMENT ACQUISITION DECISION

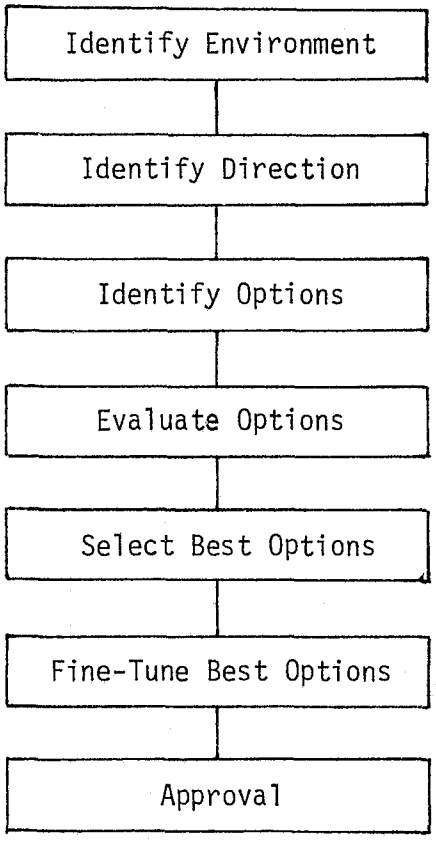
The purchase of new aircraft has been a historic airline competitive tool. It has allowed the airlines to benefit from more efficient aircraft and to capture a share of the constantly growing market. As each generation of aircraft has tended to offer increased productivity at significantly lower unit cost, and as demand has grown apace, these two influences have exerted a synergic effect on the development of new aircraft technology.

In this climate, then, the airlines have evolved from early "handshake" purchase decisions to a more business-oriented approach which accommodates the needs of the individual carriers. Figure 3.1 represents a conceptual version of the airline equipment acquisition decision process. (In this form, it is not unlike the conceptual decision process of any other industry making decisions of the same magnitude).

The airline equipment acquisition process (the fleet planning function of an airline) has two basic phases. The first is an ongoing process by which the carrier keeps itself abreast of developments in its environment. The first phase would encompass the first three blocks of Figure 3.1. The second phase is a more detailed assessment of particular courses of action and would include the remaining four blocks of Figure 3.1.

Figure 3.1

CONCEPTUAL DECISION PROCESS



Phase I

To identify their environment, an airline might perform the following tasks:

- Analyze the actions of competitive airlines to identify their aircraft purchases, changes in their marketing strategy, or new route or fare filings.
- Analyze econometric forecasts to develop market and economic projections.
- Maintain contact with the aircraft industry to keep abreast of the latest technological developments and possibilities.

The results of these actions will give the airline an indication of industry and market trends to use as a basis for determining their own corporate direction.

Decisions involving airline direction are generally determinations of corporate direction and are made at the level of the board of directors. They will reflect not only trends in the industry, but also the historic role of the individual airline. In most cases, the fleet planning function will not become directly involved in this decision but will instead be directed by corporate policy guidelines in setting or identifying future directions.

In the broadest context, this direction could include the decision, for example, to dispose of all existing aircraft and terminate service.[2] Other directions could include the decision

[2]One carrier interviewed indicated an option they were considering was the sale (at considerable gain) of their existing fleet and the investment of the realized funds in certificates of deposit.

to investigate non-transport related activities such as hotels, car rentals, equipment leasing, etc.; the decision to obtain new route authority, change existing market share, or any number of other directions that may or may not directly impact the fleet makeup.

Once overall direction has been determined, the airline will proceed to identify the various options that might enable them to attain their goals. Where these goals involve aircraft, such as the desire to increase or shrink routes, improve aircraft efficiency or productivity, or add or reduce capacity, there are three basic options that may be identified.

- acquire additional aircraft,
- modify current aircraft,
- dispose of surplus aircraft.

Within each option, there are many paths a carrier might take. For example, in deciding to acquire additional aircraft, a carrier might choose to:

- sponsor a new design,
- buy more of an existing aircraft type,
- buy more of an existing type, but not one in the carriers' current fleet,
- buy and modify an existing type of meet its own requirements,
- buy used aircraft.

Should a carrier desire to modify their existing aircraft, they might consider:

- engine or airframe changes to extend service life and increase efficiency, such as the change from pure jet to fan-jet engines;
- changes in seating configuration to increase or decrease capacity to respond to market conditions,
- improvements in passenger appeal items such as movies, television, piano-bars, etc.

Finally, a carrier must constantly monitor the performance of its existing aircraft to determine when to eliminate inefficient aircraft from the fleet.

Phase II

The move to begin evaluation of specific options is generally the step into Phase II. It implies that a carrier has identified an environmental factor (competition, new aircraft, new market, etc.) that requires response to allow the carrier to attain its corporate goals.

Detailed staff investigation will thoroughly evaluate the various aspects of each identified option. For example, while engineering conducts a step-by-step technical analysis of proposed new aircraft to verify manufacturer's performance claims, fleet planning might be reviewing operating cost data to develop cost comparisons of different seat configurations or other equipment options. Marketing may analyze passenger convenience items, such as seat pitch and size, or food service items to determine the cost/benefit of each variation. Finance would

evaluate the various terms and conditions such as capital availability and costs, realization from sale of used aircraft, leasing terms, investment tax credit, etc. to determine the most advantageous financing package.

The options selected by the various departments are synthesized into an integrated proposal to senior management that would include:

- aircraft model and specification,
- financial terms and conditions,
- number of aircraft to be purchased,
- delivery date.

Final price and contractural terms will then be negotiated by senior management. Approval of the board of directors will allow conclusion of the purchase contract.

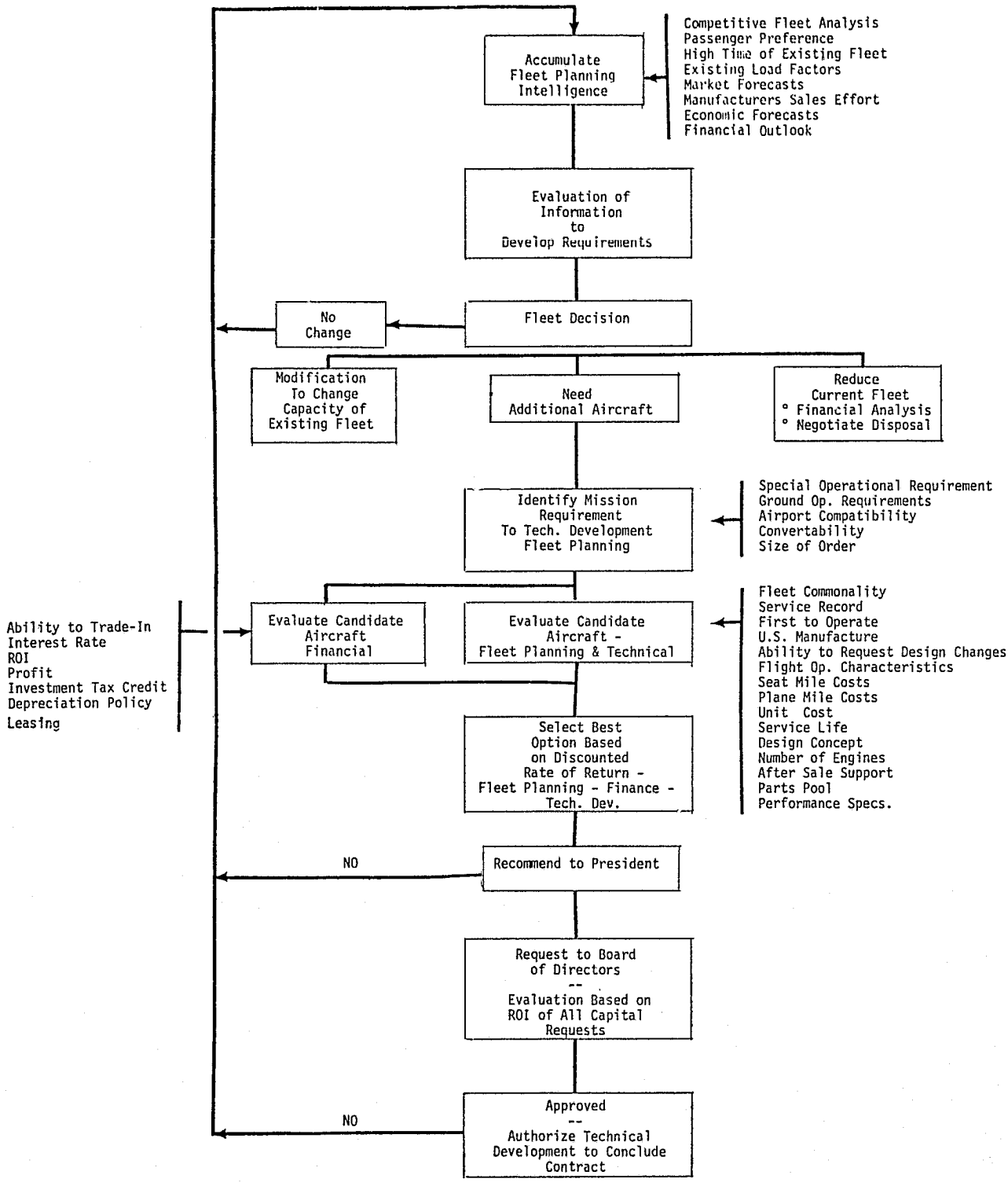
4. INDIVIDUAL AIRLINE EQUIPMENT DECISION PROCESSES

The individual decision process flow charts (Figures 4.1 through 4.10) were derived by the study team from in-depth interviews with planning and fleet planning personnel and reflect the perceptions of both the interviewer and the interviewed. The study team's task, however, was to identify individual purchase decision processes for eventual synthesis into a universal decision process without loss of sensitivity to an individual airline's unique requirements. Flow charts may vary markedly in their depiction of the decision process due to differing management philosophies, as well as to the different levels of experience and depth of the interviewee.

Carrier A

Figure 4.1 depicts the decision process of Carrier A. Carrier A, currently in the throes of financial difficulty, has historically been a sponsor of new aircraft. Today, due to marginal profitability and weak cash flow, its fleet contains a sizeable number of older, inefficient aircraft, needing replacement. Additionally, Carrier A has recently been forced to sell several new, efficient, wide-body aircraft to generate cash for survival, contrary to their fleet plan requirements.[3]

[3]The carrier had expected to invest the proceeds from the sale of these aircraft into new much needed medium range aircraft. Instead the carrier's lenders asserted prior claim to the funds and applied them against outstanding indebtedness.



DECISION PROCESS FLOW CHART

CARRIER A

Figure 4.1

In this atmosphere, though routine fleet planning activities such as competitive analysis, industry contact and manufacturing developments are being monitored, no routinized fleet planning cycle is possible. Instead, detailed planning cycles are commonly initiated by management's need to evaluate urgent, quick-reaction defensive means to avoid difficulties, perhaps by purchase or lease of new efficient aircraft, but more likely by sale, delay of delivery or grounding of aircraft in the fleet in a frantic attempt to stem losses.

Recently, a fleet plan has been developed, in an attempt to provide guidance for further fleet transactions. Requirements were developed, and fleet decisions made, based on these requirements. Three basic options were identified:

1) Modification program to enhance capacity of existing fleet.
2) Need for additional aircraft.
3) Improve current fleet by sale, grounding or lease-out of inefficient aircraft.

Once the current fleet has been "optimized" (options 1 and 3), consideration may be given to the purchase of new aircraft. In this event, fleet planning would assimilate the various company requirements and identify a mission requirement to the technical departments for selection of candidate aircraft. As the operating evaluation of candidate aircraft progressed under the aegis of fleet planning, a more critical financial evaluation would commence

within the financial department that then would pass on the financial viability of the aircraft.[4] Options would be rated based on the discounted cash flow return on investment (DCFROI) expected. No option could be recommended that produced a net cash outflow or failed to meet company ROI criteria.[5]

In general, sufficient internal coordination would exist that the president would not be asked to approve a fleet recommendation unless there was sufficient indication that his approval was likely.

Carrier B

Figure 4.2 represents the decision process of Carrier B, that would appear at first glance to be similar to Carrier A. While their present situation may be quite similar, in that Carrier B has also had several years of financial difficulty, their causal factors and probable future solutions are quite different.

