(NASA-TM-84148) NASA/FAA ADVANCED ROTORCRAFT TECHNOLOGY AND TILT ROTOR WORKSHOPS. VOLUME 2: OPERATORS' VIEWS (National Aeronautics and Space Administration) 111 p HC A06/MF A01

N82-19171

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G3/02 11823

VOLUME II

Operators' Views

PREFACE

On the first day of the Advanced Rotorcraft Technology Workshop (December 3), a special panel of helicopter users gave presentations in 12 basic areas of helicopter applications. These presentations are contained in this volume of the Workshop Final Report.

In addition, this volume contains a summary outline of a Public Service Helicopter User's Workshop which was held on July 14-16, 1980, under the sponsorship of the NASA Ames Research Center.

June 1981

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OFFSHORE - GULF OF MEXICO

Robert L. Suggs
President
Petroleum Helicopters, Inc.

Biographical Resume

Born October 12, 1911. Graduated Texas A & M University in 1932 with B.S. degree in Electrical Engineering; M.S. degree in Electrical Engineering from California Institute of Technology in 1933. From 1936 through 1940 employed by Humble Oil & Refining, first as a geophysicist and then as geophysical supervisor in the Far East. Served with the U.S. Army Air Corps during World War II in the Eastern Air Command - attained the rank of Colonel. Was one of the organizers and is President of Petroleum Helicopters, Inc., the largest and most experienced commercial helicopter operator in the world. Received the Kossler Award in 1957 from the American Helicopter Society and in 1971 received the Second Annual L.D. Bell Memorial Award during the Helicopter Association of America Convention.

Abstract

A short dissertation is given on the needs for short term development of the helicopter and the needs for future growth. Power plants and means of propulsion are examined. Advance rotor systems are compared.

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Petroleum Helicopters, the original operator in the Gulf of Mexico, is rapidly approaching the 4 million hour mark for helicopter operations. With 380 helicopters, 850 pilots and more than 800 licensed A & P mechanics, we are far and away the largest helicopter operator on the coast. While we must yield to Carl Brady on the point of who was first in the business, our precedences date back to early 1949 or nearly thirty-two years of helicopter experience. We have not been laggard in pushing for development. We have introduced to daily use many of each manufacturer's first models. We are constantly after them and hope this conference will be useful in projecting new ideas for the future.

Probably our greatest requirement revolves around our power plant needs. We need reliable, fuel efficient engines with TBOs far in excess of current procedures. All aircraft should be powered with at least two engines, with simple, and problem-free fuel controls. While available power is not now critical, more powerful engines should be designed into available types of helicopters so that less and less compromises by design engineers need be made against available power.

The servicing facilities for spares and engine replacements should be modernized so that the archaic distributor systems of some manufacturers can be replaced. Time delays and high costs of engine replacement parts could thereby be avoided or eliminated.

Original equipment manufacturers should be made responsible for the entire aircraft that they produce and not be allowed to avoid the responsibility of the power plants and other accessories installed in their machines.

All rotor systems should be of fiber glass construction and preferably with three or more blades per machine ... the better to insure a quieter and smoother customer ride. Thought should be given to "inflight" retraction or unloading and conversion to tilt rotor use.

With the advent of twin engined equipment with single engine performance, progress towards the elimination of emergency flotation gear should be made. With twin engine performance and single engine reliability, the need for emergency flotation gear will be eliminated.

Every effort should be made to make all aircraft IFR capable. This is very important not only for bad weather capabilities, but for clear traffic control. With longer ranges and greater speeds, this IFR capability becomes a necessity.

More and more flights will be conducted during night time hours as our services become more conventional. This in itself will require a greater need for an IFR capability.

Speed is always an attribute that is desired and accepted. However achieved, speeds in excess of 200 knots would make a remarkable change in our operating procedures. We have seen growth in our available speeds from 80 knots to 150 knots with accompanying service capabilities. Speeds in excess of 200 knots would greatly expand our working horizons.

Now for the future. We need a helicopter that has no transmission. A machine with no tail rotor. A power plant with almost infinite power capability and very small fuel specifics. Thrust should be developed at the blade tips either by bleed air along the trailing blade tips or by tip thrust engines. The hot cycle concept should be developed.

Single pylon tilt rotors and rotor blade retraction should be provided. Stowed rotor blade designs should be exploited.

Detachable compartments for flying crane utilization would be useful.

Quick starting and stopping cycles for power plants would be both acceptable and useful from a fuel efficiency standpoint.

While all these accomplishments would acceptable, they will probably take a long time.

OFFSHORE - NORTH SEA

Michael J. Evans
Director Flight Operations
British Airways Helicopters Limited

Biographical Resume

Royal Air Force 1959 - 1964 Fixed Wing and Rotary Wing Pilot Training. Joined British Airways Helicopters as a pilot in 1965 flying between Penzance and Isles of Scilly for one year. In 1966 commenced flying offshore operations in the North Sea. Held various management appointments - present responsibilities include Flight Crew Management, Flight Technical Services and Training. Member of the Royal Aeronautical Society.

Abstract

The paper sets out to summarize what is happening in the United Kingdom regarding helicopter operations - with particular reference to the offshore operations in the North Sea and the achievements. A brief reference to Aerodynamics and Structures is followed by considering the all weather aspects of helicopter operations. The Propulsion section highlights the engine performance problems being experienced as well as mentioning the integrity aspects of the transmission systems. Reference is made to the speed aspect of rotorcraft and also the potential market for large rotorcraft in scheduled services using London as a centre point. The conclusion suggests that the vertical flight progress is restricted awaiting technological advances.

INTRODUCTION

As an introduction it is appropriate and indeed necessary to consider the area in which we in British Airways Helicopters operate and at the same time give you some indication of how we see the application of the helicopter and its derivatives in the United Kingdom and Europe for the future.

For the last seventeen years we have operated American built machines which have been the work horses of our offshore exploration and indeed the helicopter industry as a whole. For the time being offshore activity represents by far the largest application of passenger helicopter transportation in our part of the world, but that is not to say, that the experience gained is not available for future development of scheduled services.

We may be operating American equipment, but at the risk of appearing brash, I venture to suggest that we in Britain have made a significant contribution to maximizing the helicopter capability in the operational field. This contribution, both technically and operationally has come from our own certificating authority the C.A.A., the Company of which I am a part and other operators. The development has come about partly, but not wholly because of the particularly demanding nature of the offshore exploration. This factor is also true of the rest of the world of course.

Specifically the certification of the machines to full public transport A2 standards, the development of IFR operations and the clearance to fly in icing conditions, are all aspects which are accepted in the United Kingdom as a optimum requirement for a commercial helicopter. I hope to develop these aspects in this paper using the Advance Rotorcraft Technology Report as a vehicle for my discussion. But first, let me tell you about our environment of operation.

There are two slides which show the area of operation in the North Sea. You will see, that the median line divides the continental shelf between the United Kingdom, Norway, Denmark, West Germany, The Netherlands and France. The United Kingdom, having a large coast line, did well out of the division as indeed did Norway.

The main area of helicopter operation is dictated by the finding of oil and gas fields and down in the south the major gas finds are located some 40 - 60 miles from the coast. There, two helicopter bases, not in the same place, but in the same area, that is in East Anglia and at Essington in Yorkshire. Further north in the middle of the North Sea, there have been significant oil finds including the Forties Field and the Auk Field, these distances from the shore base which is Aberdeen, are between 100 nautical miles and 170

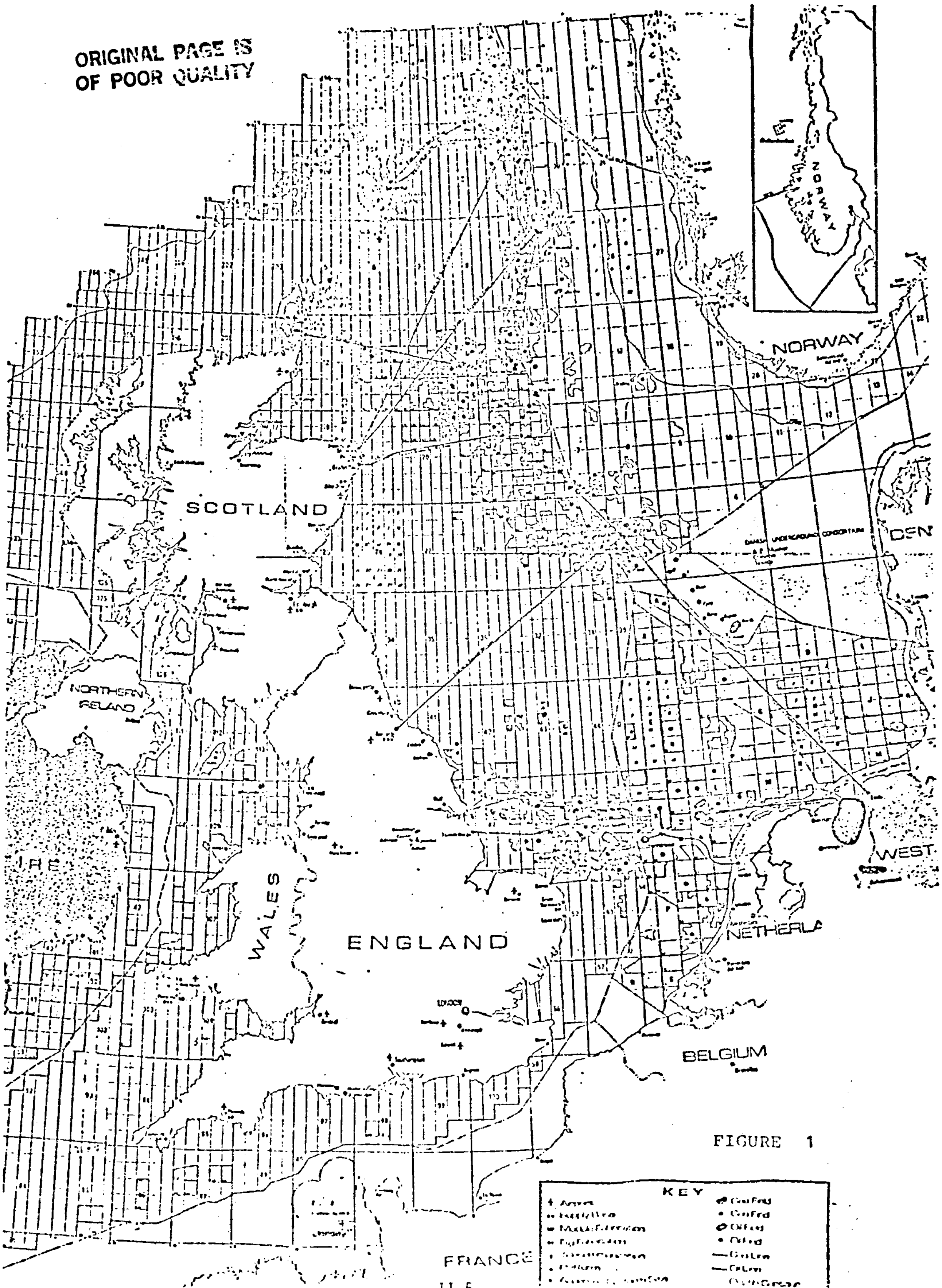

NORWAY
SCOTLAND
NORTHERN IRELAND
WALES
ENGLAND
BELGIUM
NETHERLA
FRANCE
KEY

FIGURE 1

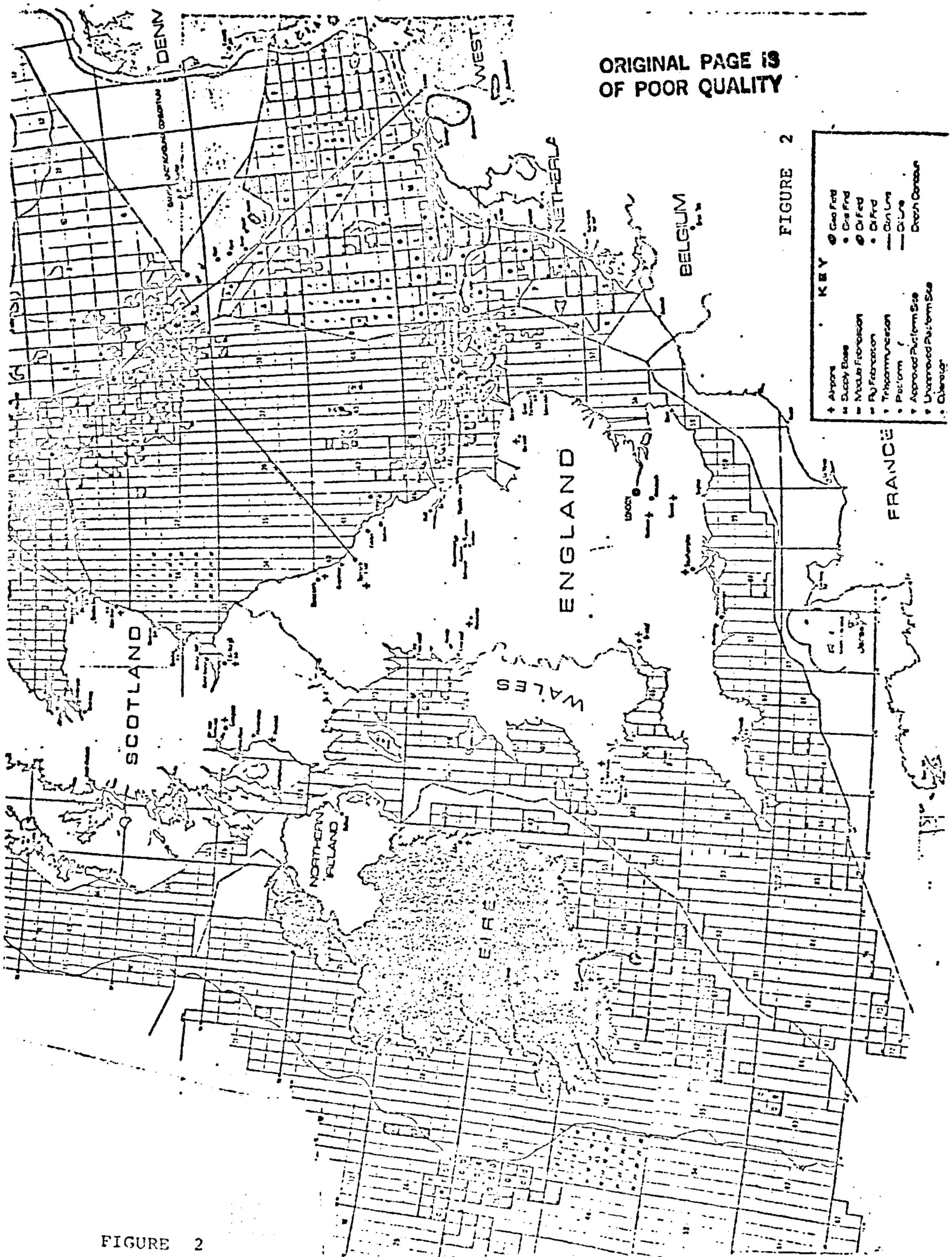


FIGURE 2
KEY
SCOTLAND
ENGLAND
WALES
NORTHERN IRELAND
EIRE
BELGIUM
FRANCE
NETHERLA
WEST
DENN

FIGURE 2

nautical miles. The most northerly operation is from the Shetland Isles to the oil find in the east Shetland basin which is some 110 miles from the main helicopter base at Sumburgh and about 80 nautical miles from another helicopter base in the northernmost island, Unst. An important point to mention here is that the present method of operation is for passengers to get on a fixed wing aircraft at Aberdeen and be flown either to Sumburgh or the northern base where they then transfer to the helicopter and are flown out to the offshore installations. This is both costly and time consuming as well as fraught with difficulties, including weather delays. The BV 234 is being purchased, initially to fulfill a Shell requirement to fly 44 passengers direct from Aberdeen to the east Shetland basin oilfields, hence cutting out the intermediate stop in the Shetland Isles.

In addition to the North Sea operation there is potential for exploration and development of natural resources yet to be established on the west side of the United Kingdom, the size of this market has yet to be established but as far as the south western approaches are concerned it is likely that the distances will be in the region of 150 nautical miles. There has been a certain amount of exploration work carried out to the west of Ireland.

Another facet of our operations is that of scheduled services which are carried out between Penzance and the Isles of Scilly in the south west of England. This service carries in excess of 85,000 passengers a year and last year carried its millionth passenger. We have been operating on behalf of the British Airports Authority, a scheduled helicopter service between Heathrow and Gatwick. It is likely that this service will carry in excess of 115,000 passengers each year. Both these scheduled services are carried out with the S61 - each operation having one machine. The standard of operation requires that it be a public transport and fully IFR exercise.

For the future, the Company sets great store by the potential for helicopter scheduled operations. In Scotland, and the islands which are close by, we see an application for helicopter operations. Presently, air communication is achieved by fixed wing aircraft which require costly runways and airports. For geographical reasons, these airports are often remote from the centres of population. The service is very prone to bad weather and barely meets the requirements of the communities. We see, and are continually pushing the authorities, the concept of helicopter services in this difficult terrain.

With regard to the city centre service the United Kingdom is well placed for cities close to the European mainland. An international heliport to be east of London in a area which was previously dockland, now no longer utilised, is seen as an ideal site for a helicopter service to Amsterdam, Rotterdam, Paris, Brussels and other population centres within this 200 mile radius, including of course, our own cities such as Birmingham and Cardiff. Indeed, as regards using a helicopter as a commuting vehicle to Heathrow Airport, we are continuing our efforts to achieve the service between Milton Keynes, a dormitory town of London, and Heathrow for the businessman. We see this concept being extended to include cities within a 100 nautical miles of Heathrow, Stansted and Gatwick, whereby the helicopter becomes a feeder service to international airports.

Finally with regard to the present situation in the United Kingdom, the breakdown of civilian helicopters is as follows:

FIGURE 3

Helicopters over 6,000 lbs:	6 Pumas
	4 S58Ts
	53 S61s
	8 S76s
	15 Bell [illegible]2s
	4 Wess[illegible]
	4 Dau[illegible]ins
Executive Transport:	50 machines
Helicopters less than 6,000 lbs.:	356 machines involved in Aerial Work which includes - Powerline inspections Crop spraying Forestry Spraying Construction Gas pipeline inspections

This then is a brief summary of the helicopter situation in the United Kingdom.

AERODYNAMICS AND STRUCTURES

It is not the intention to talk in depth about aerodynamics and structures other than to say that operators are becoming increasingly aware of the aero/acoustics, vibration and composite airframe characteristics of the machines which they propose purchasing.

External noise is vitally important. The noise generated by the helicopter, be it from its areodynamic components or engines, must be acceptable to the community and the regulations, both national and international. Indeed, community acceptibility may well be more demanding, since the approval of landing sites or heliports is nearly always the subject of planning or construction permission which in turn, leads to public enquiries which are often prolonged and negative in their attitude to the advancement of the industry.

In the United Kingdom the depth of feeling towards noise is deep routed and there is recent evidence that the siting of heliports close to population centres is going to be an up-hill struggle, unless it can be shown that the machines are quiet - very quiet, and even then objections will be numerous.

In the main, objections are definitely not objective. They arise from the public's inherent wariness of aviation as a whole and the noise that it generates in particular. I refer specifically to the second London heliport of Trigg Lane which as been given the go ahead on a limited scale and the Bridge of Don Heliport on the outskirts of Aberdeen, which was shot down - to coin a phrase - when the authorities came to consider the planning permission and presented it to the public for their views.

The route between Heathrow and Gatwick was the subject of a public enquiry which took two weeks. When we eventually got it into operation, noise complaints were running at the rate of thirty to forty per month. After two years of operation, we receive virtually no noise complaints at all.

I have come to realize in the last three years, that noise. or rather the lack of it, rules the game. Invariably the complainants are leaders of the local populace and are able to make political gain on a subjest that is always gets quick support.

Vibration is both fatiguing and uncomfortable. Vibration free characteristics have to be achieved throughout the life of the helicopter without the present need for long periods of down time maintenance to achieve this. It would appear that the newer machines are achieving a satisfactory level of smoothness.

With regard to airframe structure, the passenger carrying helicopter has to also cater for copious amounts of baggage and also have the flexibility of freighting. These particular aspects should not be ignored in the initial design of the machine. Nor indeed should it be forgotten that as with normal aviation procedures, there is a requirement to carry emergency and support equipment which the manufacturer does not consider in the overall design of his product.

The certification of the helicopter to fly in light icing conditions is a beginning, but regretfully, barely adequate for the tasks required of the machine. It is a tentative approval to flying in conditions forecast as no worse than light to moderate but the actual accretion must be no more than light.

Other limitations include not less than $-5^{o}C$ and below 5000 feet and that the freezing level must not be below 500 feet - this latter limitation provides the let out!

These restrictions do not bite when the major part of helicopter operations are over the sea but regretfully, they are a real stopper for flights over land, under I.M.C., where safety heights versus icing conditions become very important flight planning factors.

Full icing clearance then, we put high on our list of priorities for next generation helicopters.

FLIGHT CONTROL AND AVIONIC SYSTEMS

It is the policy of operators involved in offshore exploration in the North Sea, to ensure that their helicopters are fully IFR equipped and as far as possible independent of ground support for their navigation and letdown requirements. The North Sea operators, in general, have equipped their aircraft to comparable fixed wing standards:

2 VHF transmitter receivers
2 ILS VOR receivers
Marker beacon receiver
Automatic direction finders
Single side band HF radio

as well as area navigation aids which in the case of the North Sea is predominantly DECCA. Most important of all, and to achieve the independence, all weather radar and radio altimeters are also fitted.

We have been fortunate that in our area we have been able to rely on the DECCA navigator. This system has been more than satisfactory in giving a constant position of the aircraft either using the DECCA flight log or digital readouts in the case of TANS. Its accuracy has enabled us to develop letdowns to the low limit of 250 feet decision height and 600 metres visability.

As a concept, area navigation systems, we believe should have pictorial displays. This may be achieved either through a moving map display, however that may be presented, or using the C.R.T. system. The crew of the helicopter, or indeed the pilot in single pilot operations, has a need to establish the position of their own aircraft in relation to other helicopters giving their positions, terminal points and routes. In areas where there is high helicopter traffic, there is evidence to suggest that those pilots who are relating their positions by digital means are unable to assess their position in relation to the factors mentioned. It seems therefore, that if the f'xibility of the helicopter is to be achieved in I.M.C. conditions outside controlled airspace with the same standards of air safety, then there has to be a degree of discipline from the pilots themselves. The information to achieve this discipline has to come from an immediate visual representation of the plot taking into account, all relevant factors.

With regard to terminal letdowns, as previously mentioned, we have tried to make the helicopter self supporting. As far as offshore locations are concerned, we either have an en route letdown or a terminal letdown procedure which enables the helicopter using the area navigation aid, the radar and radio altimeter to be entirely independent. The charts for these letdowns are shown, you will see that the en route letdown gives us a decision height of 300 feet and a visability of 900 metres. This is used predominantly to obtain V.F.R. flight below the weather. Letdowns at the installation does use the N.D.B. of the facility but this is a means of identification rather than a integral part of the letdown. Positive identifaction of the facility of course, could be achieved by the transponder system. You will note that we are achieving decision heights of 200 feet and in flight visability of 900 metres.

Let Down Charts for this particular part of our operation are:

En route Let Down Over Sea (Day Only)	(Figure 4)
En route Let Down Over Sea (Night)	(Figure 5)
NDB (Day Only) Offshore Installation	(Figure 6)
NDB (Night) Offshore Installation	(Figure 7)
Beccles DECCA Approach	(Figure 8)

Trials are presently being conducted with M.L.S. system MADGE which is being sponsored by Mobil who are operators of the installation upon which it is installed. This is an offset approach and the limits have yet to be defined, but we understand that certification is someway off. The benefit of using the aid offshore is arguable. It would have very definite advantages for night time approaches but during the day, the decision height would have to be additional to the height of the platform above the sea. The platform already being some 135 feet above sea level, might will negate the advantages of the aid itself. Its prime advantage, of course is that there is a digital readout of the distance of the helicopter from the rig at all times, this would be a plus factor when compared with the present system of reading ranges from the radar screen.

With regard to the use of conventiional aids the limits are as detailed below.