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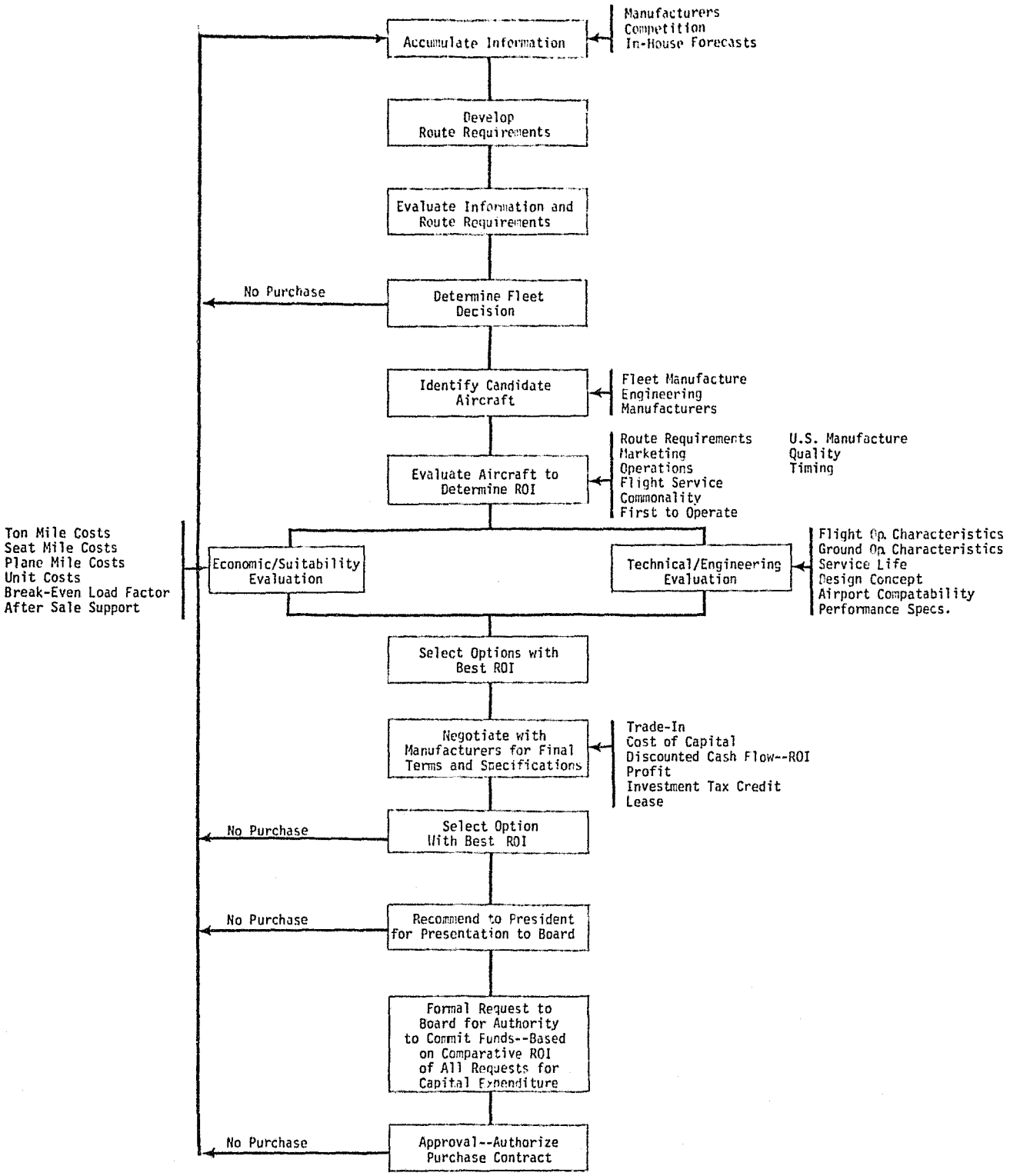
[4]The financial criteria of Carrier A are primarily intended to insure that any action taken by the carrier will result in an immediate return on investment, based on a discounted cash flow analysis.

(The discounted cash flow return on investment is the discount rate that equates the present value of the expected cash outflows with the present value of the expected inflows. Mathematically, it is represented by that rate, r, such that

$$\sum_{t=o}^{n} \left[\frac{A_t}{(1 + r)^t} \right] = 0$$

where A_t is the cash flow for period t, whether it be a net cash outflow or inflow, n is the last period in which a cash flow is expected, and the capital Greek sigma denotes the sum of discounted cash flows at the end of periods o through n.) From: James C. Van Horne: Financial Management and Policy, Prentice-Hall, Third Edition, 1974, p. 17.

[5]Though ROI criteria are not revealed, observation of the industry suggests that airlines attempt to maintain a before tax rate of return on investment of 15%.



DECISION PROCESS FLOW CHART

CARRIER B

Figure 4.2

Carrier B had placed large orders for wide-body equipment during the phenomenal growth period of the mid-sixties. When delivery began in '69, not only had traffic growth failed to maintain momentum, but initial wide-body aircraft were operating substantially below performance specification.[6] Escalating costs and levelling revenues caused substantial losses for several years.

Again, though routine fleet planning activities continued, no evaluation cycle could evolve as poor finances and existing over-capacity prohibited purchase of new aircraft.

As conditions stabilized, need for a new aircraft was identified for special long-thin markets, where the payload/range economics of existing aircraft were not suitable.[7] Candidate aircraft were identified and evaluated based on preliminary data to determine if ROI criteria could be met. Those aircraft meeting this test were then subject to detailed technical and economic evaluation to allow ranking of those options in terms of DCFROI potential. Attempts were then made to maximize financial return through final negotiation with manufacturers. At this critical stage, final selection between two nearly identical aircraft could easily be swung by one manufacturer's late offering of more favorable

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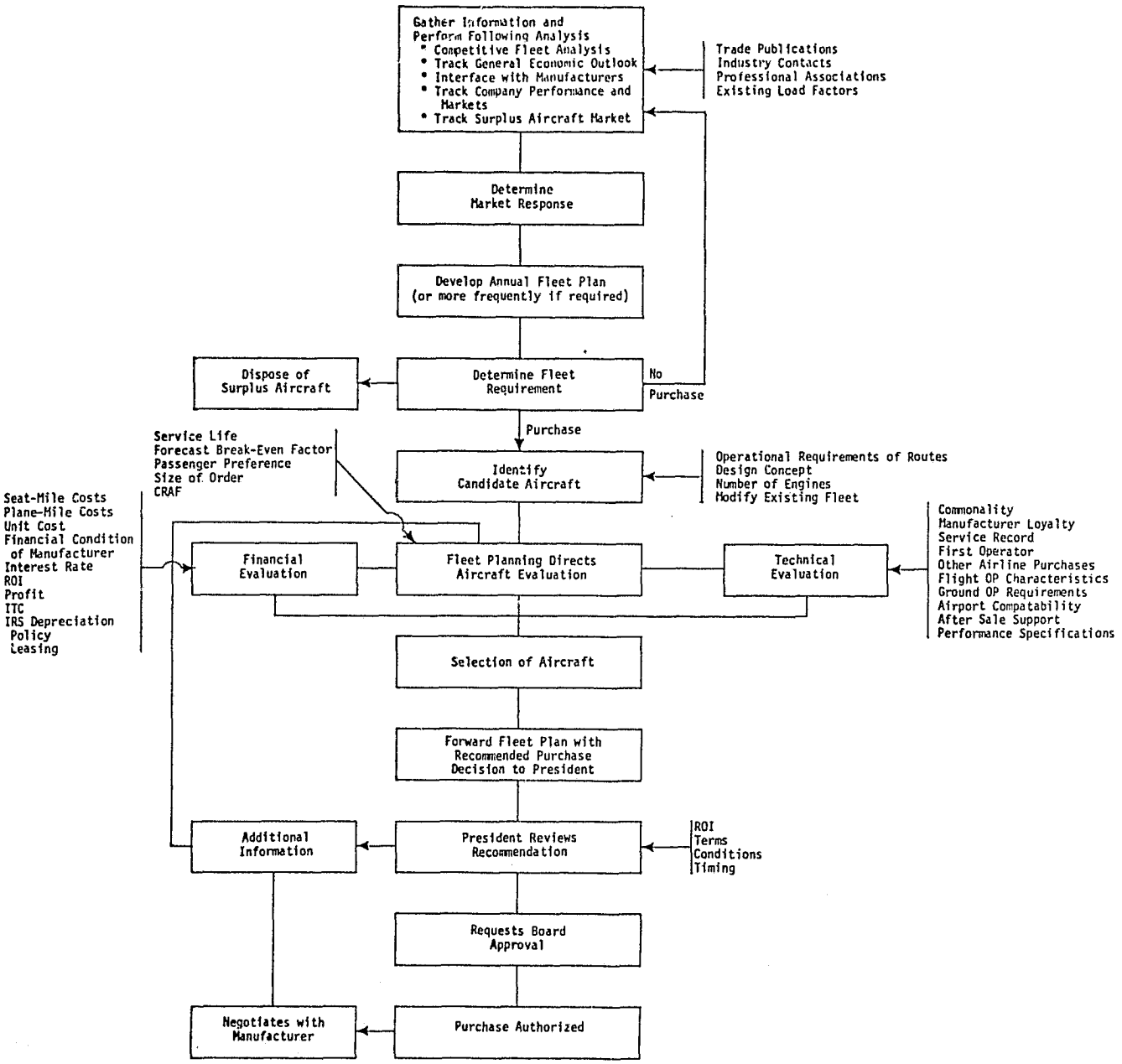
[6] For a discussion of problems with initial 747 performance, see The Great Gamble: The Boeing 747, Laurence S. Kuter, University of Alabama Press, 1973.

[7] NYC-TYO was the primary route requirement where a combination of great distance and thin traffic demand required a new longer range, lower payload aircraft.



DECISION PROCESS FLOW CHART

CARRIER C

Figure 4.3

financial terms.[8] It is possible that favorable financial terms could even tip a decision away from an aircraft design that was clearly technologically superior. In fact, another manufacturer entered transportation competition at just this point with a modification of an existing design that was priced so low as to exceed the DCFROI of the other designs, and win the competition.

Having selected the final version, fleet planning presentation would be made to the president for recommendation to the board of directors. As with Carrier A, presentation to the president would not be made without the president's tacit approval of the expected recommendations.

Board approval of the president's formal proposal would be based on the ROI of the proposed flight equipment versus the expected ROI of any other capital needs of the carrier, as the supply of capital funds would be limited.

Carrier C

Figure 4.3 represents the decision process for Carrier C. While traditionally a major sponsor of new aircraft designs, recent management difficulties, coupled with poor performance during the recent recession, have suggested that Carrier C may continue to lack adequate financial resources. Though current financial

[8]In the discounted cash flow return on investment analysis, outflows of cash early in the period require larger dollar inflows over time as the discount rate acts exponentially. Therefore, any reduction on early term outlay such as lower cost, less support equipment or other front end costs has a much more significant impact on rate of return than a similar increase in cash inflow at some point in future.

performance has improved markedly, long term financial problems still exist and may relegate this carrier into a minor role in support of future new designs due to their lack of buying power.

While recent changes in this carrier's fleet planning staff have caused a certain amount of unfamiliarity in procedures and company philosophy, routine fleet planning functions were continuing as in the other carriers. Though fleet planning cycles were interrupted during the crisis atmosphere of the latest slump, new efforts have resulted in an annual fleet planning cycle being developed which projects fleet composition through a five-year period. Acquisition, disposal and modification[9] of aircraft are being considered based on projections over the five-year period.

In the event additional aircraft are recommended, candidate types would be identified jointly by fleet planning and engineering. Financial and technical evaluations are then conducted and coordinated by fleet planning, resulting in selection of a desired aircraft type, the quantity needed and the delivery requirements. These are presented to the president for review in a formal fleet plan. Additional analysis may be requested prior to presidential endorsement. On his acceptance of the fleet plan, approval of the board of directors is requested to authorize concluding negotiations with manufacturers for final purchase.