Landing Weather Limits

Code:

PAR	=	Precision Approach Radar
SRA	=	Search Radar Approach
ILS	=	Instrument Landing System
VOR	=	VHF Omni-range Beacon
NDB	=	Non Directional Beacon
CC	=	Cloud Ceiling
DH	=	Decision Height
RVR	=	Runway Visual Range

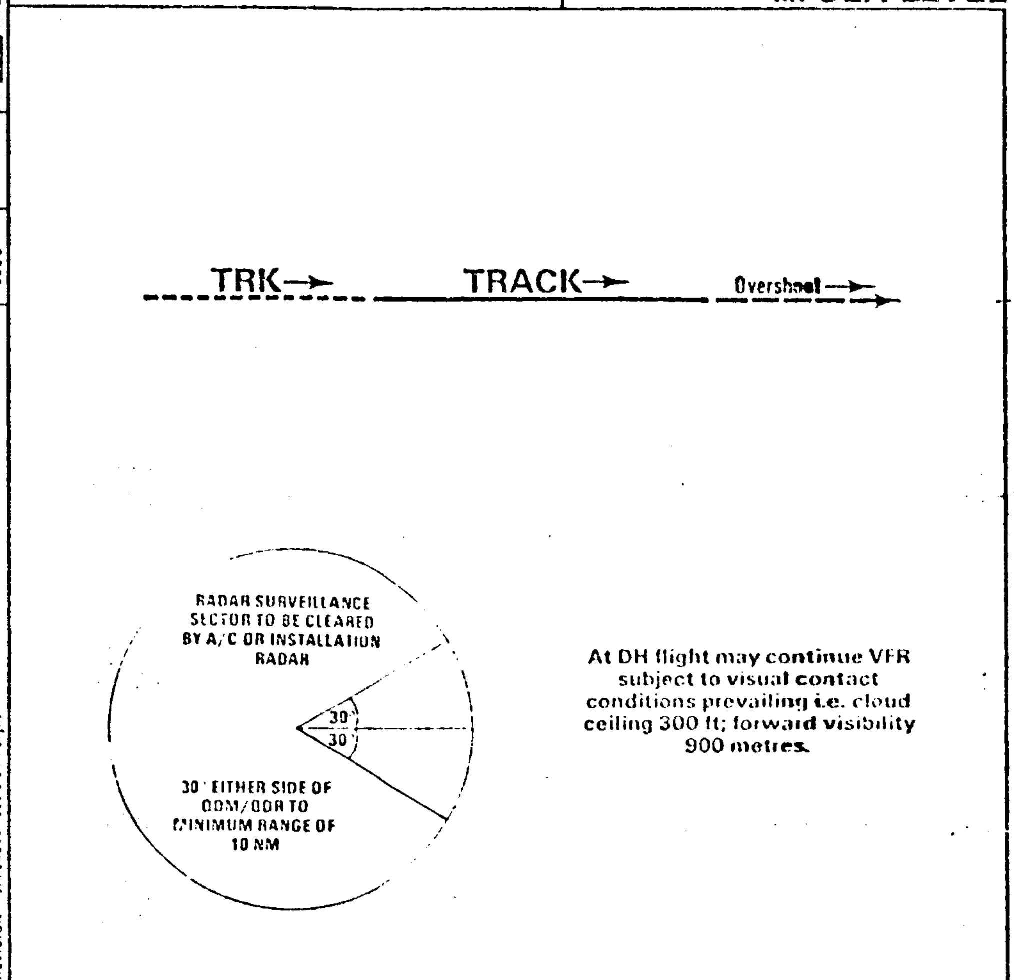
8883

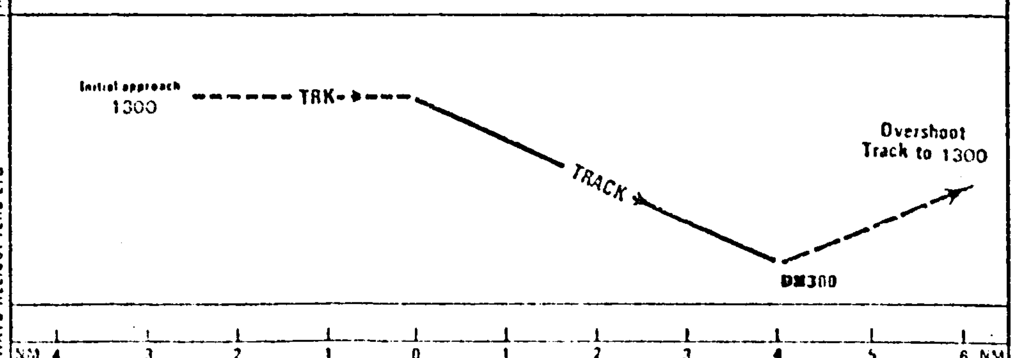
REVISION Amended decision height

BRITISH AIRWAYS HELICOPTERS LTD

EN ROUTE LET DOWN OVER SEA (DAY ONLY)

ELEV SEA LEVEL

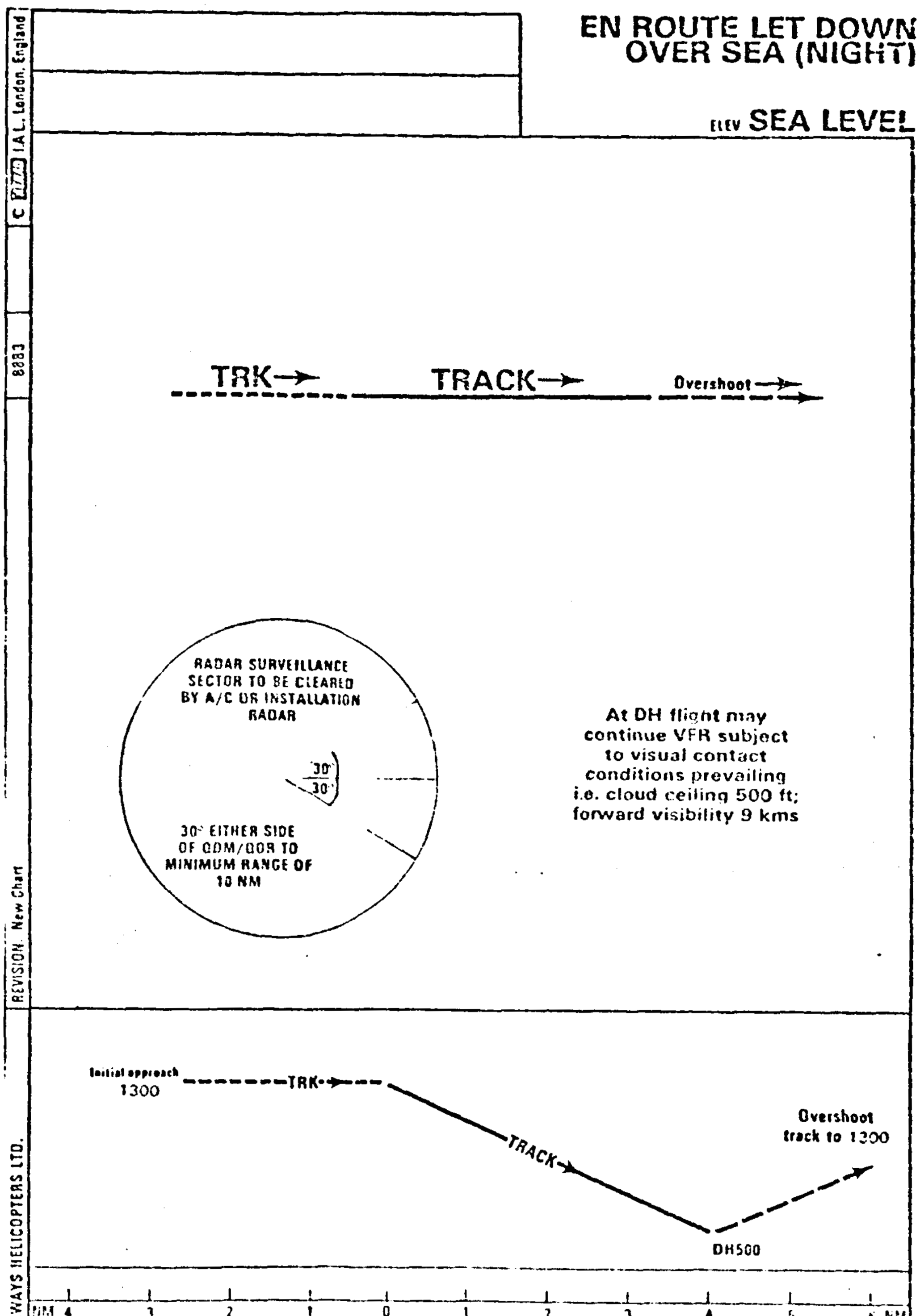




GROUND SPEED IN KNOTS	50	70	90	110	130	150	Bearings are magnetic
TIME FROM TOP OF DESCENT TO DH	4 45	3 25	2 50	2 10	1 50	1 25	Variation to be checked
DESCENT ON GP FT PER MIN	230	320	290	500	600	750	Elevations in feet AMSL

EN ROUTE LET DOWN OVER SEA 24.5.77 (DAY ONLY)

FIGURE 4



GROUND SPEED IN KNOTS	50	70	90	110	130	150	Bearings are magnetic
TIME FROM TOP OF DESCENT TO DH	4 45	3 25	2 50	2 10	1 50	1 25	Variation to be checked
DESCENT ON GP FT PER MIN	230	320	390	500	600	750	Elevations in feet AMSL

EN ROUTE LET DOWN OVER SEA 24 5.77 (NIGHT)

FIGURE 5

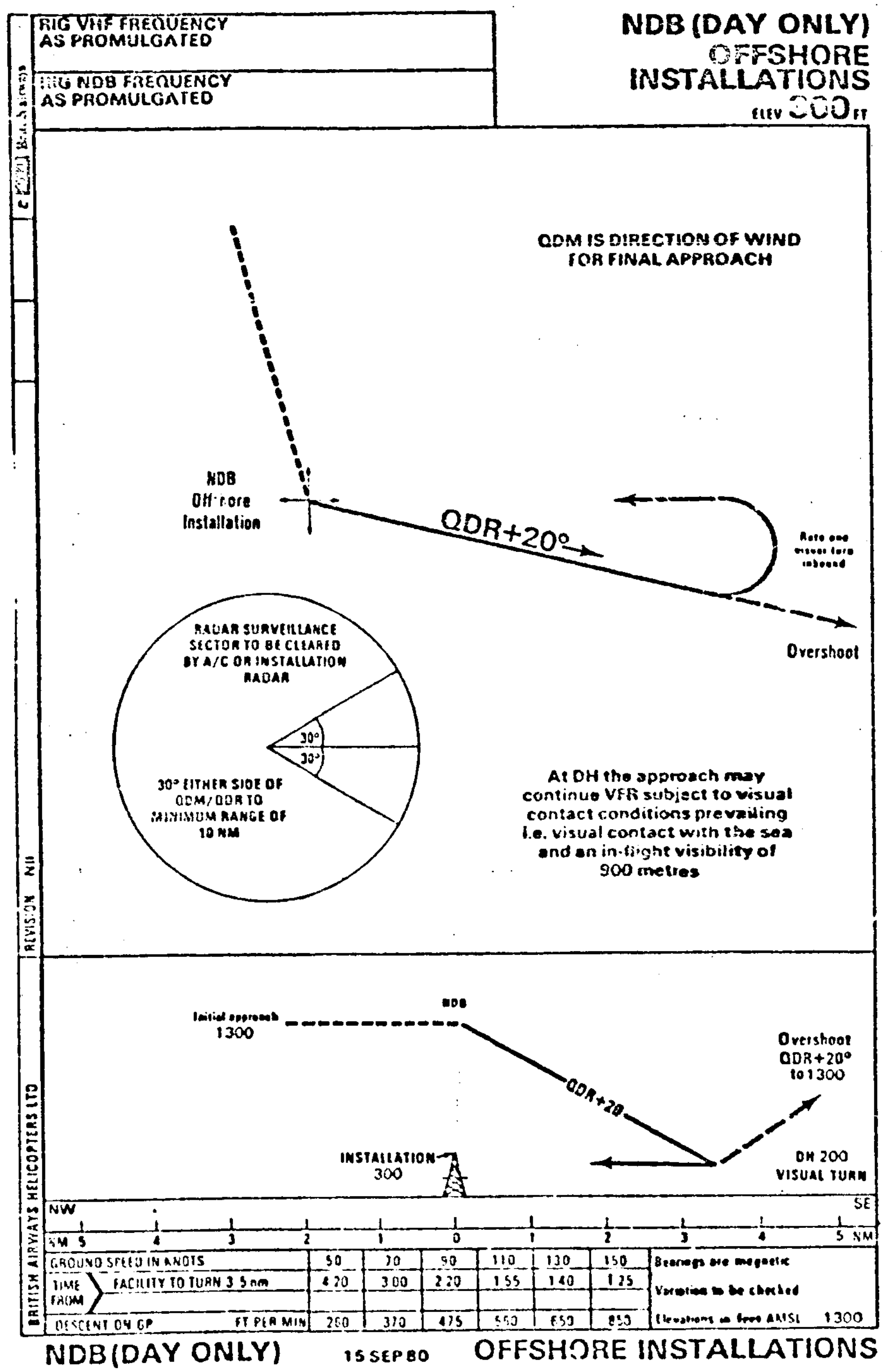
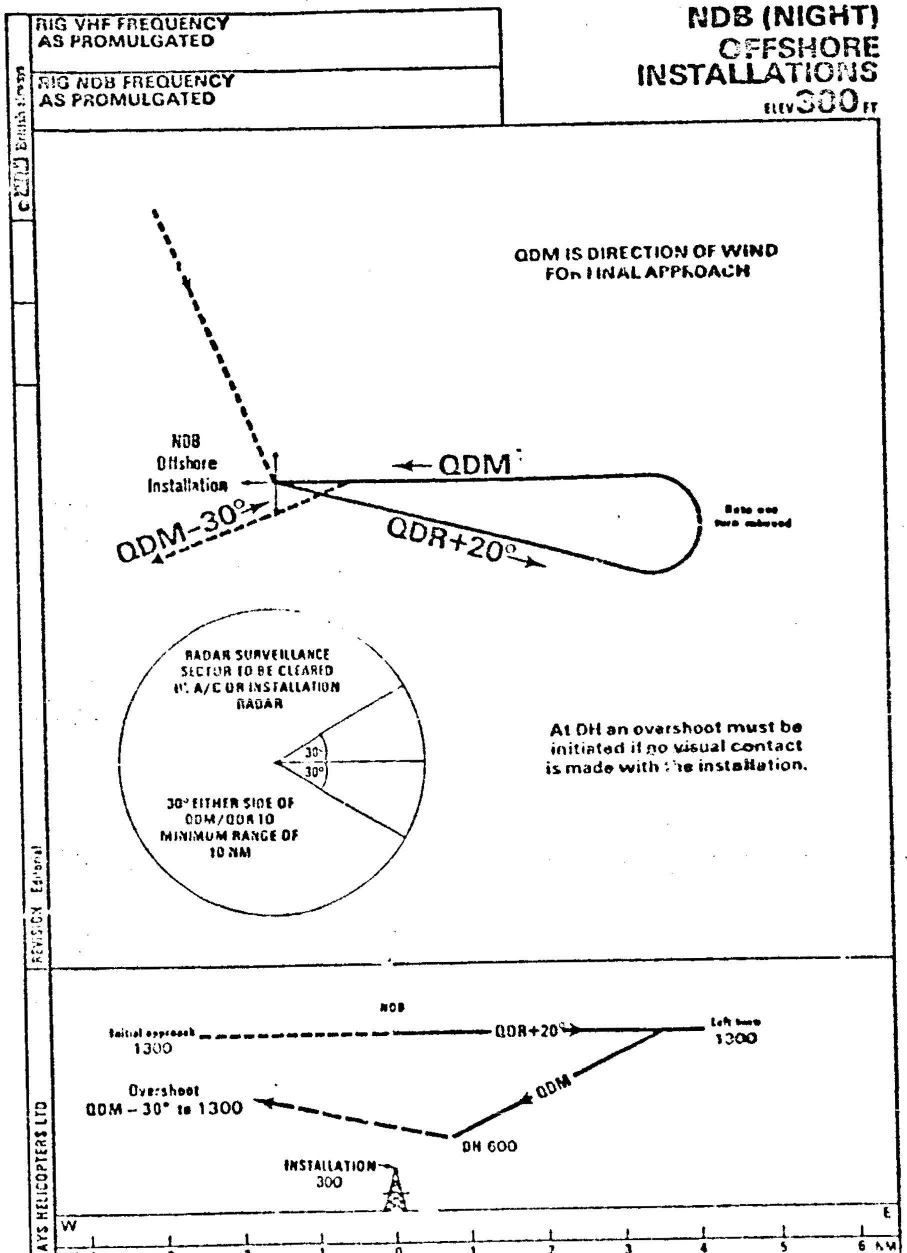

RIG VHF FREQUENCY
AS PROMULGATED
RIG NDB FREQUENCY
AS PROMULGATED
NDB (DAY ONLY)
OFFSHORE
INSTALLATIONS
ELEV 300 FT
QDM IS DIRECTION OF WIND
FOR FINAL APPROACH
NDB
Offshore
Installation
QDR+20°
Overshoot
RADAR SURVEILLANCE
SECTOR TO BE CLEARED
BY A/C OR INSTALLATION
RADAR
30°
30°
30° EITHER SIDE OF
QDM/QDR TO
MINIMUM RANGE OF
10 NM
At DH the approach may
continue VFR subject to visual
contact conditions prevailing
i.e. visual contact with the sea
and an in-flight visibility of
900 metres
Initial approach
1300
NDB
QDR+20
Overshoot
QDR+20°
to 1300
INSTALLATION
300
DH 200
VISUAL TURN
NW
SE
NM 5 4 3 2 1 0 1 2 3 4 5 NM
GROUND SPEED IN KNOTS 50 70 90 110 130 150
TIME FROM FACILITY TO TURN 3.5 nm 4 20 3 00 2 20 1 55 1 40 1 25
DESCENT ON GP FT PER MIN 260 370 475 550 650 850
Bearings are magnetic
Variation to be checked
Elevations in feet AMSL 1300
REVISION NIL
BRITISH AIRWAYS HELICOPTERS LTD
NDB (DAY ONLY)
15 SEP 80
OFFSHORE INSTALLATIONS

FIGURE 6



		50	70	90	110	130	150	
GROUND SPEED IN KNOTS		50	70	90	110	130	150	Bearings are magnetic
TIME FROM	FACILITY TO TURN 3.5 nm	4 20	3 00	2 20	1 55	1 40	1 25	Variation to be checked
	FINAL APP TO ½ NM	3 35	2 30	2 00	1 40	1 25	1 10	
DESCENT ON GP	FT PER MIN	200	275	350	430	500	600	Elevations in feet AMSL 1300

NDB (NIGHT) 15 SEP 80 OFFSHORE INSTALLATIONS

FIGURE 7

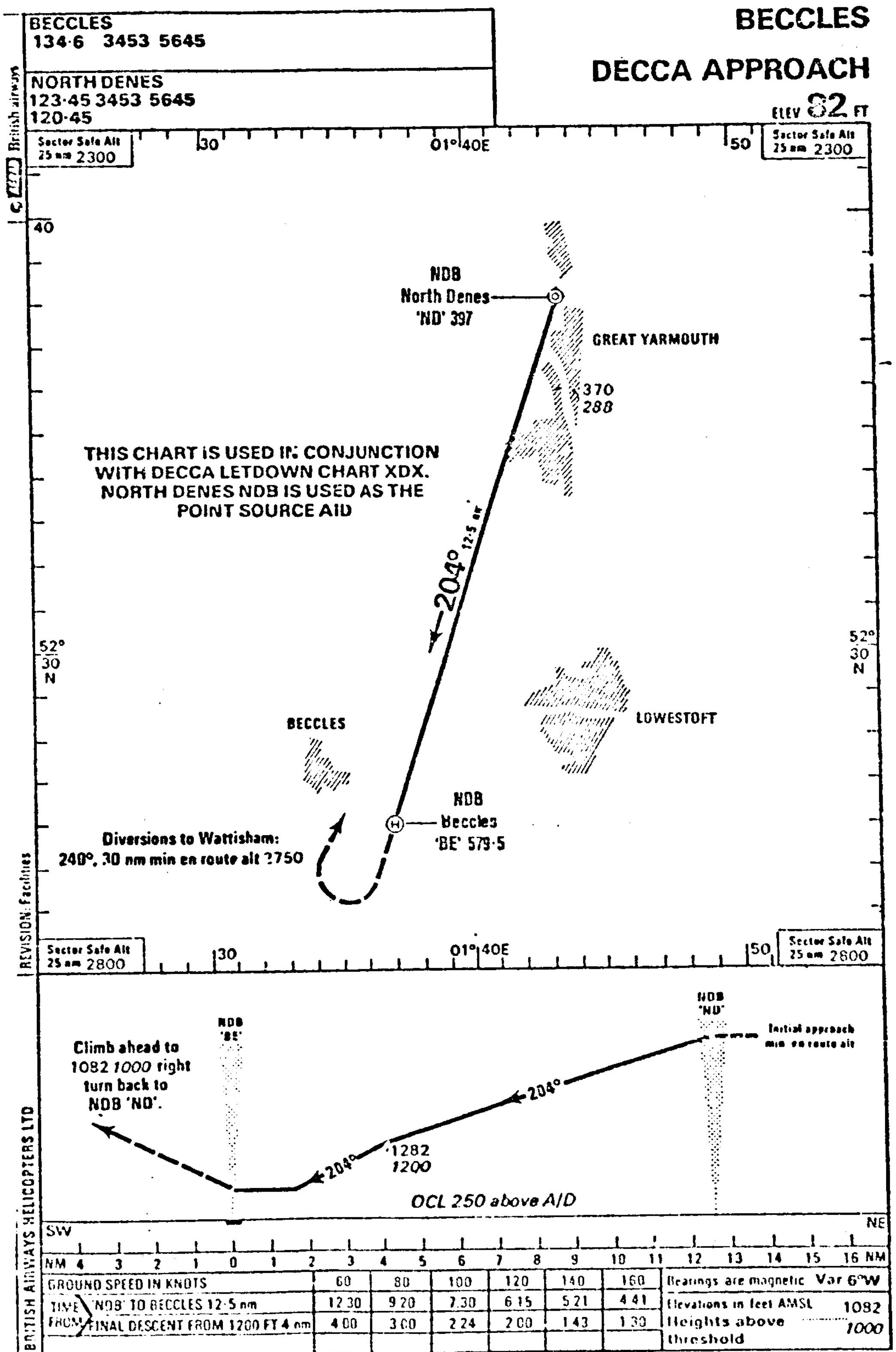

BECCLES
DECCA APPROACH
BECCLES
134·6 3453 5645
NORTH DENES
123·45 3453 5645
120·45
ELEV 82 FT
Sector Safe Alt 25 nm 2300
Sector Safe Alt 25 nm 2300
30
01°40E
50
40
52° 30 N
52° 30 N
NDB
North Denes
'ND' 397
GREAT YARMOUTH
370
288
THIS CHART IS USED IN CONJUNCTION WITH DECCA LETDOWN CHART XDX. NORTH DENES NDB IS USED AS THE POINT SOURCE AID
204° 12·5 nm
BECCLES
LOWESTOFT
NDB
Beccles
'BE' 579·5
Diversions to Wattisham:
240°, 30 nm min en route alt 2750
Sector Safe Alt 25 nm 2800
Sector Safe Alt 25 nm 2800
NDB 'BE'
NDB 'ND'
Initial approach min en route alt
Climb ahead to 1082 1000 right turn back to NDB 'ND'.
204°
204°
1282
1200
OCL 250 above A/D
SW
NE
NM 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 NM
GROUND SPEED IN KNOTS | 60 | 80 | 100 | 120 | 140 | 160
TIME FROM NDB TO BECCLES 12·5 nm | 12 30 | 9 20 | 7 30 | 6 15 | 5 21 | 4 41
FINAL DESCENT FROM 1200 FT 4 nm | 4 00 | 3 00 | 2 24 | 2 00 | 1 43 | 1 30
Bearings are magnetic Var 6°W
Elevations in feet AMSL 1082
Heights above threshold 1000
DECCA APPROACH
24 MAR 80
BECCLES
BRITISH AIRWAYS HELICOPTERS LTD
REVISION: Facilities
c British airways

FIGURE 8

Landing Limits (Figure 9)

	DAY		NIGHT	
	CC or DH (ft)	RVR(m)	CC or DH (ft)	RVR(m)
PAR	200	Note 1	200	Note 1
SRA Terminating at ½ NM	200	600	200	600
SRA terminating at 2 NM	300	600	300	600
ILS	200	Note 1	200	Note 1
ILS without Glide Path	250	600	250	600
ILS Back Beam	250	600	250	600
VOR	300	600	300	600
NDB	300	600	300	600
DECCA	250	600	250	600
Take Off Limits	100	300	100	300
Operating bases where special instrument Departure Procedures	At aerodromes or helipads where the aids detailed above are in use. Captains approved by a suitably qualified Training Captain may use the lower Take Off limits using the instrument runway heading.			
	50 or CDP whichever higher	100	50 or CDP whichever higher	100

Note 1

The minimum RVR on any given approach aid is calculated according to the Decision Height for that approach and is devised from the following tables:-

Figure 10

TABLE I		TABLE II	
Landing site with Lighting		Landing site without Lighting	
Decision Height	RVR(m)	Decision Height	RVR(m)
200' - 220'	300	200' - 220'	300
230' - 270'	350	230' - 270'	300
280' - 320'	400	280' - 320'	300
330' - 370'	500	330' - 370'	350
Over 380'	600	Over 380'	400

Captains must be approved by a Company Training Captain to use these reduced minima. Where the Captain is not approved, then the standard minima of 600 metres must be use.

Note 2

Until an individual Captain has completed 100 hours in command on a new type, he may not operate to below the 300', 600 metres minima or the specified minima which ever is the higher

DECCA is approved for a letdown system providing that the position is updated by a point source prior to commencement of the letdown and that the helicopter has a chart which is complimentary to the letdown system. You will have seen the limits to which we operate using this system. This system of course has the advantage of being flexible and may be used at locations which do not have sophisticated aids such as ILS or ground radar.