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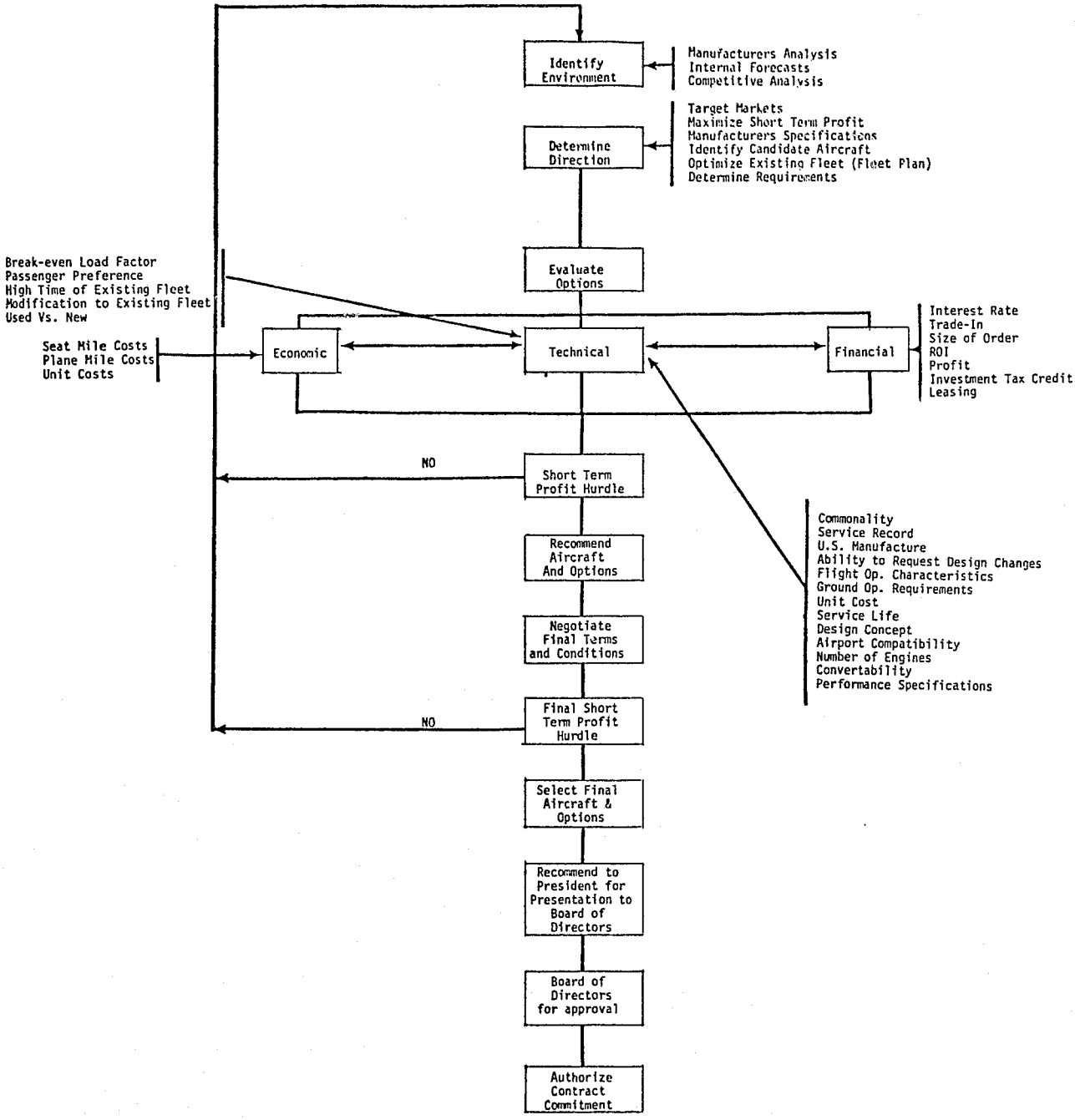
[9]Frequently, in response to competitive pressure, a carrier may refurbish the interior of its fleet or even change its seating configuration to add or delete seats. The conversion of a passenger aircraft to an all-cargo aircraft is another example of a modification option available.

Carrier D

Figure 4.4 depicts the decision process of Carrier D. During this period, Carrier D was generally considered to be in the worst financial condition of any airline in the industry. Serious overcapacity, due to large purchases of wide body equipment, and a flat market had taxed the carrier's ability to meet loan obligations. Many aircraft were sold in an attempt to relieve fixed obligations; in fact, some aircraft were sold that had never been put into service. As with other carriers in this group, the fleet planning routine that had existed prior to the difficult period had been lost in the urgent need to develop survival plans.

In this atmosphere, most fleet decisions pertained to determining fleet reduction options until financial conditions stabilized, after which a cautious look at new, more efficient aircraft could begin under obvious demands of very thorough analysis.

Planning began by identifying the operating environments--including review of the competition, manufacturing developments, as well as company generated forecasts. Desired direction was then charted consistent with the demands of revised company policy, market, operating and financial goals were also identified. Fleet requirements would then be determined involving purchase, sale, lease or modification of equipment. Technical, economic and financial evaluation of equipment options would result in recommendation of specific aircraft and options after assuring their



DECISION PROCESS FLOW CHART

CARRIER D

Figure 4.4

ability to exceed company short-term profit requirements. Barely surviving bankruptcy, Carrier D could not expect creditor approval[10] of any change in fleet composition that did not result in immediate improvement in financial condition. In fact, reference was made to a particular aircraft order that resulted from a manufacturer's financial proposal that would provide short-term profit relief while the competing manufacturer was unwilling to meet such favorable terms. Short-term advantage far outweighed long-term benefit in this case in the calculus of the airline.

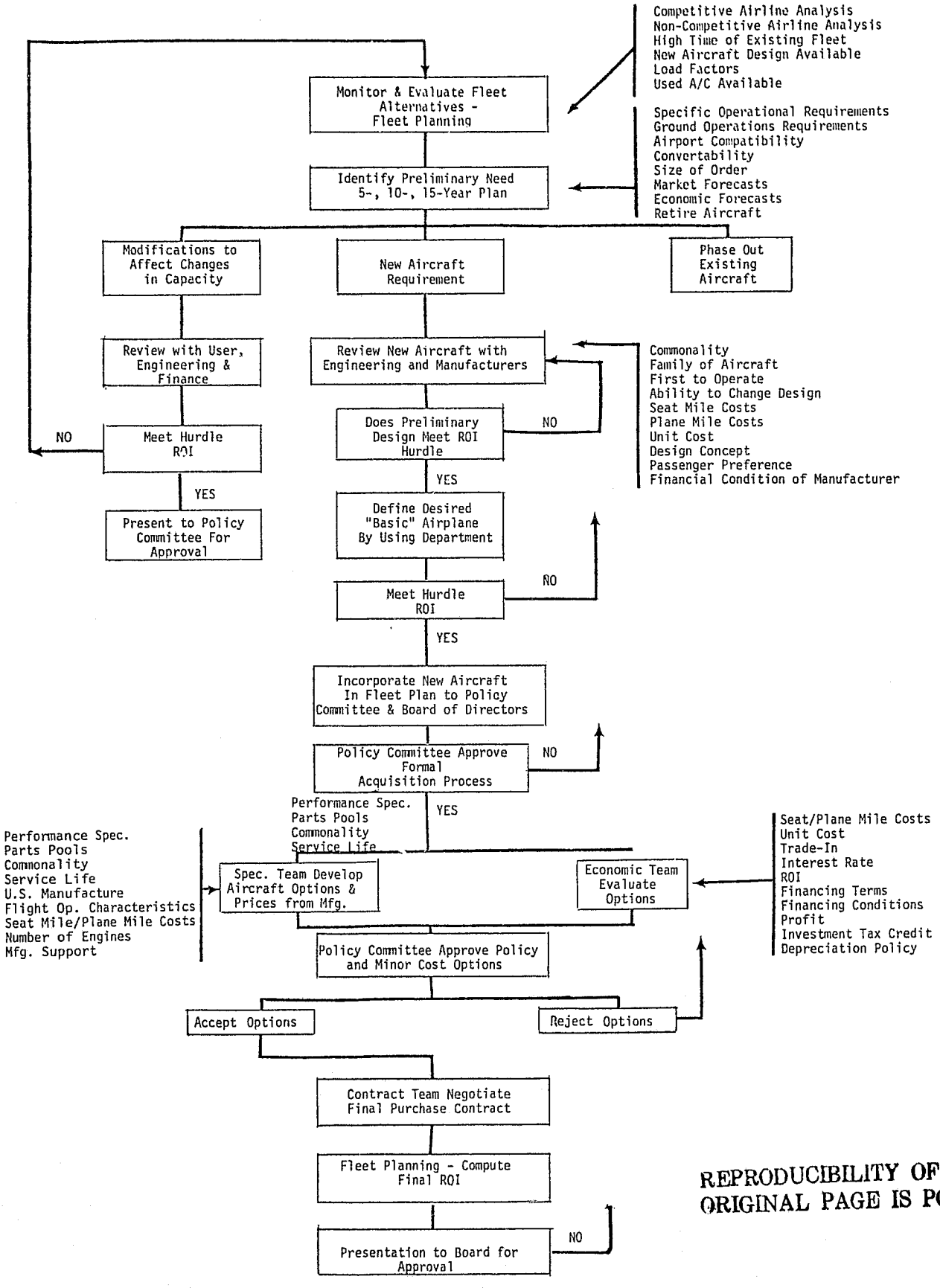
Final negotiation would attempt to extract maximum favorable financial terms from manufacturers. Final selection of aircraft and options would then be made from those options promising greatest profit.

Presidential endorsement and board approval follow as a matter of procedure. Though preliminary briefings would have been provided prior to formal presentation, final approval would result only after careful analysis of management recommendations.

Carrier E

Figure 4.5 depicts the decision process of Carrier E, one of two identified as having a history of consistent financial profitability. Operating one of the largest fleets in the industry, Carrier E has developed a rudimentary structured decision process.

[10] Institutions providing funds to the airlines generally set minimum financial ratios that must be met while their loans are outstanding. Typically, these involve asset and liquidity ratios. Further indebtedness requires specific creditor approval.



DECISION PROCESS FLOW CHART

CARRIER E

Figure 4.5

Because of its success, this carrier has long been involved in research programs dealing with new aircraft technologies sponsored by both government and industry. As a result, the routine intelligence-gathering functions at Carrier E are probably performed on a much broader level than at the other carriers, even placing them in the position of being considered "industry spokesmen" in many instances.

Actual fleet planning effort is divided into two main thrusts, one being the construction of an annual fleet plan for presentation to the board of directors to identify fleet requirements through the next five, ten and 15 years. Near-term recommendations will identify acquisition, sale or modification of specific aircraft types. Longer term requirements may identify specific aircraft types, but more generally deal with quantities and dates of preliminary or conceptual aircraft. As the requirement for these aircraft approaches in subsequent annual fleet plans, specific candidate aircraft will be identified for eventual acquisition analysis.

The second type of effort involves the implementation of the fleet plan through the actual evaluation of technology. All changes in fleet make-up are analyzed by fleet planning with support of the various departments involved. Individual new technologies are evaluated independently of specific aircraft application, such as configuration changes, passenger convenience and flight equipment options.[11] Pending new aircraft orders, these individual

[11] One recent evaluation involved the assessment of the counter-drum-pointer altimeter, and its possible retro-fit into the fleet. Other options could involve new engines, new electronic equipment or other components.

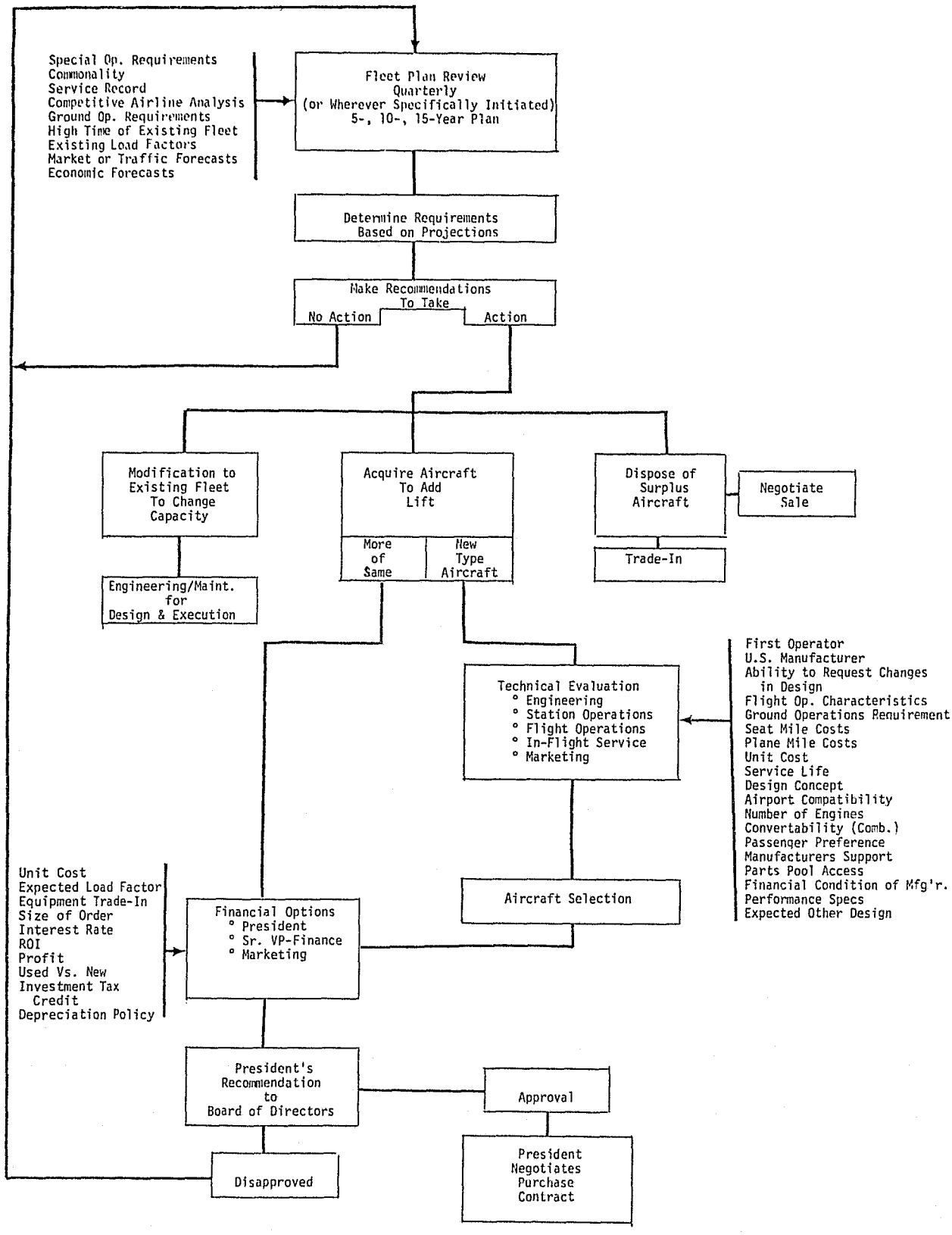
evaluations may result in application or retro-fit to the existing fleet if market or investment (ROI) conditions are favorable, or possibly to be included on new aircraft orders if retro-fit is not warranted.

Through this process, the airline maintains a concept of a current basic airplane to be refined as a purchase evaluation begins. Preliminary concepts that meet company ROI criteria are submitted to corporate policy review. Specification and economic evaluation teams are then established to perform detailed analysis of each candidate aircraft approved. Recommendations are developed for policy committee evaluation. If approved, a contract team is established to negotiate final purchase details, after board approval based on final ROI.

Carrier F

Figure 4.6 represents the decision process of Carrier F, a moderate-sized trunk that has also had a consistent record of profits.

As with Carrier E, Carrier F also develops an annual fleet plan identifying fleet projections for five-, ten- and 15-year terms. However, Carrier F has a series of aircraft purchase options falling due quarterly for several years. As a result, a quarterly fleet review is also performed to determine whether the options should be exercised.



DECISION PROCESS FLOW

CARRIER F

Figure 4.6

Since the fleet planning function of this carrier is an integral part of its long-range planning function, all future requirements are generated by the same staff of two.[12] Citing an informal organization structure, planning personnel routinely discuss recommendations with the president on an informal basis. No rigid evaluation criteria exist; instead, approval is based on experience, and a rigorous cost control procedure. This approach has allowed the carrier to avoid recent industry overcapacity problems by not developing fleet size greater than market demand, a common situation in equipment purchasing.

Financial stability allows Carrier F the orderly and timely revision of its airline fleet. A typical fleet plan might involve modification of existing fleet, retirement of inefficient aircraft or new aircraft purchases or the possibility of all three, depending on the investment variables determined by planning at the time.

If purchase is indicated, acquisition of additional aircraft of a type already in service avoids a technical evaluation which new designs would be subjected to, and instead requires only an extensive financial evaluation. In either case, the president would forward his recommendations to the board for approval. On receipt of board approval, he would conclude final purchase contract negotiation.

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[12]Most airlines interviewed indicated their fleet planning staff had recently been cut as an expense reduction measure. Existing staffs of other carriers varied from 3 to 5, from former levels of 4 to 10.

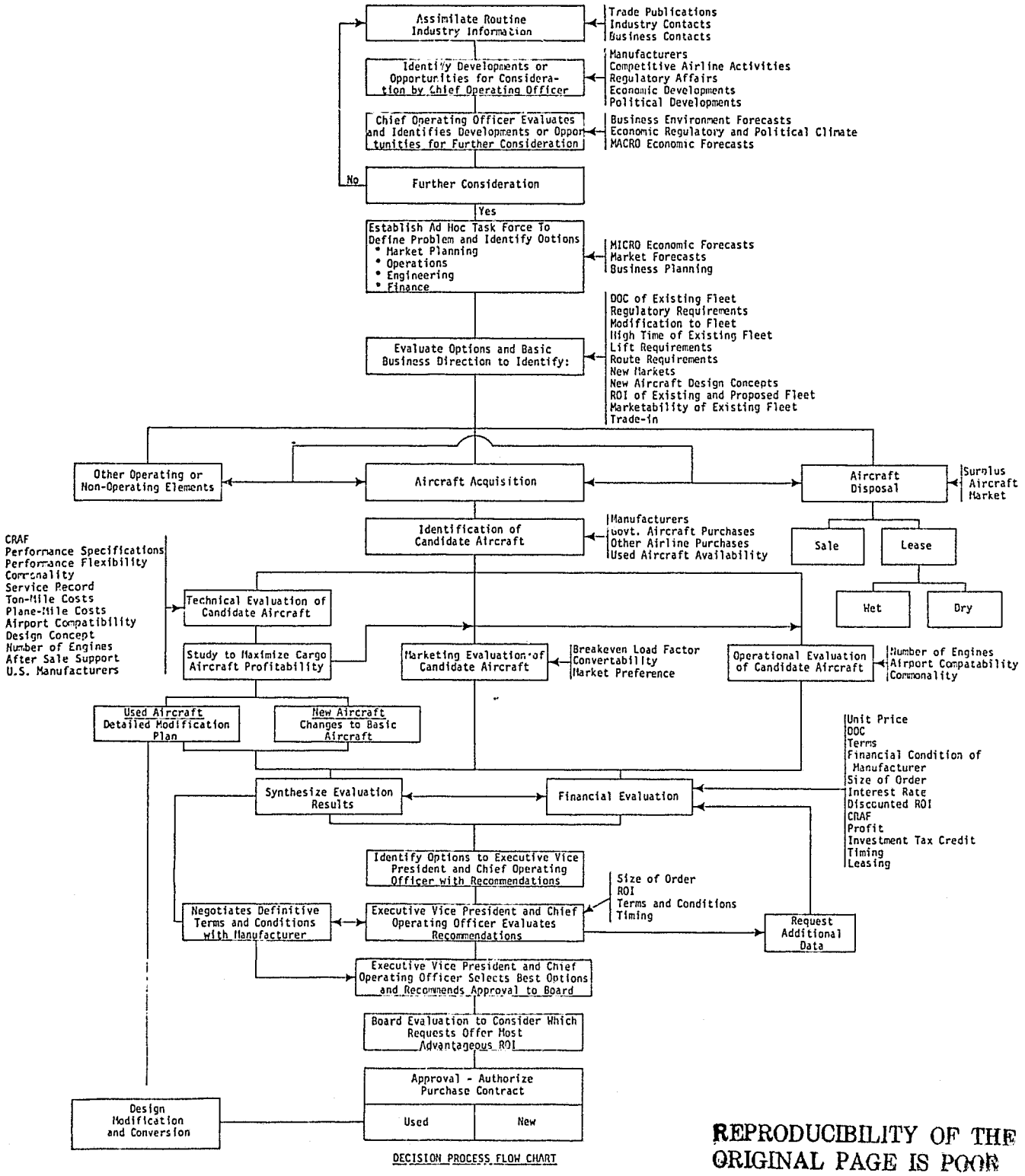
Carrier G

Figure 4.7 depicts the decision process at Carrier G, a scheduled all-cargo carrier with domestic and international routes. Carrier G is the largest and most profitable carrier in this group, though small in comparison to the trunk carriers. Perhaps due to its size, the management at Carrier G exhibits an entrepreneurial character, in which the chief executive officer may make decisions independent of or contrary to staff analysis.

Since there is no fleet planning staff, various departments may identify market, technical, or economic factors with fleet impact to the Chief Operating Officer (COO) for his evaluation. After informal evaluation, should the COO determine that sufficient need exists to conduct in-depth evaluation, he will establish an ad hoc task force with representatives of marketing, operations, engineering and finance to define the problem under consideration and identify options. The ad hoc group is not restricted to aircraft considerations at this point but may, in fact, identify other operating options.[13]

Should aircraft acquisition be suggested, candidate aircraft will be identified initially for technical evaluation. Because of the unique requirements of an all-cargo carrier, technology evaluation criteria are quite different than for a passenger carrier. Engineering studies of the feasibility of candidate

[13]An example had been cited where, due to the relatively high value of their existing aircraft on the used market and the high cost and unsuitability of new aircraft for cargo service, the carrier had considered the sale of their used equipment with the investment of the proceeds in Certificates of Deposit.



DECISION PROCESS FLOW CHART

CARRIER G

Figure 4.7

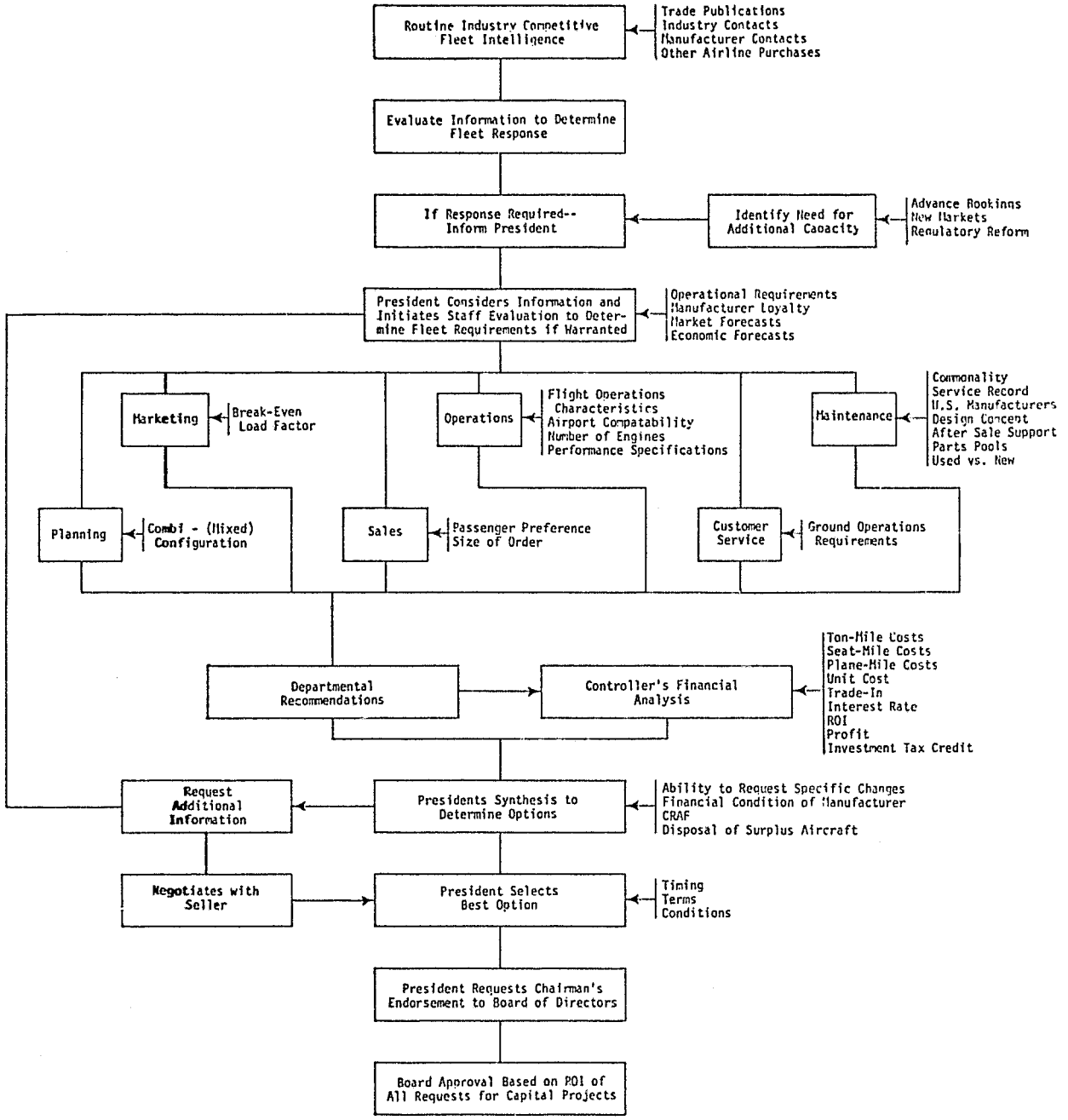
aircraft include such options as conversion of passenger designs, used aircraft, military aircraft and foreign aircraft in an attempt to maximize cargo aircraft profitability. Marketing and other operational departments provide support and data.

Financial evaluation of technical options results in recommendations to the COO of best ROI choices. Final negotiation with the vendor strives to obtain maximum favorable terms. The COO, with the president, presents recommendations to the board of directors for approval and final authorization for purchase.

Emphasizing the entrepreneurial character of the line, an example was cited of a previous fleet purchase where at a meeting the president had received formal staff recommendation for purchase of 12 aircraft and had, in turn, announced that he had placed an order for 17 aircraft. Another situation was related wherein the staff had recommended against the purchase of a particular aircraft. Yet at a staff evaluation meeting, the president suggested the staff should become more involved with the aircraft as he had just ordered ten. Following airline tradition, the president, in these cases, chose to follow his own investment judgment rather than staff recommendation, a common practice of carriers of this type.