The use of other area nav aids without map display as letdown aids to these sort of limits, we have still not developed. Our certifying authority require us to demonstrate the integrity of the receiver/digital readout relationship. We also have further work to do on the relationship between the digital readout, as opposed to the map display in DECCA and the pilot's interpretation of this digital presentation.

It is felt that while the MADGE system is of doubtful benefit when located offshore, we do believe that there is application in the city centre concept where multi-directional approaches, and overshoots as well as differing approach angles, the optimum being 6° may be utilised to the benefit of the operations. It must be appreciated that decision heights are related to the obstacle clearance limit for the area into which the letdown is going to take place. Successful approaches in visability of 300 metres (600 feet) using present decision heights of 200 feet are a routine achievement. The advantages of slow speed and vertical sight allow the pilot to orientate himself at the decision height by outside reference, providing approach lighting or visual cues are available. These are virtually CAT II limits on the cheap. However, to achieve CAT III, the short term objective must be to reduce the Decision Height remembering that the present state of the art requires the old maxim "you have to be able to see to land". For the future, the independence and the flexibility of the helicopter, in terms of bad weather approaches, must come from the develoopment of the infra-red concept, if this is technically possible, or else from high resolution radar. If the pilot is to have any input in the approach then he must be looking up at the critical time.

The present weather regularity in the inclement environment of the North Sea is 97.5%. This final achievement of an all-weather capability is of dubious value within our area of operation. On the other hand, in all other areas of helicopter operation it is of paramount value if the helicopter is going to achieve an acceptable regularity in the off-airport environment.

N.B.	CAT I	200 feet	DH
		800 metres	RVR
	CAT II	100 feet	DH
		400 metres	RVR
	CAT III	NO DH LIMITS	
		200 metres	RVR

PROPULSION

With certain exceptions, the performance of most twin engined helicopters is abysmal when you consider that they are vertical machines. As so often happens for reasons of efficiency and economy, any increase in power in an existing model, usually results in an increase of all-up weight. For a helicopter to be creditable, it is just not good enough to talk about a thousand foot reland area during the take off phase in the event of an engine failure.

As a public transport machine, the certificating authorities will always look at the engineering integrity. The C.A.A. have classed most twin engine helicopters into the Group A2 category which is the Group A rotorcraft having engineering standards that the probability of an emergency landing may be considered as reasonably probable, of course this classification refers to the machine as a whole and this reasonable probability is in the order of 10^{-6}. As it happens, statistically the S61 operation in the United Kingdom would seem to indicate that this figure is more like 10^{-8}.

Nonetheless, as far as engine performance is concerned it is no argument to say that the probabilities of engine failure in the take off stage may be ignored since the overall integrity of the machine is to a lower standard. Our own Authority therefore, with a few exceptions, does dictate that the take off performance equates to normal fixed wing operation of 10^{-8}.

In other words, you cannot reduce the engine performance to the lowest common denominator.

Having said that, to overcome the problems in the short term, the British Helicopter Advisory Board is trying to persuade the certificating authority that there is an argument for allowing an exposure time during the take off phase. The purpose of this is to reduce the landing area designated as the area for relanding in the event of an engine failure, providing there is available, an emergency area which is free of significant obstructions and where there is no likelihood of third party damage. The reasons for proposing this are self evident, the S61 at all-up weight, for example requires in the region of a thousand feet cleared area for a reland and the S76 in the public transport category, has a graph which indicates somewhere in the region of two thousand five hundred feet in the event of an engine failure in the take off phase. This makes a mockery of the helicopter and the situation cannot be allowed to continue into the next generation.

Put quite bluntly, helicopters with two or more engines, are going to have to continue flight after an engine failure without any significant deterioration in their performance. Otherwise, as we go into the eighties, sites from which they are required to operate, will be deemed to be unacceptable by the various authorities.

The proposal illustrated in Figure 10 is to reduce the present CDP by an amount (x) to a new point (CDP^1) such that the present minimum height of 35 feet in the continued take-off is reduced to a redefined height (x^1).

Note: It is proposed that the new minimum height shall not be less than a height which allows a 10 feet clearance. The new CDP^1 may therefore be a variable, and calculated on the basis of x^1.

By applying to CDP^1 a time factor (t), equivalent to the maximum acceptable engine failure exposure to risk time, a new point (DP^2) can be established which will take into account a reject following an engine failure, and which will thus determine the required take-off strip (prepared surface).

In the remote eventuality of an engine failure occurring between DP^2 and CDP^1 it will necessitate a land-back on the unprepared, but obstruction free area. The definition of an 'unprepared' surface is yet to be made, but it will certainly have to allow a landing to be made on to it which will not result in injury to the helicopter occupants nor third party damage. It is proposed that this area should extend out to a distance at which 50 feet ground clearance has been achieved during a single engine continued take-off from CDP^1.

This proposal should only be regarded as a quick fix and it is detailed here as an indication of the dire straits the operator is in to try and achieve a degree of respectability for his machines.

Transmission or power transfer has made rapid advances in recent years and the operators are beginning to benefit from new technology. That is not to say that the vulnerability to emergencies has disappeared because it has not.

Transmission problems continue to cause by far the highest number of emergency and precautionary landings and this problem has to be overcome. True, auxiliary lubrication systems, the ability of transmission systems to run dry for a period of time both help the situation but there has to be a method of

1. Establishing the exact nature of the mechanical problem so that an in flight assessment may be made.

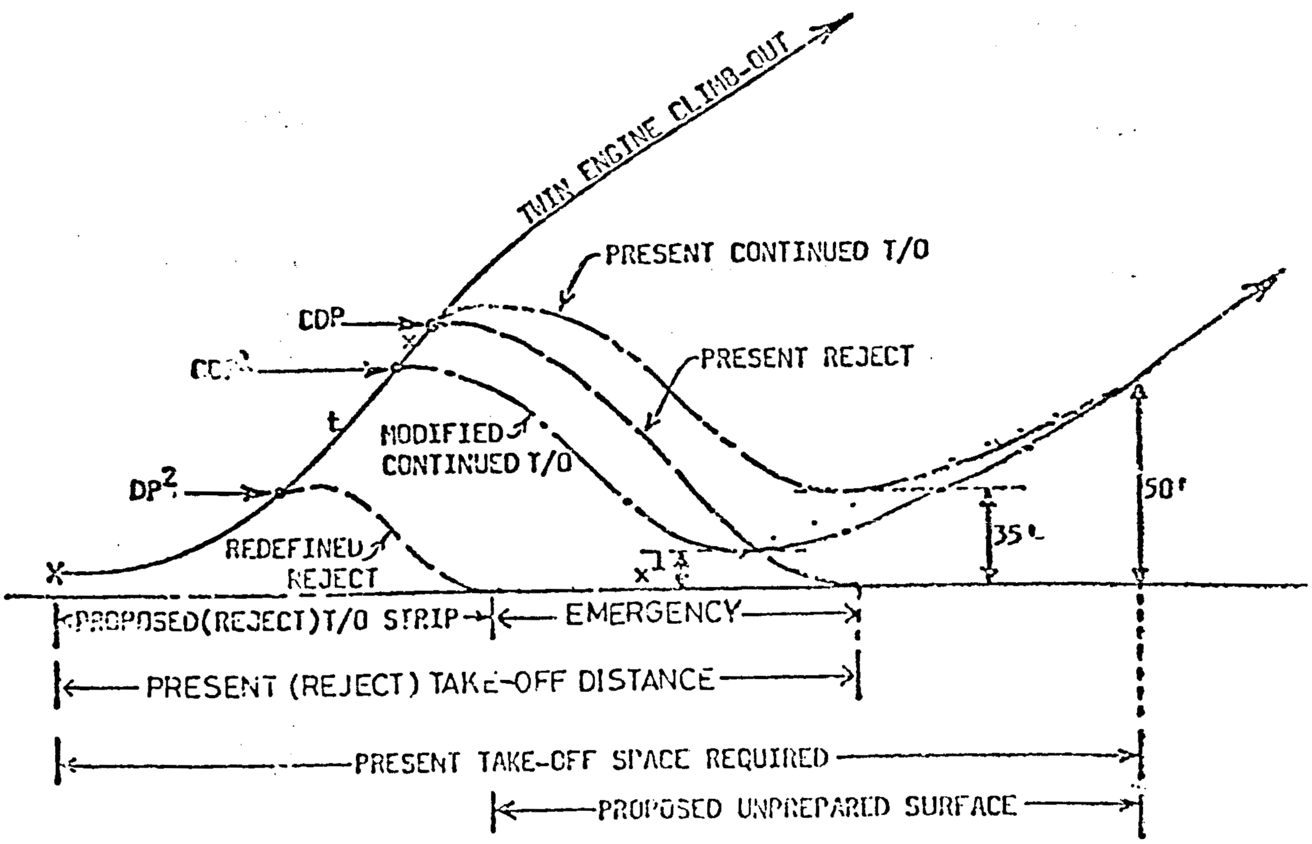
2. Clear cut guidance that flight may continue or cease.

Easier said than done - but what does a chip detector tell the pilot, or a high oil temperature or a runbling gearbox - that he has a problem and therefore must land immediately or as soon as possible. For the future, more information must be made available and analyised for the pilot so that he may act accordingly. The majority of the precautionary landings would therefore be avoided.

For the time being though the transmission system continues to cause concern. Helicopters are being operated over long sea routes, over mountainous regions and often in I.M.C. - the requirement to land immediately, once the privilege of the machine, is now denied.

Figure 11

PERFORMANCE DIAGRAM



VEHICLE CONFIGURATION

High Speed Concept

The chart illustrating the sort of distances applicable to helicopter operations in the United Kingdom will give an indication of the speed requirements.

Over the shorter distances, speed will not be such an important factor, but nonetheless speeds should be of the order of 130 - 150 kts which in turn will give acceptable ground speeds in most weather conditions.

The longer distances 100 n.m. plus requires higher cruise speed for a number of reasons - three to be mentioned:

1. Utilization of machines
2. Passenger acceptability
3. Operational

It is perhaps the operational aspect that concerns me in particular.

The integration of helicopters with aeroplanes in the Air Traffic sense is not a problem that may be ignored. Not only the integration with areoplanes but also with helicopters has to be considered. It is not reasonable to ignore the problems that will be experienced - the success of the helicopter transferring people between population centres 'per se' means congestion. We see this in the East Shetland oil basin which handles 252,000 aircraft movements a year, which makes it almost equivalent to London Heathrow. I submit that operationally speed is a vital factor to increase flow rates at terminal areas as well as producing comparable en route times to conventional transportation.

Large rotorcraft, if the BV 234 be included, are about to become operational next year. This 44 seater as mentioned will commence operations in July next year and the introduction of this machine will be the logical step towards the stretched 66 seat version and thereafter to the heavy lift helicopter.

But it is the scheduled routes that wil benefit from the large rotorcraft and in particular those routes shown below which all fall within 200 n.m. of London and have an established passenger market.

Figure 12

PASSENGER TRAFFIC TO/FROM LONDON HEATHROW

		1979 (000)	1978 (000)
London -	Birmingham	133	122
	Channel Isle	550	542
	Manchester	551	534
	Amsterdam	1100	1100
	Rotterdam	209	205
	Luxembourgh	66	62
	Brussels	628	605
	Paris	2009	2010

CAA Annual Statistics
CAP 431

These routes are already congested, with lengthy sector times, long terminal delays and much passenger inconvenience. It may take four hours from London to New York, but still takes four hours London Centre to Paris Centre - a sobering thought but nonetheless true.

These then are the target routes for large rotorcraft utilizing the relative free airspace below 10,000 feet and operating at terminals orientated to the control of such machines.

CONCLUSION

As a summary and conclusion, a review of the state of the art as it exists at the moment is necessary. This summary only relates to the United Kingdom Scheduled Passenger Services and the Offshore Operations. First of all the scale of the activity is shown in "All Class 7 Licence Operations 1979" and "Domestic Scheduled Services 1979" (Figure 13).

Some million and a quarter passengers are carried each year on these operations alone.

The major part of this passenger movement is completed by the S61N operation on a scheduled basis within a charter environment. The average aircraft utilization is in the region of 1500 flying hours per year.

The overall regularity is in the region of 95% i.e. departures within 30 minutes of deadline. This regularity is achieved in typical temperate climatic conditions bearing in mind the sea fog and high wind conditions.

Operations are totally I.F. orientated, an achievement obtained after the introduction of the S61N Simulator. This enables the helicopter, given the accepted standard of avionic fit to compete with and better present fixed wing weather limits.

The problems of running, what in effect is a short haul airline operation, have been highlighted in this paper and they are:

- The integrity and performance of the machine itself
- The limited clearance to flying in icing conditions which therefore places height restrictions upon the helicopter
- The high level of maintenance
- Integration with Air Traffic Procedures
- Slow speed and low payload

I'd like to conclude by saying that on balance the operators on our side of the ocean have prepared the operating environment for tomorrows helicopters so that given the new technology machine of the right size, the market is there, as is the operating experience.

FIGURE 13

All Class 7 Licence Operations 1979

	Aircraft-km (000)	Stage flights	Aircraft hours	No. of passengers uplifted	Seat-km Available (000)	Seat-km Used (000)	% of available	Cargo tonnes uplifted	Tonne-km available (000)	Tonne-km used Total (000)	Tonne-km used Cargo (000)	Tonne-km used Passengers (000)	% of available
British Airways	30	17	49	696	3 542	1 688	47.7	–	426	158	–	158	37.1
British Airways Helicopters	5 649	38 673	28 207	381 973	122 057	60 231	49.3	2 615	11 930	5 250	432	4 818	44.0
British Caledonian Airways	18	3	20	60	2 999	476	15.9	–	441	38	–	38	8.6
B.E.A.S.	1 134	48 634	7 561	243 390	12 690	5 635	44.4	568	1 291	516	15	501	40.0
Bristow Helicopters	6 951	42 012	40 653	358 171	120 562	67 170	55.7	2 577	10 214	6 509	477	6 032	63.7
Gleneagle Helicopters	69	1 043	383	4 865	808	299	37.0	16	224	30	3	28	13.4
Management Aviation	946	15 816	4 681	49 935	5 954	3 588	60.3	356	512	308	26	283	60.2
North Scottish Helicopters	2 291	32 775	11 305	110 490	12 837	8 171	63.7	–	920	617	–	617	67.1
Tradewinds Airways	6	2	9	–	–	–	–	33	266	187	187	–	70.4
TOTAL	17 092	178 975	92 868	1 149 570	281 448	147 258	52.3	6 163	26 224	13 613	1 139	12 474	51.9

Domestic Scheduled Services 1979

	Aircraft-km (000)	Stage flights	Aircraft hours	No. of passengers uplifted	Seat-km Available (000)	Seat-km Used (000)	% of available	Cargo & Mail uplifted tonnes	Tonne-km available (000)	Total (000)	Mail (000)	Tonne-km used Cargo (000)	Tonne-km used Passengers (000)	% of available
Passenger Services														
British Airways	23 170	76 983	77 694	4 653 272	3 012 330	1 973 805	65.5	11 743	280 076	173 798	997	3 467	169 332	62.1
British Airways Helicopters	225	3 683	1 226	86 211	6 762	5 259	77.8	135	524	409	2	7	401	78.1
British Caledonian Airways	5 086	18 237	14 162	599 762	415 711	249 640	60.1	5 038	41 354	22 080	252	922	20 906	53.4
Air Anglia	3 780	17 189	12 866	169 908	114 181	59 769	52.3	113	11 492	6 123	–	161	5 963	53.3
Air Ecosse	157	976	520	5 714	2 448	899	36.7	24	186	77	2	2	73	41.1
Air Wales	83	415	348	1 675	747	335	44.8	1	60	27	–	–	27	44.9
Air Westward	156	430	659	1 987	1 615	733	45.4	–	137	62	–	–	62	45.5
British Island Airways	2 735	14 204	11 422	333 908	119 718	77 253	64.5	1 372	11 040	6 891	11	253	6 627	62.4
British Midland Airways	5 934	20 392	19 354	796 117	440 354	256 923	57.6	2 375	38 625	20 794	24	708	20 062	53.8
Brymon Airways	1 427	6 239	6 228	71 775	39 818	19 430	48.8	27	3 621	1 598	–	7	1 589	44.1
Burnthills Aviation	51	455	305	794	206	90	43.6	–	65	7	–	–	7	10.8
Dan-Air Services	2 618	11 160	9 348	296 266	156 360	89 190	57.0	163	13 276	7 641	–	70	7 571	57.6
Express Air Services CI	12	35	42	808	670	291	43.4	–	59	22	–	–	22	37.1
Haywards Aviation	82	451	447	2 377	606	428	70.1	6	119	86	–	1	85	72.0
Intra Airways	293	845	391	38 566	18 471	14 541	78.7	–	1 540	1 088	–	–	1 088	70.7
Loganair	2 282	22 856	11 361	120 123	30 826	15 159	49.2	–	2 810	1 379	–	–	1 379	50.4
TOTAL Passenger Services	54 102	194 540	166 958	7 229 661	4 366 909	2 763 893	63.3	21 794	404 983	242 084	1 287	5 597	235 198	59.8
Cargo Services														
British Airways	337	693	778	–	–	–	–	5 766	5 472	2 955	21	2 933	–	54.0
British Caledonian Airways	283	496	588	–	–	–	–	2 998	2 323	1 680	1 679	–	–	72.3
Air-Bridge Carriers	51	273	204	–	–	–	–	987	362	199	–	199	–	55.0
British Island Airways	710	3 099	2 841	–	–	–	–	7 737	3 271	1 742	254	1 489	–	53.3
TOTAL Cargo Services	1 381	4 561	4 410	–	–	–	–	17 545	11 427	6 578	1 954	4 622	–	57.5
GRAND TOTAL	55 483	199 101	171 368	7 229 661	4 366 909	2 763 803	63.3	39 339	416 410	248 660	3 241	10 218	235 198	59.7

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REMOTE AREA - ALASKA

Carl Brady
President - ERA Helicopters, Inc.
President - ERA Aviation Center, Inc.
Executive Vice President - Rowan Companies, Inc.

Biographical Summary

Brady, Carl Franklin, aircraft charter co. exec.; b. Chelsea, Okla., Oct. 29, 1919; s. Kirty A. and Pauline Ellen (Doty)B.; student U. Wash., 1940; m. Carol Elizabeth Sprague, Mar. 29, 1941; children - Carl Franklin, Linda Kathryn, James Kenneth. Co-owner, Aero Cafe, Yakima, Wash., 1946-47; pilot Central Aircraft, Yakima, 1947-48; partner Economy Helicopters, Inc., Yakima, 1948-60; pres. ERA Helicopters, Inc., Anchorage, Alaska, 1960-, ERA Aviation Center, Inc., 1977-, Livingston Copters, Inc., 1977-; exec. v.p. Rowan Companies, Inc., Houston, 1973-, also dir.; dir. Alaska Pipeline, Inc., Alaska Gas and Service Co., Alaska Pacific Bank, Alaska Pacific Bancorp. Mem. Alaska Ho. of Reps., 1965-66, Alaska Senate, 1967-68; pres. Alaska Crippled Childrens Assn, 1963. Served with USAAF, 1943-46. Mem. Helicopter Assn. Am. (pres. 1953, 57, Larry D. Bell award 1976), Anchorage C. of C. (pres. 1963-64), Alaska Air Carriers Assn., Am. Helicopter Soc., Commonwealth North, Air Force Assn., Navy League. Republican. Methodist. Clubs: Petroleum of Alaska, Elks. Home: 510 L St. Anchorage, AK 99501 Ofice: PO Box 762, Anchorage, AK 99510.

Abstract

33 years of helicopter operations have been reviewed herein beginning in 1947. Although the principal topic of this presentation is Remote Area - Alaska, other aspects of helicopter operations are discussed. Among them, the years of FAA regulatory authorities lumping helicopters and fixed wing aircraft into the same category simply because both become airborne and, therefore, came under the jurisdiction of an agency that had for some 40 years regulated fixed wing only.

The History of helicopter activity in Alaska is reviewed as well as problems inherent in operating a long distance from manufacturers, source of parts, communication problems, cold weather, etc.

The cyclical increase and decrease in rotary wing activity in Alaska and the causes for such variance is presented as well as development of IFR flight in Alaska.

Alaskan operators' problems as viewed by the author, re manufacturers warranties, testing of new models in remote areas, back ordered parts, and high freight rates are related as well as recommendations to the manufacturers regarding design and performance capabilities for the helicopter of the decade ahead.

Thirty-three years ago last month, I flew a Bell A-model helicopter to the city of Palo Alto from Bay Meadows Airport near San Mateo. I approached the airport from the west at about 150 feet, circled several times while awaiting the tower to give me a green light to cross the runway and land on the ramp. Recognizing that I was being ignored, I let down to 10 to 12 feet, hovered up to the edge of the runway, assured myself that there was no traffic, crossed the runway and landed on the ramp. By the time I shut the engine down, an irate FAA tower operator was all over me. After the initial yelling and screaming subsided, I was informed I had two choices facing me. One, a serious violation resulting in a citation, fine, possible loss of license; or two, to start the helicopter, hover down the taxi strip to the end of the runway, wait for the green light, take off down the runway, climb to 500 feet, turn left, climb to 800 feet, turn downwind, until time to turn base leg, let down to 500 feet, watch for a green light, then land at the end of the runway. Upon landing, I was to wait for another green light, at which time I could hover to a spot on the ramp.

I had learned to fly the helicopter at Central Aircraft in Yakima, Washington, in May of that year while earning a living as a fixed wing crop duster pilot. Central elected to start a flight school in the San Francisco area, Bay Meadows was picked as a base. I trained ten helicopter pilots that fall and was a designated FAA examiner for the helicopter since there was not a qualified FAA examiner in the area. Well, I am supposed to discuss with you today, Remote Area - Alaska, and Yakima and Palo Alto are a long way from Alaska and they were particularly so in 1948. But before I relate the operating problems caused by the remoteness of Alaska, allow me to briefly relate the history of helicopter activity in Alaska.

1948 was the year that Economy Pest Control was formed by myself and two other gentlemen, for the purpose of treating crops in the Yakima Valley. We had at our disposal a ground sprayer and duster, a Stearman airplane and two leased helicopters. Central bid on an experimental helicopter contract in Alaska for the topographic branch of the USGS and Economy contracted with Central for me to fly the contract.

The stripped down, open cockpit A-model was dismantled and flown to Juneau, Alaska, in a Pan Am DC4 with myself and Joe Beebe as my mechanic. Upon reassembling I flew the machine over 80 miles of open water to Pelican, a small fishing village on Chichigof Island. We were there 90 days, but actually accomplished our mission to map the island in 33 of those days due to the mountains being engulfed in clouds the rest of the time.

During those 33 days we mapped the northern half of Chichigof Island with four topographers, whereas it had taken seven years to map the southern half of the island utilizing 7 topographers, who walked and had the support of native packers and horses. We lived in a tent camp, cut trees, built a tripod to pull the helicopter transmission each 25 hours for inspection.

The helicopter had four wheels, the front two castered and it had no brakes. It was not an easy chore for a 150 hour helic pter pilot, no radio, no other helicopter in Alaska, no one to rescue us if need be other than on foot.

We would land on mountain tops and ridges, the passenger would jump out, hold the helicopter to prevent it from rolling forwards, backwards or sideways, as a result of the castering front wheels. I would shut off the engine get out and chock the wheels with rocks, after which the plane table was set up and mapping would begin.

I believe that Joe Beebe and myself invented the first set of skid gear. We purchased two hardwood 2 x 4's from a one man sawmill and wired them to the front and back wheels; though slightly illegal, it was somewhat easier to land on ridges, rockpiles, tundra, etc.

We suffered two engine failures that summer; one my own fault, carburetor ice; the other borken fan belts. The rescue is another story. We were found and needed parts dropped by air, as determined by prearranged signals I had worked out with Beebe. I returned to Pelican some 24 hours after the forced landing and spent the following 12 hours picking up fishermen and village people who were looking for us on foot, 34 persons in all, ranging from 2 to 15 miles out in the bush. That day I made up my mind that living in Alaska, among Alaskans, was to be my destiny.

ERA Helicopters or its predecessors have been in Alaska each year since 1948. 1948 to 1956, summer contracts only; in 1956 our first hangar was built in Anchorage. ERA presently has 8 bases in Alaska with offices and hangars, and conducts charter and contract flights throughout Alaska. Our bases are located in Juneau, Yakutat, Sitka, Valdez, Kenai, Anchorage, Fairbanks, and Deadhorse.

From 1949 to 1953, all helicopter flights were conducted for government agencies, primarily mapping. In 1953 the oil industry began active exploration in Alaska conducting surface geology and seismic surveys. Oil was discovered on the Kenai Peninsula in July of 1957 and the rush was on.

Helicopter activity in Alaska is cyclical; some years for ERA and its competitors were poor, others good, but eacn year the preponderance of flying is complete from May to October.

Today there are some 20 helicopter operators in Alaska. Some years we are very busy during the summer months, others we are not and consequently very competitive. The winter activity is always very competitive. The industry in Alaska had its greatest expansion after oil was discovered on the north slope in 1968 and peaked in 1975 during the height of pipeline construction. In May 1960, there were perhaps 30 helicopters in Alaska, in 1975 there were more than 300, presently there are about 164 commercial helicopters in the state.