Carrier H

Figure 4.8 represents the decision process at Carrier H, a supplemental carrier operating both passenger and cargo service.



DECISION PROCESS FLOW CHART

CARRIER H

Figure 4.8

Following very closely the practice of Carrier G, this carrier also has no dedicated fleet planning function. (Though there is a manager of fleet planning, his role is more closely related to future aircraft scheduling.) Any operating department perceiving fleet-related developments such as new aircraft, competitive industry actions or market developments, relates these to the president for his consideration. Informal staff investigation may be initiated and formal departmental evaluation will be authorized when deemed necessary. Departmental recommendations together with the controller's financial analysis will be submitted to the president for synthesis prior to his selection of best options. Board approval will be solicited based on the ROI of aircraft purchases versus other capital requests.

Carrier J

Figure 4.9 depicts the decision process at another large supplemental, Carrier J. Substantially the same as carriers G and H in concept, Carrier J did engage in periodic, though randomly timed, reviews of company fleet and market projections.

Candidate aircraft are identified and evaluated on substantially the same economic, service and technical basis, except that this carrier introduces a novel twist. Each manufacturer of a candidate aircraft is given the performance and cost data of competing aircraft and required to evaluate the entire group, a practice similar to that of at least one other supplemental carrier.

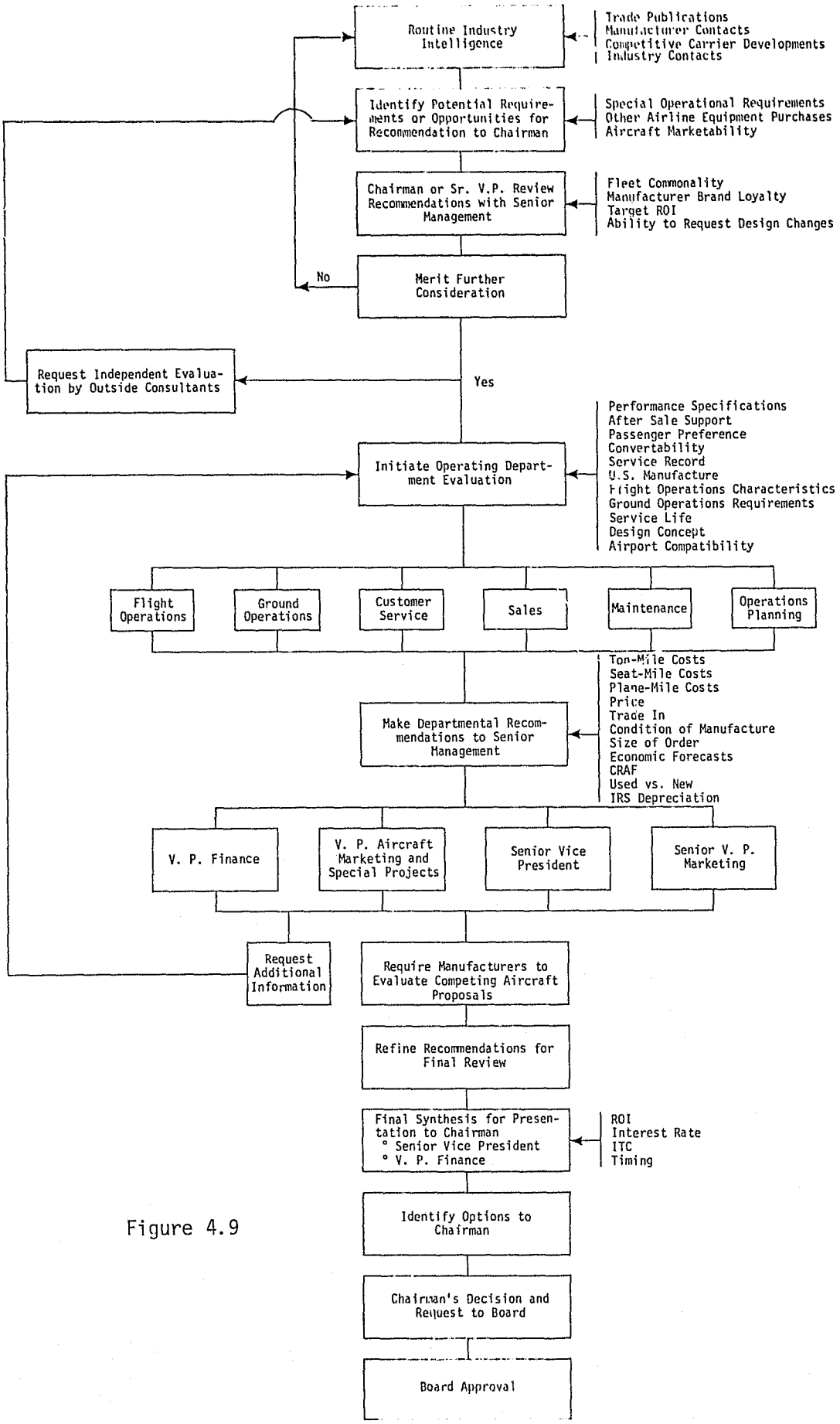


Figure 4.9

DECISION PROCESS FLOW CHART

CARRIER A

On receipt of staff recommendations, the chairman may become personally involved in negotiations or even further analysis. As resale considerations are an extremely important aspect of this carrier's aircraft acquisition policy, the chairman's personal decision may result more from his investment judgment than from staff analysis as the carrier makes more money from trading in aircraft than it makes operating as an airline.

Carrier K

Figure 4.10, the decision process of Carrier K, describes again substantially the same process as the other supplemental carriers. In this case, however, the chairman performs the fleet planning function and conducts most initial analysis himself. If he feels the need, full staff analysis will provide departmental input. Concurrent with staff evaluation, the manufacturers will be asked to evaluate each other's proposals as in J. In the chairman's words, "when we get all three manufacturers to agree with each other's lies, we probably have a pretty realistic view of the airplanes."

After consideration of staff recommendations, final selection again results from the chairman's judgment. An example was offered wherein a staff recommendation of one aircraft was ignored by the chairman in favor of another type.[14] A decision was taken reflecting the entrepreneurial nature of the firm and the chairman's perception of his role, not a staff analysis of the technology.

[14] In the example, the staff had recommended purchase of a large wide-body aircraft. The CEO disagreed, feeling that the large aircraft provided too much capacity and instead ordered a smaller wide-bodied aircraft.

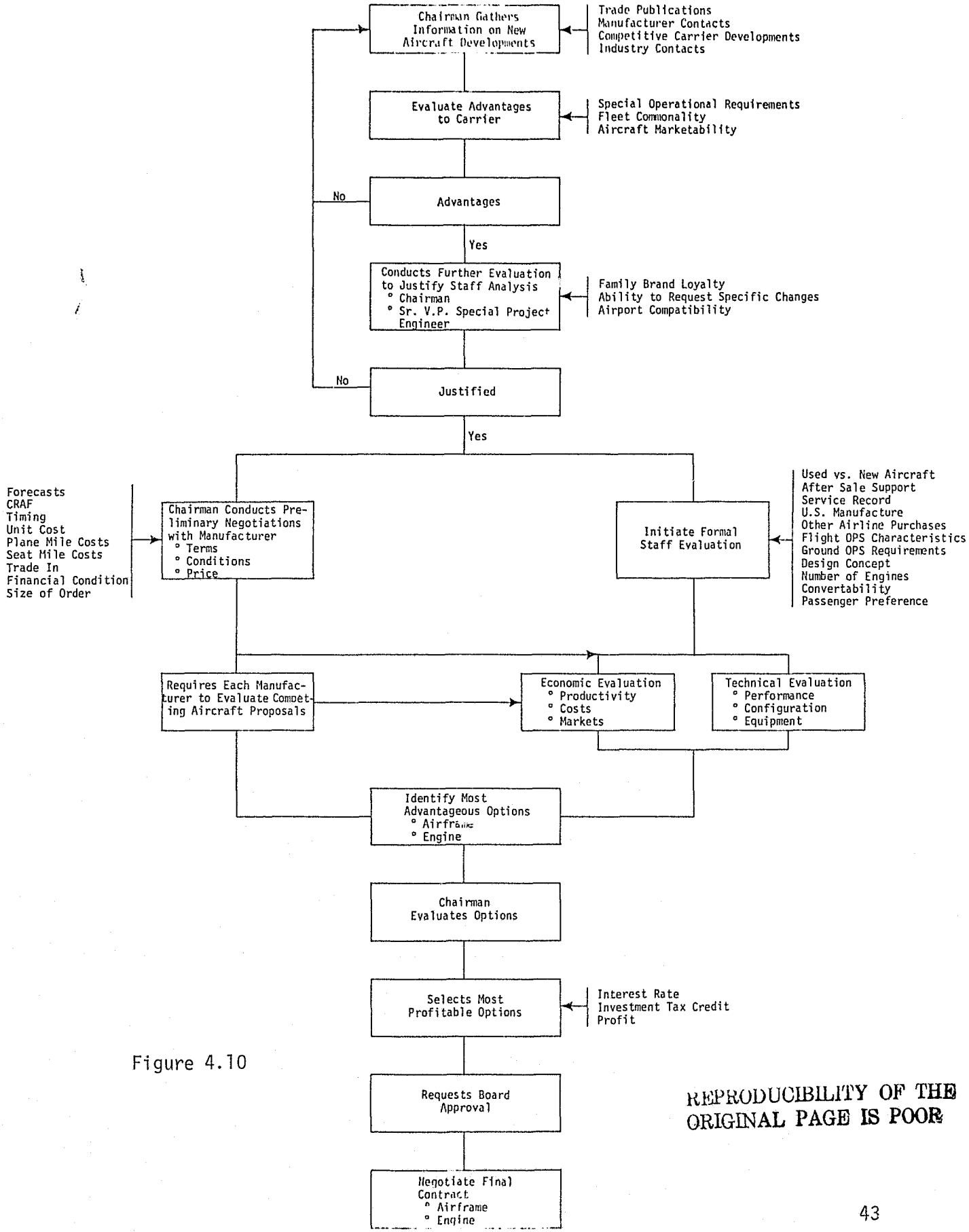


Figure 4.10

DECISION PROCESS FLOW CHART

CARRIER E

5. ANALYSIS

Initial objectives of this study in detail were to:

(1) analyze individual airline equipment purchase decision processes,

(2) determine whether a universal purchase decision process could be identified,

(3) describe generally a universal purchase decision process, if identifiable,

(4) identify and analyze potential historic incentives or barriers,

(5) analyze replacement of barriers with incentives.

During the course of this study, over 600 pages of transcribed notes were taken. In addition, a great many informal, unrecorded conversations were concluded, yielding relevant information.

As perceived through interviews and consequently reflected in decision process flow charts, the decision processes of the ten carriers interviewed can be grouped into three categories. The groups and carriers are described in Figure 5.1.

Group I

The two carriers within this group are a large and a small domestic trunk airline with the following characteristics:

- consistently profitable,
- identified fleet planning process,
- scheduled fleet planning review cycle,

Figure 5.1

AIR CARRIERS GROUPED BY DECISION PROCESS

Group I			
First Level Carriers	E		
Second Level Carriers	F		
Group II			
First Level Carriers	A	B	C
Second Level Carriers	D		
Group III			
First Level Carriers	G		
Second Level Carriers	H	J	
Third Level Carriers	K		

- ease in financing equipment purchases (though subject to money market conditions),
- expected to sponsor new aircraft,
- extensive engineering evaluation capability,
- ROI maximization determinant factor in equipment purchase.

(This classification is the goal of all trunk carriers. Indeed, most have been in this group through a significant period of their existence and see their absence as only temporary.)

Aside from the important ability to obtain financing, probably the most significant feature of the carriers in this group is their role in sponsoring new aircraft designs. The carriers that define final design specifications have, in effect, set the means of production of the entire segment of the industry to their requirements.[15] Other carriers will then be offered only variations of the original design, which may result in financial disadvantage to those carriers with differing requirements.

Decision Cycle

The fleet planning cycle for this group commences at periodic intervals and results in the construction of a formal fleet plan identifying five-, ten- and 15-year projections. Additional fleet plans will be constructed out of cycle, if required by specific need. Fleet optimization functions, such as configuration changes, flight or passenger equipment modifications, are also a responsibility of fleet planning and may initiate evaluation processes as well.

[15] For example, the new technology aircraft identified by Carrier E will be required to fly coast-to-coast with one stop carrying around 180 seats. On the other hand, Carrier A foresees a need for an aircraft to fly non-stop coast-to-coast with approximately 200 seats.