Decline in activity is primarily due to two factors, 1) the lack of offshore discoveries and this is due to two more factors (a) failure to find oil in offshore areas that have been drilled and (b) because of the delays in offering offshore leases for sale to the industry as caused by state and federal controlling agencies, delaying sales for one reason or another, permits, environmental considerations, etc.; 2) lack of onshore areas to explore. Only one percent of Alaska's land is in private ownership, the rest is federally owned, state owned, or owned by the native corporations. I'm sure you are all aware of the recent land legislation, known as D-2 which effectively locks up 32 percent of Alaska lands, 10 percent of which is highly regarded possible oil provinces by the oil industry.

REMOTE AREA PROBLEMS

Although Alaska is not nearly as remote from support services as it once was, operating there still presents problems.

1. Distances from parts supply - requiring an unusually large inventory of expensive parts and components, as well as very expensive freight charges.

2. Hangar and storage facilities for the flight equipment and for protection and comfort of personnel who fly and maintain the equipment.

3. Once a helicopter is overhauled, inspected and ready to go to work, we usually are leaving a remote area for an even more remote area. One must remember that Alaska is made up of 586,000 square miles, has more coastline than the entire USA and if a map of Alaska is overlayed on a map of the United States, it would reach from Fort Lauderdale, Florida on the east to San Diego on the west, from Houston on the south to the Canadian border on the north.

During summer months, we must provide a mechanic with each ship when it moves out to the bush from one of our bases, additionally, a large adequately supplied parts box is necessary, communications must be set up, usually requiring high frequency radios; often phones are not available.

During winter months, in addition to the above, we must provide covers for the helicopters and blades; Herman Nelson heaters, Carter heaters, deicing chemicals, etc. All helicopters must be equipped with basic flight instruments due to our long winter nights and white out conditions prevalent during the winter months.

When we operated in summer months only, an aircraft was needed to transport parts to remote areas, usually a small single engine aircraft. Presently we have a twin engine fully IFR equipped Cessna 402 that can deliver parts and supplies in all weather conditions to remote areas throughout the state, winter or summer. Another consideration is the expense involved in the employment of pilots and mechanics in Alaska. Salaries, travel and related costs are somewhat higher than in the South 48.

AERODYNAMICS AND STRUCTURES

In Alaska we have few problems with noise complaints, but many of our customers, as well as employees, would like to see a reduction in cabin area noise.

From the manufacturers, we would like to know why many of our components fail or wear out prematurely. We would like to see better warranties by the manufacturer during the 1980's. We would like to see helicopters with a longer cruise range, without reducing drastically the pay load. We would like to see helicopters that could carry, legally, a full load of fuel and fill all the passenger seats or carry the manufacturers stated cargo lift capability with more than 30 minutes of fuel.

We the operators in Alaska, would like to see improvements in all these areas.

We are disturbed by the frequency we are required to test the manufacturers' equipment in remote areas. We are tired of time life items lasting half the time they are supposed to and we are particularly tired of having parts and components back ordered simply because the manufacturer would rather sell more new helicopters than support the poor operator who just bought one.

Where vibration is concerned, we congratulate the industry on the strides they have made in recent designs which have reduced vibrations considerably, particularly in cruise flights.

FLIGHT CONTROL, AVIONICS SYSTEMS

Great strides have been made in recent years in the area of allweather operation. IFR operations in Alaska are becoming commonplace. ERA Helicopters, Inc. was first certified to fly IFR (SFAR-29) November 26, 1975, with routes in the Gulf of Alaska. We were also certified to fly on fixed floats under SFAR-29.

ERA and Evergreen Helicopters commenced flying IFR in the Gulf of Alaska in February 1977 utilizing S-61 and 212 helicopters. ERA began the first IFR flights on the north slope in November 1978. 800 minimum enroute altitude was approved in March '78 to get out of icing conditions. 200 feet and 1/2 mile airborne radar/non directional beacon approaches with transponder for rig identification was approved in July 1978.

Last summer we operated two Bell 212 helicopters supporting two seismic ships in the Gulf of Alaska and Bering Sea, Bristol Bay and Norton Sound. Hours flown on IFR helicopters thus far are as follows.

Gulf of Alaska	2,700
North Slope	1,600
Lower Cook Inlet	1,800
Norton Sound	500
Bering Sea	300
for a total of	6,900

(see attached map)

900 airborne radar/NDB approaches have been made to offshore and onshore locations. Max distance flown offshore is 250 nautical miles in the Bering Sea, utilizing Bell 212 equipped with Loran C and special long range tanks. These trips also were made to a moving target, a seismic ship.

I relate the above only because we at ERA believe that, although there is always room for improved technology, present systems are satisfactory for the missions we must complete in remote areas, except for one very important area.

I refer to "white out" conditions. As stated previously, we at ERA are concentrating on more IFR qualified aircraft and pilots. The one very critical area not covered is that of hovering in a whiteout or any other condition which creates a lack of horizon and visability. I would think there could be developed a system whereby in a hover, a pilot could identify whether or not he is moving forward, backwards or sideways and bring the aircraft to a touchdown without seeing outside. Presently, that does not exist. There have been many accidents due to this problem. ERA has had several.

PROPULSION

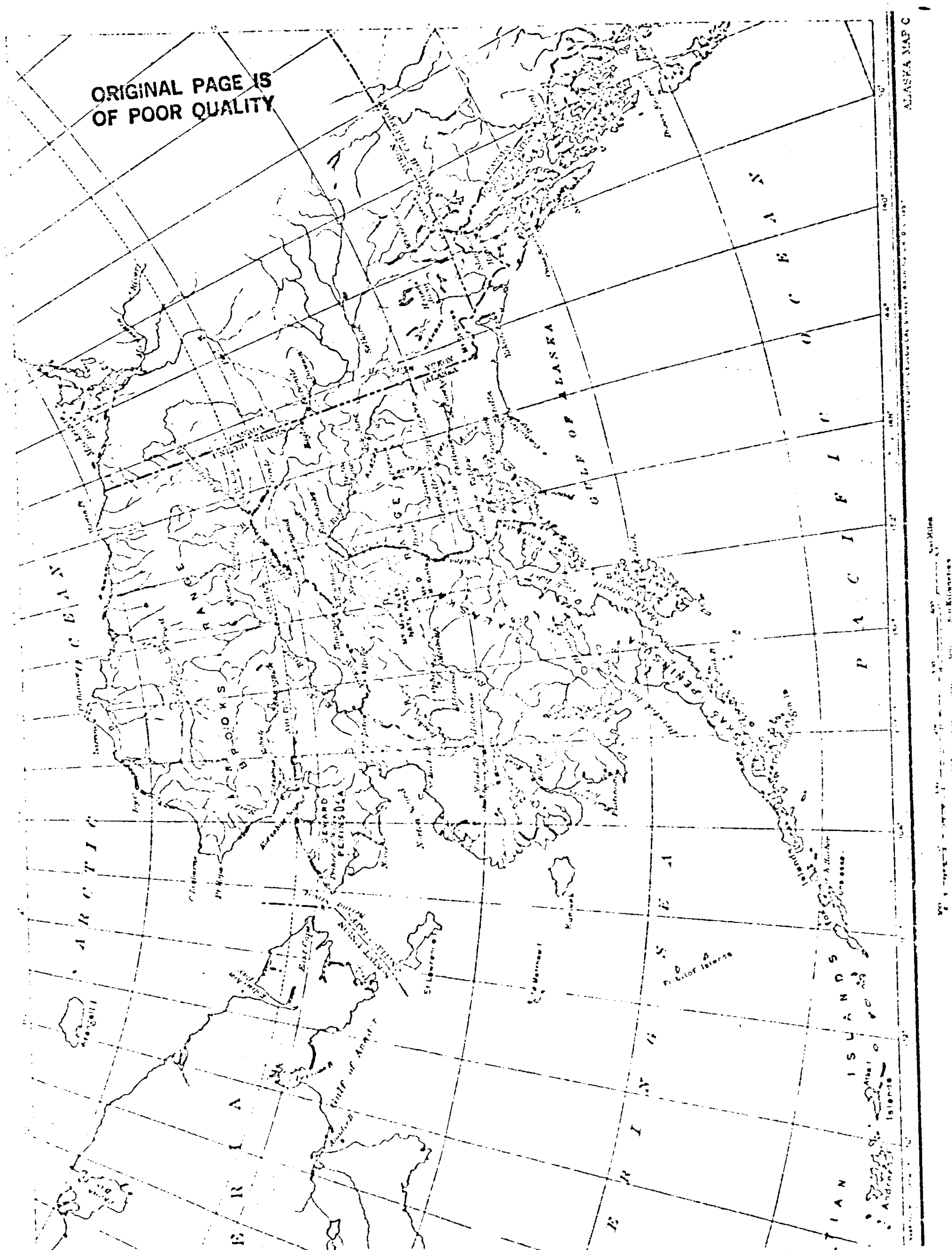
Those of us who are pilots or pilot/operators are not qualified to discuss propulsion and power transfer technology in a technical sense, at least I am not. I will state simply that we all want more dependable engines, gear boxes and combining gear boxes. We want them to weigh less, engines to have more horsepower but not at the expense of dependability. Improved inlet systems are needed where icing and snow are prevalent. This should be considered a must during the coming decade.

VEHICLE CONFIGURATION

Although I believe the manufacturers are becoming much more oriented toward the civil market than they were during the past 20 years, more attention must be given to what type of aircraft we the operators need and how it should be configured. Recognizing that the manufacturer is faced with trying to satisfy a market which includes corporate, executive, offshore, utility, agriculture, heavy lift and commuter users, it seems to me that helicopters could be designed to fit each of these categories, utilizing the same airframe and engine. Attractive interiors should be designed which can very quickly convert the aircraft from cargo to passenger and vice versa, seats which can be removed or replaced quickly; as mentioned before, we need longer range and faster cruise capability, we must carry more fuel or have engines that use less fuel, or both. Crash resistant fuel tanks are a must as are energy attenuating seats. The military has required these innovations for some time now. Another problem that I would like mention is fuel contamination. This is a serious problem in Alaska and other remote areas, I'm sure. We would like to see future helicopters equipped with adequate filtration systems so that in the event contaminated fuel was brought aboard the aircraft, the engine would continue to operate. The fact that the fuel was contaminated could be identified and corrected at a later time. Right now, if a sufficient amount of contaminated fuel is taken on board, the filters will be bypassed and the contaminated fuel will go directly to the engine and fuel control.

In Alaska we do not need frills, we do not need fancy interiors, noise does not bother us too much; what we want are simple systems, longer range, more payload, faster speeds, all consolidated into a vehicle as sturdy and dependable as a well built and maintained four wheel drive pickup truck.

Finally, this presentation began by relating to you how helicopters were regarded by the Federal Aviation Administration, then the Civil Aeronautics Agency, in 1947. Here we are 33 years later and the same attitude as displayed by that tower operator is still prevalent in the minds of some high FAA officials in Washington, D.C. They still believe anything that flies should be regulated and the pilots who fly them in the same manner as fixed wing aircraft.


ALASKA MAP C
GULF OF ALASKA
SEWARD PENINSULA

REMOTE AREA - CANADA

Nick Crawford
Vice President/General Manager
Kenting Helicopters

Biographical Resume

Nick Crawford was a naval aviator and helicopter bush pilot before becoming General Manager of Kenting Helicopters in 1970. He has a Bachelor of Commerce degree in Transportation Economics from the University of British Columbia and is a Post Chairman of the Air Transport Association of Canada.

Abstract

The operators of commercial helicopter services in remote areas of Canada utilize contemporary turbine-powered rotorcraft that were not designed for their particular operating environment. Consequently, they have encountered operating problems associated with very cold temperatures, large distances, corrosive soil elements and uncrashworthy helicopters.

They desire rotorcraft designed to perform reliably in a harsh environment. These helicopters should be crashworthy, permit easy accessibility to all systems for maintenance and repairs, possess cabin spaciousness, be able to fly medium distances at slightly higher speeds than contemporary helicopters and be able to handle utility missions.

I am pleased to have been invited to address this very important workshop to present the Canadian viewpoint on operator concerns and needs in the technological development of American Rotorcraft. In order to accomplish this task, I shall first make some general comments on the make-up and origin of the Canadian commercial helicopter fleet. This will be followed by a consideration of the characteristics of the remote Canada operating environment and a brief analysis of the commercial helicopter accidents in Canada during the last 4 years. Many of the concerns and needs of the Canadian operators will become obvious from this rather lengthy but necessary introduction and these will be expanded upon later.

The Canadian Transport Commission recently released its publication, "The Canadian Helicopter Operating Industry 1979," summarizing the events of that year. It notes that there were 815 commercial helicopters in Canada with 686 or 84 percent of these being turbine powered. Of the 686, 544 were light turbines and only 39, or 6 percent of the total fleet, were of multi-engine design. All but 47 or 6 percent of the total were designed and manufactured in the United States. Therefore, the concerns expressed in this presentation are with the American product and desirable improvements in it.