Process

As with Group II, routine developments of the airframe manufacturers, competing airlines and the companies' own fleet performance are monitored by fleet planning. Distinct from Group II, however, is the increased amount of time and resources allocated to working with the manufacturers and in-house engineers to develop new aircraft requirements, and receive and evaluate newly proposed aircraft design concepts if existing designs are deemed unsuitable. Partly due to the size of their fleet and also the depth of their analytical ability, these carriers have developed their own evaluation criteria, independent of suggested criteria of the manufacturers--which the carriers feel may not be sufficiently rigorous for their purposes. Thus, these carriers, unconstrained by financial considerations, are able to identify and consider a much wider spectrum of technological options to allow maximization of their return on investment.

Within this group, purchase decisions therefore tend to be:

- purchaser dominated,
- probably large quantity,
- favorable financing with little interference from financial institutions,
- long term consideration,
- technologically advantageous,
- not subject to other asset purchase needs.

Barriers or incentives to technology transfer:

- This group of carriers will be the prime sponsors of new technology aircraft.
- Rigorous analysis and large buying power will allow this group of carriers to determine what technologies will be delivered.
- Due to the size of the total market (both primary and secondary) of this group of carriers, technology development tends to concentrate on their needs, to the detriment of second or third level carriers needs.
- Due to operational costs, this group of carriers is reducing the variety of aircraft in their fleet, resulting in the likelihood of fewer competing aircraft being manufactured.
- In spite of close and frequent regular contact, airframe manufacturers do not appear to perceive the decision process of individual carriers.
- The airlines consider that the manufacturers do not understand the criteria with which the carrier has to evaluate the manufacturers' products. This is true of a complete aircraft and the disparity is much greater when it comes down to the evaluation of a component, sub-system or technology.

- The evaluation of an individual aircraft technology is only one step in the air carrier flight equipment acquisition decision process.
- Major carriers tend to develop their own evaluation criteria. In some cases, this is proprietary, either in total or in some significant aspect. They do not use industry or manufacturers' evaluation methods for equipment purchase considerations.

Group II

The carriers making up Group II include three major trunk carriers and one international carrier with the following general characteristics:

- recently- or currently-experienced financial losses,
- have experienced recent difficulty obtaining equipment financing,
- no structured fleet planning process,
- no scheduled fleet planning review,
- unlikely to sponsor near term new aircraft model,
- extensive engineering evaluation capability,
- ROI a determinent factor in equipment selection (except Carrier "D" whose severe financial plight demanded short-term profit to result from any proposed expenditure).

The carriers in this group all operate within the same environment as the other trunk airlines, but they are unique in that their major corporate decisions, recently, have all been made within the constraints of their poor financial condition. Though prudent management will always scale its options for major asset acquisition to its ability to arrange financing, these carriers have instead been forced to forego the normal airline replacement considerations during this period. Instead, only as financial conditions improved, or as new financing techniques have made capital available at acceptable rates, have these carriers been able to consider asset purchases. A fleet planning cycle has been based not on need, but on the likelihood of obtaining financing. One carrier described the development of "some rather creative leasing techniques," and another described its financial officer's attempts to locate funds before a fleet planning decision could be undertaken. Yet another described the need to keep existing creditors informed of the carrier's equipment needs to ease the way for requests for either additional borrowings or relaxation of financial ratios to allow additional borrowing.

In any event, no wholesale fleet re-equipment program can be planned by the carriers in this group until their financial plight reverses.

Perhaps predictably, none of these carriers anticipated being permanently in poor financial condition and therefore did not sense a lasting change to their decision process. Instead, current

financial constraints were viewed as temporary conditions to be accommodated as much as possible within existing procedure.

Decision Cycle

The fleet planning decision cycle for this group tends to be initiated randomly by specific stimuli, the most common of which are:

- financing availability,
- competitive actions,
- new model equipment being offered,
- need for added capacity.

Industry developments and company performance are monitored by fleet planning and engineering functions within the context of stated company policy. Initial sorting of possible stimuli is accomplished within the fleet planning area. Fleet planning staff may routinely evaluate and discard many options that fail to meet criteria for further consideration, without initiating the formal decision cycle. It is only when current decision criteria are met that a decision cycle will be initiated. Such criteria might include:

- significant changes in costs of equipment operation,
- significant changes in route or market forecasts,
- regulatory requirements such as noise or emission retro-fit programs.

Process

As specific situations are identified requiring company reaction, other related departments are involved to obtain a balanced evaluation.

Under the direction of fleet planning, a full operational and economic evaluation of candidate aircraft is accomplished applying proposed specifications to identified company route/market requirements. As technological suitability is determined, an analysis is also being performed to evaluate the financial impact of the various technological options. Options available to carriers within this group, however, are limited by the carriers' ability to arrange financing. Thus, equipment requirements, selection and evaluation are therefore constrained by financial limitations.

Resulting aircraft purchase decisions therefore tend to be characterized by:

- limited quantity (though need may be great),
- high cost of capital,
- possibly a debt moratorium, mandating leases,
- the financing offered rather than technological suitability,
- near-term profit orientation instead of long-term profit maximization,
- need to obtain approval of senior lending institutions,
- comparison with ROI for other capital projects,
- supplier domination because of limited buying power.

It is also possible that final delivery may be conditioned on the carrier's ability to fulfill last-minute financial requirements. Consequently, timing of actual delivery may not coincide with a carrier's needs based on traffic level and traffic growth.

Barriers or incentives to technology transfer:

- As carriers within this group will be limited to small sporadic purchases of equipment with relatively short lead time (due to uncertainty of obtaining financing), they will not be significant sponsors of new technology.
- Further, as financing terms and conditions are the determinant criteria for purchases of carriers in this group, technology will be subordinated to short-term financial concerns.
- Though significant engineering capability still exists in carriers of this group, cost reduction efforts have eliminated most support staff and have cut funding for long-term research and development projects.
- Purchase of new cost-reducing technologies would likely be justifiable by this group as financial institutions would approve cost efficiencies.
- Retention of older aircraft beyond economic efficiency by some carriers contributes to potential demand for highly efficient new technology aircraft.
- As a result of recent experience with overbuying aircraft capacity based on faulty economic projections, new equipment purchase decisions for this group are generally requiring more extensive economic justification.

Group III

The carriers in Group III include a scheduled all-cargo carrier and three supplemental carriers with the following characteristics:

- small fleet size,
- entreprenuerial management philosophy,
- generally require unique equipment characteristics,
- no dedicated fleet planning staff,
- no structured fleet planning processes,
- no scheduled fleet planning cycle,
- trading aircraft is major source of profit,
- marginal financial performance,
- varying financial resources.

Decision Cycle

As in Group II, the fleet planning decision cycle for this group tends to be initiated randomly at the identification of a specific need which may involve:

- competitive action,
- new equipment/financing offer,
- need for additional capacity,
- investment opportunity,
- new market development.

Process

As there is no fleet planning staff within these carriers, the fleet planning function is included in other areas of responsibility. It may be market planning, maintenance/engineering,

corporate planning or even within the chief executive's purview. Typically, within this group, any department sensing the need to review or reconsider fleet composition identifies this need directly to the chief executive officer for his evaluation and concurrence. The CEO may conduct an informal analysis as part of his evaluation, perhaps involving senior staff. No formal staff evaluation is initiated, however, without the concurrence of the CEO. As the need for formal evaluation is identified, it is likely that an ad hoc group will be formed to conduct the evaluation effort. This group will have representatives from the operating departments as well as finance, and perhaps the legal department, and certainly with the continuing involvement of the CEO, who may personally conduct negotiations with manufacturers.

In addition to the in-house evaluation of candidate aircraft, some carriers require the manufacturers to evaluate competing aircraft designs. Their recommendations are then synthesized, with the final selection of the best option left to the CEO.

Purchases within this group tend to be:

- small quantity,
- unique or foreign technology,
- investment (resale) oriented,
- opportunistic.

Barriers or incentives to technology transfer:

- Though small scale purchasers, the unique requirements and entrepreneurial character of this group of carriers encourages independent development of technologies.
- Because of small market, manufacturers tend to resist fulfilling these carriers' needs.

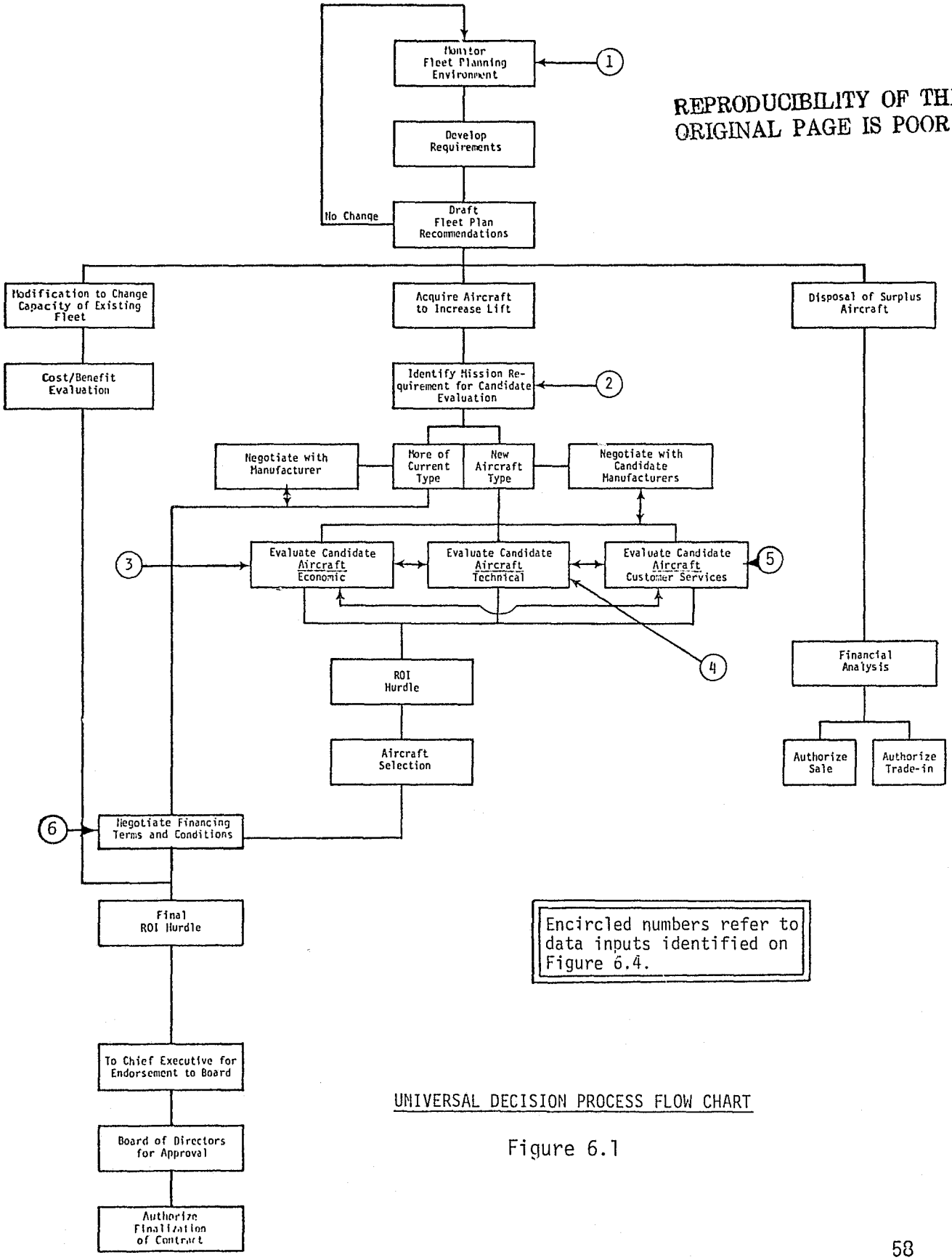
6. GENERALIZED DECISION PROCESS FLOW CHART

Analysis of the decision processes derived from the ten interviews reveals that although extreme differences may exist in carriers' resources, organizational structure and philosophy, the perceived decision processes exhibit similar conceptual process flows (see Figure 3.1, page 11).

Expanding this conceptual framework into a working flow chart requires detailed elements which vary depending on the carrier group involved. Particular elements may show wide swings between carriers and, indeed, pivotal criteria for one carrier may be unimportant to another, again reflecting the individual characters of the carriers.

Group I

Figure 6.1 describes the basic decision process flow chart which is applicable to the carriers in Group I. The acquisition decision is, for these carriers, primarily an exercise to justify expenditure of capital funds, based on adequate return on investment (ROI).



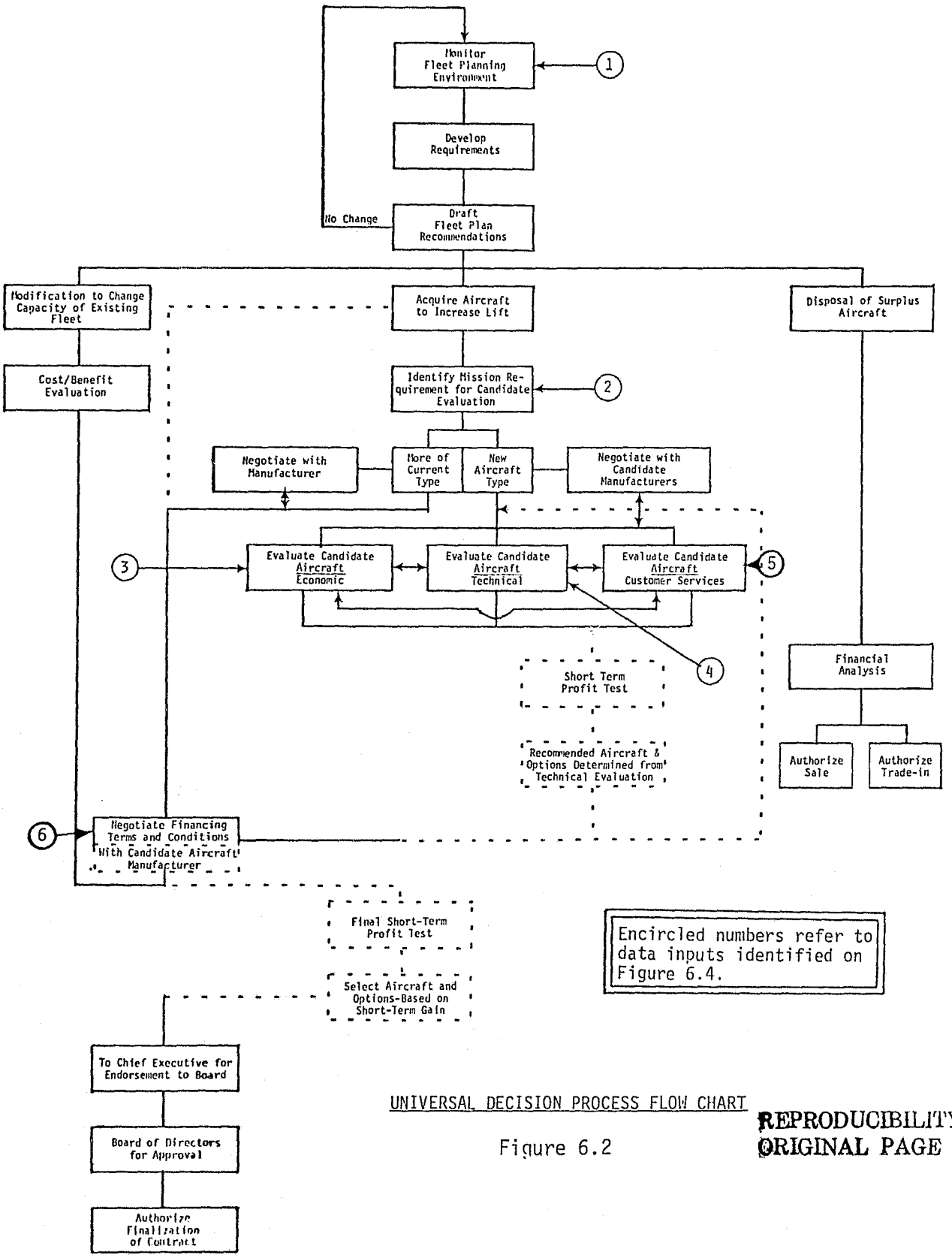
Encircled numbers refer to data inputs identified on Figure 6.4.

UNIVERSAL DECISION PROCESS FLOW CHART

Figure 6.1

Group II

Figure 6.2 incorporates modules necessary to accommodate the financial constraints of the carriers in Group II (dashed line). In this group, the acquisition decision is predominantly an exercise to acquire needed aircraft at minimum short-term cost and maximum short-term gain.



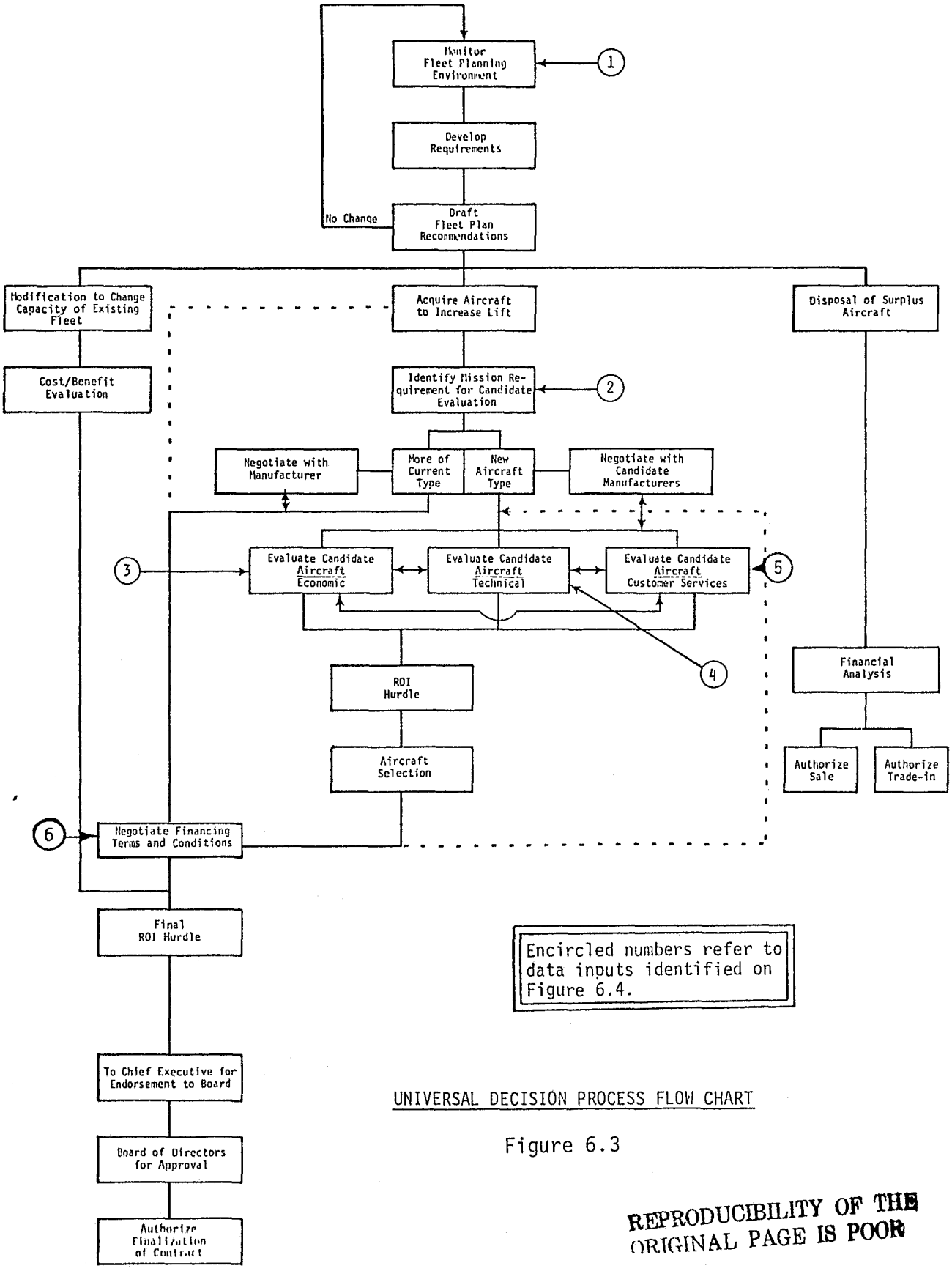
Encircled numbers refer to data inputs identified on Figure 6.4.

UNIVERSAL DECISION PROCESS FLOW CHART

Figure 6.2

Group III

Figure 6.3 indicates the loop (dashed line) by which the entrepreneurial carriers of Group III may exercise management judgment to override staff recommendations. The decision in this group is primarily one of investment for resale or lease, on either a short- or long-term basis, wet or dry.



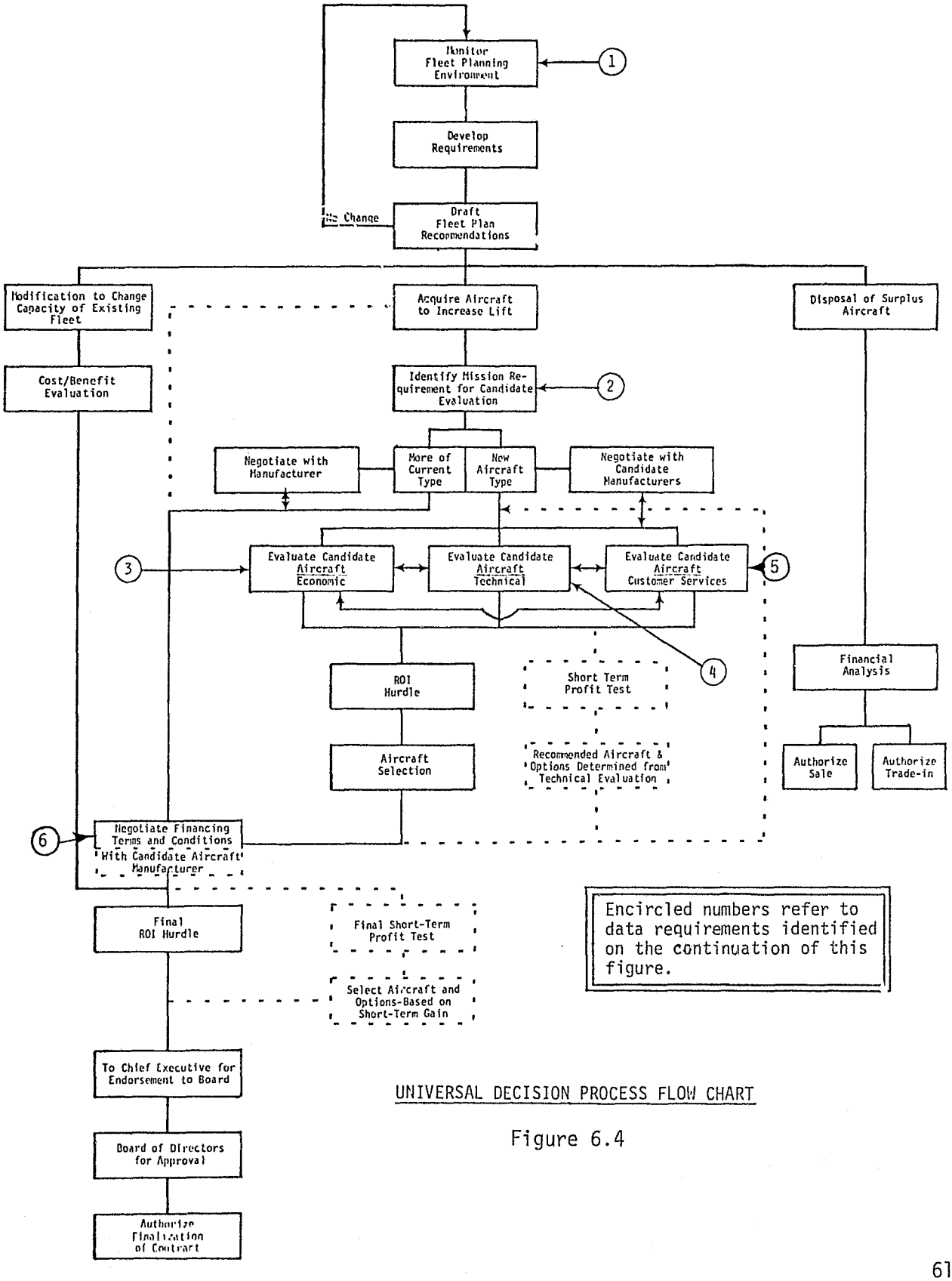
Encircled numbers refer to data inputs identified on Figure 6.4.

UNIVERSAL DECISION PROCESS FLOW CHART

Figure 6.3

Universal Decision

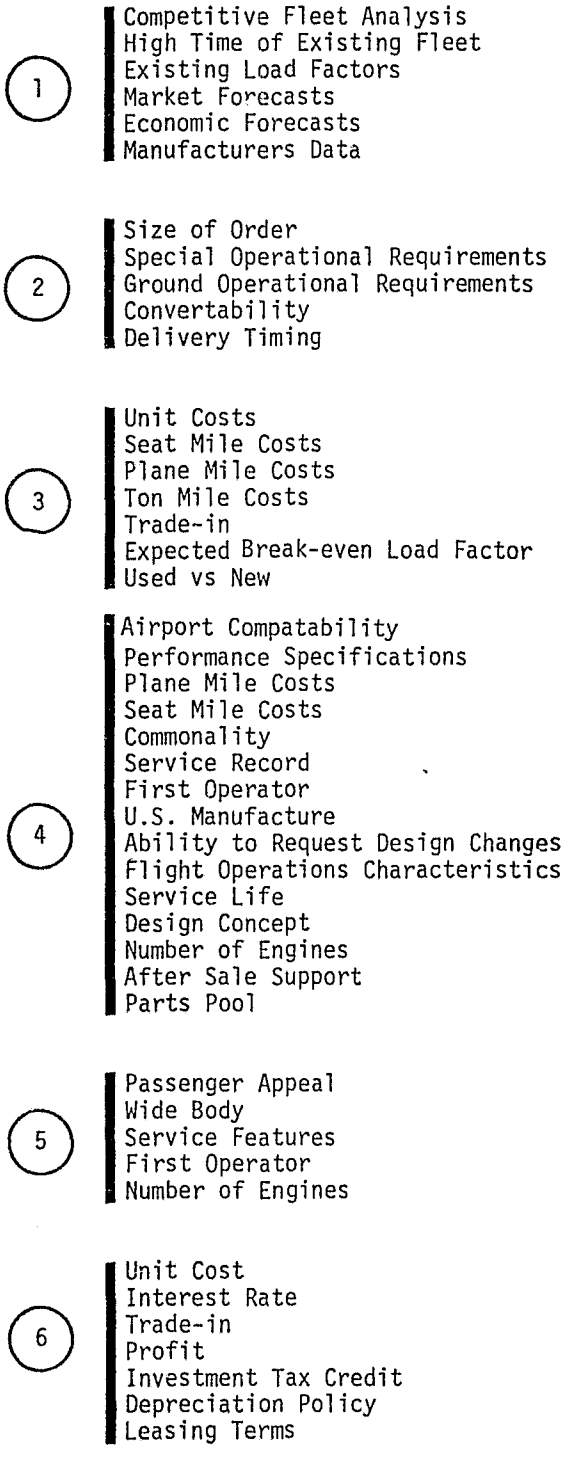
Figure 6.4 depicts the universal decision process with all modules included.



UNIVERSAL DECISION PROCESS FLOW CHART

Figure 6.4

Figure 6.4 (continued)



7. RECOMMENDATIONS

Results of the interviews, the subsequent analysis and the preceding conclusions suggest that there are several areas of involvement which would be of major benefit for NASA to pursue given the dynamics of the air transportation industry. Internal and external forces will exert changing influences on the decision process itself as well as on the interrelationships between such significant groups as the manufacturers, the financial institutions, the regulatory agencies and the air carriers themselves.

GRA therefore feels it important that NASA:

(A) Monitor the airline industry in terms of its general progression towards increasingly formalized flight equipment decision processes.

(B) Periodically determine how each individual air carrier goes about reaching its own flight equipment investment decision.

(C) Take appropriate steps to acquire greater knowledge and understanding of the way in which airline engineering evaluations are made in support of aircraft investment decisions.

(D) Develop a greater appreciation for the role that financial institutions play in the air carriers' flight equipment investment decisions, especially where financial considerations dominate the process.

(E) Ascertain the manner in which a carrier's stock of used aircraft enters the calculus of its new aircraft requirements and of the type of aircraft it will acquire.

(F) Systematically identify opportunities to employ NASA-generated technological possibilities through aircraft component retrofit programs which often compete for resources with new aircraft acquisition programs.

(G) Take steps to assist aircraft manufacturers to become more aware of the manner in which the various air carriers reach their flight equipment investment decisions.

(H) Involve various influential parties to the flight equipment evaluation process in NASA's various advisory groups in order to promote the efficient and timely transfer of NASA-generated technological possibilities to the airline community; given the nature of the carriers' decisionmaking processes, representation should be sought from the engineering department of potential transport aircraft sponsors from the financial community, from the ranks of the entrepreneurial chief executives of smaller carriers and from aircraft manufacturers.

APPENDIX A

DECISION MODEL

I. Structured Interview

Within your corporate structure, where is the final decision made to purchase aircraft --

- What criteria are used in making the decision?
- What departments input information?
- What departments input requirements?
- What alternatives are considered?
- Do any outside parties input?

Within your corporate structure, where is the decision made as to what aircraft to purchase.

- What criteria are used in making the decision?
- What departments input information?
- What departments input requirements?
- Who determines which aircraft to consider?
- Do any outside parties input?

Within your corporate structure, where does the requirement to consider acquisition of new aircraft originate?

- What criteria are used in making the decision?
- What departments input information? In what order?
- What departments input requirements? In what order?
- Do any outside parties input?
- Who determines the quantity to order?

II. What importance do you place on the following in determining what and when to buy?

Determinant - High - Medium - Low - No

- Special operational requirements of a specific route
- Overall operational requirements of all routes or groups of routes
- Fleet commonality
- Family or manufacturer brand loyalty
- Service record
- Being first to operate new type
- U. S. manufacture
- Other airline equipment purchases

- Ability to request specific changes in existing types (e.g., new engine, range, equipment)
- Flight operations characteristics
- Ground operations requirements
- Ton mile costs
- Seat mile costs
- Plane mile costs
- Unit cost
- Service life
- Design concept
- Airport compatibility

- Number of engines
- Expected break-even load factor
- Convertability or mixed (combi) use
- Ability to "trade in" for new equipment
- Passenger preference
- Manufacturer "after sale" support
- Access to Parts Pools
- Unfavorable publicity to a specific model
- Financial condition of manufacturer
- Performance specs of new aircraft
- Size of order
- High time of existing fleet
- Modifications to existing fleet to increase efficiency as an alternative
- Interest rate
- Discounted cash flow, ROI
- Expected near term competitive design available
- Existing load factors
- Market or traffic forecasts
- Economic forecasts
- Eligibility of CRAF participation
- Profit
- Used aircraft vs new aircraft
- Investment tax credit
- IRS depreciation policy
- Disposal of surplus aircraft

III. Group the following into the steps of the decision process.

1 = first, preliminary step. 2 = next level, etc.

- Evaluate cost of operation of existing aircraft
- Construct traffic forecasts
- Review economic forecasts - GNP, personal income, employment, etc.
- Determine existing load factors
- Target new market penetration
- Identify excess capacity
- Anticipate new route awards
- Consider schedule performance of existing fleet
- Consider operational weaknesses of existing types
- Consider fleet commonality
- Await sales approach from manufacturer
- Consider passenger appeal
- Evaluate other airline purchases
- Identify which types to consider
- Evaluate various types
- Consider alternatives to purchase (e.g., mods to existing fleet)
- Consider ground operation requirements
- Consider flight operation characteristics
- Evaluate discounted cash flow - ROI
- Evaluate ton mile costs
- Evaluate seat mile costs

- Evaluate plane mile costs
- Consider unit cost
- Evaluate maintenance cost
- Evaluate maintenance record
- Investigate financing options
- Consider disposal of old fleet
- Make determination to purchase
- Determine what model to purchase
- Determine when to purchase
- Determine quantity to purchase

IV. Within your flight equipment purchase decision processes -

- How do you evaluate innovative technologies proposed by the manufacturers?
- Are there any instances where your company recommends or insists on innovative technologies being included in a new aircraft or new purchases of an existing fleet aircraft?
- Does the type of technology influence your considerations?

  e.g. Examples of passive technological innovation might be the introduction of bonded structures, composite materials, etc. Example of technological innovation which would influence maintenance, spares, economics, etc. might be the introduction of quiet, fuel efficient engines, active controls, etc. Examples of technological innovations having direct impact on passengers (active or passive) might be wide body design, in-flight movies, tricycle landing gear, supersonic speeds, etc.

APPENDIX B

GLOSSARY OF IN-PUT TERMS

the ability to request design changes - The ability of an airline to request modifying changes in the design of an aircraft currently in production, to enable the aircraft to more closely meet an airline's particular requirements.

after sale support - Assistance offered by the manufacturer to the purchaser of aircraft after the aircraft has been put into airline service. It generally includes support outside of warranties, and implies sufficient financial depth of the manufacturers to develop follow-on aircraft as well as requested design changes.

airport compatability - The ability of an aircraft to operate from existing airports in regard to runway length, strength and width. For example, due to severe limiting conditions at LaGuardia and Washington National, airlines serving these points require that new aircraft be able to operate from these airports.

commonality - Aircraft manufactured from substantially similar components (as a family of aircraft). Because of the costs of crew training, spare parts and ground equipment of each unique aircraft, the airlines attempt to minimize the number of aircraft types in their fleet. The main sales attraction of the B-747 SP, for example, was that it was sufficiently similar to the standard 747 so that it did not require separate equipment or crew requalification.

convertibility - The feature of an aircraft allowing it to operate in either an all passenger configuration, an all cargo configuration or a combination of mixed passengers and cargo.

delivery timing - The scheduling of the arrival of new aircraft to allow them to be fed into the fleet as needed. Rapid introduction of a large number of new aircraft into the fleet can cause over capacity and start-up problems, involving crew qualification and servicing. For these reasons, airlines attempt to schedule the arrival of new aircraft on a gradual basis, as they feel demand will require.

depreciation policy - A determination of the time span over which a carrier depreciates the value of aircraft on its books. These periods can range from ten to eighteen years depending on the financial philosophy of the carrier. One carrier explained that their rapid (10 year) depreciation policy was prudent, as it allowed them to off set the rising aircraft operating costs. Since the depreciation expense would drop out after 10 years, the depreciation expense allocation can then be used to cover increased operating costs.

design concept - The overall design configuration of an aircraft. For example, high-wing, low-wing, engines mounted within the wing, engines slung from the wing, etc. would be different design concepts.

existing load factor - The actual load factor attained by the carrier's current fleet. The ratio of capacity used over capacity offered.

expected break-even load factor - The calculated load factor at which carrier anticipates a new aircraft will cover its operating costs.

first operator - The airline that first introduced a new aircraft into airline service. While historically, being the first operator was considered competitively advantageous, recent airline experiences with the introduction of the wide-body aircraft have made airlines less enthusiastic. The alternative is to let another airline "wring the bugs" out. First operators however usually benefit from lower prices as the manufacturers attempt to encourage early support.

flight operations characteristics - The flying characteristics of an aircraft, that would include such features as approach and landing speeds, trim characteristics, and the size of the crew required.

ground operational requirements - The ground support requirements of an aircraft including external power or air conditioning units, tow units, or other unique service equipment.

high time of existing fleet - The accumulation of excessive flight hours on a particular fleet of aircraft. As there is a tendency for aircraft performance to deteriorate over time, high time aircraft are considered to be less effecient.

leasing terms - The conditions (cost and term) under which an airline is able to acquire an aircraft by leasing. Leasing offers the airlines with poor financial performance a means of acquiring aircraft with minimum cash outflow.

manufacturer's data - The information supplied by the manufacturers that describes the proposed performance and cost characteristics of a new aircraft. As the manufacturers tend to develop their own presentations, comparisons between aircraft data of different manufacturers may not be possible. As a result, the airlines have developed their own evaluation procedures.

number of engines - Under current FAA regulations, aircraft with two engines are prohibited from operating over water, in passenger service, on routes that extend more than one hours's flying time from an approved airport. Therefore, airlines with over water routes would evaluate two engine aircraft with different criteria than airlines with predominately over land routes.

parts pool - An arrangement whereby airlines may combine to purchase and stock parts to aircraft they operate in common. Such a parts pool offers significant savings by sharing the cost of providing spares. Conversely, an airline that is the only operator of a particular aircraft must bare the entire burden of its parts supply.

passenger appeal - The attraction that an aircraft has in the mind of the passengers. For example, wide-body aircraft are considered to have strong passenger appeal.

performance specifications - The total operating requirement of an aircraft, including speeds, payload and range. In purchasing a new aircraft, airlines will develop desired performance specifications for guidance to the manufacturers. The manufacturers in turn will develop proposed performance specifications for their aircraft design.

plane mile costs - The total cost incurred in flying an aircraft, one mile. Its main significance is to charter operators who may ferry empty aircraft, to position them for revenue flights.

seat mile cost - The cost of flying one airplane seat, one mile. This is an important aircraft cost index for passenger airlines.

service features - Those equipment items on board an aircraft used in providing passenger services. An example would be galley service units, coat racks, cabin luggage bins, etc.

service life - The number of flight hours an aircraft is designed to provide. An aircrafts physical life as opposed to its economic or useful life.

service record - The accumulated experience of an aircraft in service. Important in the purchase of used aircraft.

size of order - The number of airplanes bought in each order. The larger the number, the greater the influence the carrier could exert in setting the aircraft design.

special operational requirements - Unique aircraft requirements dictated by an airline's route characteristics. For example, the airlines serving the west coast of South America operate into airports over ten thousand feet above sea level. Their aircraft operating requirements are markedly different from airlines operating at sea level airports.

ton mile costs - The cost of flying one ton of payload one mile. An important cost measure for cargo carriers.

unit costs - The purchase price of an aircraft.

wide-body - The aircraft design concept that is characterized by two or more aisles in passenger cabin. Their advantage is in offering low seat mile costs by carrying more seats per aircraft.