The helicopter operating environment in the remote areas of Canada is extremely demanding of both man and his rotorcraft. It is a region that begins roughly at the Arctic Circle in the West and the 60th parallel of latitude in the East. It extends North to the Canadian territorial limits in the vicinity of the 84th parallel, and encompasses an area of over 2 million square miles. The cold climate, the great seasonal changes in the hours of daylight, great distances, and corrosive soils impose the major hardships on helicopter operations.

The prime feature of the climate is very low temperatures which can range from a relatively mild mean annual of 10°F to a more extreme mean annual of -20°F. Daily extreme highs and lows can range from 80°F in the southern summers to -80°F in the northern winters. Wind chill factors can drop below -100°F in the extreme North. Seasonally, there are short cool to cold summers and long to very long cold winters. Precipitation is generally light and much of the region could be classed as an Arctic desert.

At the 75th parallel, the sun makes it first appearance over the horizon in early February and disappears from view near the end of September. Late in April it rises above the horizon for a period of about four months. Daylight restricts the operating season from a start in early March to an end in late September, causing severe peaking problems in the interim.

The vastness and remoteness of this region makes distance a major consideration in ferry trips, stage lengths within the area, and logistical support. The most northerly permanent outpost is Alert on Ellesmere Island, a distance of 2400 miles from Calgary. For comparative purposes, Honolulu is 25[illegible] miles from Los Angeles. Allowing for course deviations due to fuel availability and enroute weather, a contemporary light turbine helicopter will take 24 flying hours to make the trip from Calgary to Alert and 18 - 20 hours to Rae Point or Resolute on the 75th parallel. Enroute [illegible] are few navigational aids as these are clustered near the small settlements that receive regular commercial airline service. Within the operating area, stage lengths can be up to 600 miles and this requires the caching of fuel along the routes, a chore usually accomplished with a STOL aircraft. Most of the turbine fuel utilized in the area arrives by summer sea-lift and is only moderately more expensive at the beaching point than southern fuel prices. However, fuel airlifted from the beach inland can be extremely expensive.

Spread thinly over the permafrost in the Arctic and sub-Arctic areas are sedimentary soils that can be very corrosive to rotorcraft. These small ground-up rocks are very common in the Arctic Islands where main rotor blades, tail rotor blades, engine compressor blades and painted surfaces suffer whenever a helicopter lands on a dry exposed soil surface.

In Transport Canada's Aviation Safety publication "Vortex", issue 7/80, and analysis of the 365 helicopter accidents that occurred in Canada between January, 1976 and March, 1980 revealed that engine failures, collisions and loses of control were the primary casual factors in approximately two-thirds of the cases. Engine failures accounted for 101 or 28 percent of the total, revealing a high degree of powerplant unreliability. Collisions with wires, poles, trees, the ground, the water, snowbanks, buildings, vehicles, other aircraft in the air, other aircraft while taxiing and miscellaneous objects caused 88 miscues or 24 percent of the total. Fifteen percent, or 53 of the accidents, resulted from losses of control in flight (other than stalls), losses of directional control on the ground or water, and losses of altitude control due to settling.

These primary causes resulted in 207 secondary events, most of which damaged the helicopter involved. For example, 76 suffered hard landings, 44 rolled over, 19 collided with trees, 7 made uncontrolled impacts with the land surface, 4 nosed over, 2 suffered tail rotor failures and 2 experienced complete landing gear failures. None of these rotorcraft were crashworthy.

The operational problems, concerns and requirements of commercial rotorcraft operators in the remote Canadian environment can be summarized under the headings of reliability, crashworthiness, accessibility, spaciousness, range, speed and utility.

1. Reliability

Our rotor systems and airframes are not reliable. We're experiencing too many bonding failures in both tail rotor and main rotor blades. Vibration levels are causing failures in other systems, notably avionics and aircrew. Door latches and doors are too flimsly and complicated in design, causing each door to lose its fit, and in cold temperatures we need tight doors. Sidewindow demisting is inadequate in all helicopters and most of the cabin heating systems lack the necessary capacity. Much of the honey-comb structure cannot stand up to operational wear and tear. We want; improved quality control from the manufacturers in the production of all components, redundant systems, and incipient failure warning systems for all gearboxes. Resistance to harzardous environments should be designed into the rotor craft. For example, corrosion resistent leading edges on rotor blades used in arctic operations. Skid gear is the most reliable landing gear in this environment and it should be designed to minimized drag. Flotation gear is preferable to fixed floats if it can be designed to function properly in the cold temperatures.

Our single engine propulsion systems are not reliable. They suffer from poor intake air filtration, bearing and seal failures, carbonization, fuel flow governor malfunctions and, in some cases, approved times before overhaul that are too high and unrealistic. We want multi-engine reliability, warning devices to alert us of approaching failures and their origins in the system, power available indicators, good fuel consumption, and integrated particle separators fully functional in falling snow.

The reliability of flight controls could be improved by removing the problem that some helicopters now have of insufficient tail rotor control to maintain direction at altitude. Standardized cyclic controls and load scales would also allow for more safety in the cockpit.

The use of flexible insulated wire with a fiberglass component in it that resists cracking due to extremely cold temperatures can make avionics and electrical systems more reliable. The effect of airframe vibrations can be reduced by using crimping instead of solder joints at connections, by using snaps instead of threads on cannon plugs and by mounting avionics equipment of rubber shocks designed to absorb both horizontal and vertical vibrations. While VLF/Omega navigational systems are now being utilized, the area is ideally suited to satellite navigation when it becomes a commercial reality.

2. Crashworthiness

We would like to see crashworthy fuel cells, crashworthy seats for both aircrew and passengers, and shoulder harness as standard equipment in all of our contemporary helicopters. In future models we hope to see crashworthy cabin structures, tail rotors mounted high above the surface to avoid strikes, tail rotor blades with high resistance to damage, and landing gear systems designed to take significant shocks on contact with the surface. There have been instances of main rotor blade segments entering the cockpit during accidents and we hope that the probability of that type of event can be designed out of the system.

3. Accessibility

In a very cold environment, the helicopter maintenance men need easy access to all systems to be able to accomplish rapid field servicing and repairs. The openings should be large enough to allow a man in a parka to be able to comfortably reach into the interior of the fuselage.

Starting systems and fuel caps on helicopters used in remote area operations should not require the use of a key. Pity the poor pilot at a fuel cache who loses his key in the snow.

4. Spaciousness

Contemporary helicopters lack the space required for all of the extras carried in a remote area operation. Where do you place the survival equipment, the refuelling equipment including the many filters required in Arctic region refuelling operations, the extra fuel required for the long ferry flights, and the additional avionics equipment and maps necessary for safe flights in the area?

New helicopters should accomodate six persons and all the extra gear mentioned above as well as providing a roomy well designed cockpit. There should be no partitions in the cabin, a flat floor, removable seats, and ample baggage space in aft compartments.

How can a pilot function effectively and safely in a small cockpit where his freedom of movement is hampered by the bulky arctic survival clothing that he and his passengers are required to wear?

5. Range

Increased range is essential to counter the demands of distance, the costs of establishing fuel caches and downtime for refuelling. A range of 400 miles plus VFR reserves on standard tanks is desirable. Crashworthy long range tanks should be designed into all new helicopters with potential in the Canadian environment. Auxiliary fuel tanks should be crashworthy, of a quick disconnect design and mounted externally, possess good aerodynamic qualities so as not to induce drag.

6. Speed

Time passes rapidly in the operating season and contemporary helicopters lack speed as well as range. A cruising speed of 140 miles per hour at maximum gross weight is desirable.

7. Utility

Aside from the seasonal off-shore oil and gas exploration drilling in the Beaufort Sea and Davis Strait, most helicopter operations in the Arctic are of a utility nature. Wildlife surveys, fishery surveys, geological surveys and a wide variety of scientific studies require the helicopter to move passengers or sling cargo.

I have reserved comments on desirable vehicle configurations, reasoning that the characteristics of this operating environment demand a consideration of the previous seven points in any design studies of rotorcraft to be operated in remote areas of Canada.

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ENERGY EXPLORATION/PRODUCTION

Lonnie R. Nail
Transportation Manager
Tenneco Oil Exploration & Production

Biographical Resume

At present is Regional Transportation Manager for Tenneco Oil Exploration and Production, based in Lafayette, Louisiana. Responsibility includes both air and water logistics for the entire Gulf of Mexico. Operations are spread from Corpus Christi, Texas to Tampa, Florida serviced by a fleet of 52 boats and 26 helicopters with an annual budget in excess of 56 million dollars.

A pilot and mechanic who is active in both National Business Aircraft Association, technical committee and Helicopter Safety Advisory Conference chairing committees on military liaison and passenger briefing.

He is a graduate of Northrup Aeronautical Institute and Eastern Michigan University with a B.S. Degree in Applied Mathematics. He is a member of the Society of Logistical Engineers. He has served as industry spokesman to the F.A.A., Pentagon and other interested groups.

Abstract

The helicopter has matured in the Oil Field. It is recognized as a cost effective means of transportation. The oil industry will provide input as to its needs and offers to share flight operational data. Safety is still of prime importance, closely followed by productivity. Gulf of Mexico IFR now permits 97.6% of missions started to be completed. Vibration and noise levels in 2nd generation helicopters are adequate.

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The intensified search all over the world for additonal petroleum reserves has forced certain logistical concepts to be changed. As the costs of drilling, support and related services escalate, it is well stated to say that "time is money," hence our reliance on the helicopter to save time as well as being a cost effective means of transportation.

The helicopter for our use has evolved from the "Bell 47" to the "Boeing Chinook." From a slow noisy machine to one offering airline comfort. With the equipment changes, our operating policies and procedures have also changed. Our people spend a lot of time in the air so their safety and comfort is important to us.

When the helicopter was introduced to the Oil Patch it was at first considered a luxury, an alternate to boats, or surface transportation and was not appreciated as a cost effective tool.

Along the same line of reasoning, the manufacturers and operators did not appreciate what the helicopter demands of the future would comprise. For many years all we had to use was a "civilized" military machine. The attitude was that, if it was good enough for our troops it had to be good enough for our oil field workers, since they would tear up anything nice.

I would like to state very clearly that that sentiment "won't fly" anymore. We want the safest, best, most cost effective helicopter we can obtain. As a user industry, we intend to make our needs known, and as has happened already, the foreign manufacturers are the only ones listening. Our flight experience gained in actual usage, should provide the best data base possible. Our company alone logs almost 3,000 helicopter flight hours every month, so we are able to model on our computer actual analysis of all operational parameters. We can test a new machine for our flight program without even flying it.

What would we like N.A.S.A. to address in the future? The key areas are outlined in the Task Force Report, however, our priority differs somewhat. From our viewpoint, we would list them this way:

1. Safety
2. Productivity Improvement
3. Reliability and Maintainability
4. Fuel Consumption
5. All Weather Capability
6. Flying-Ride Quality Improvement
7. Vibration Reduction
8. Noise Reduction

SAFETY

In behalf of the people riding in the helicopters, safety must receive priority. Safety to us implies the structural integrity of the complete ship. No catastrophic failures, no surprises. We have been down this road with "T-T" straps, turbine blades and salt corrosion. The importance of safety cannot be over emphasized.

PRODUCTIVITY IMPROVEMENT

This is a function of speed and size. Our lowest S/C/M helicopter happens to be our largest and fastest. Over the years we have found the optimum size for Gulf of Mexico operations to be 12-18 passenger. A helicopter of this size capable of speeds in excess of 250 MPH would be ideal.

We do not see an application for the tilt wing or very large helicopters in the Gulf at this time.

RELIABILITY AND MAINTAINABILITY

Some of our helicopters are based offshore. These especially need ease of maintenance. Component reliability is like safety, you can't have too much.

FUEL CONSUMPTION

With all other factors equal we will use the most fuel efficient machine. It is not in our company's or the nation's best interest to waste fuel. This is why we do not see a place for surface effect vehicles in the Gulf of Mexico.

ALL WEATHER CAPABILITY

Certain areas, Alaska, North Sea and other remote locations, encounter severe weather conditions. In the Gulf of Mexico our present IFR capability has permitted us to complete 97.6% of the missions attempted. Present capabilities, although backward when compared with fixed wing aircraft, are proving adequate. What we have found to be essential is better understanding by the F.A.A. of our problems and capabilities.

FLYING-RIDE QUALITY IMPROVEMENT

We believe the standards available in current 2nd generation helicopters to be adequate.

VIBRATION REDUCTION

The vibration levels of 2nd generation helicopters appear acceptable to our passengers. The part vibration plays in pilot fatigue and fatigue of structure should be addressed.

NOISE REDUCTION

All our flights are over open seas or remote areas. We should not compromise safety for the sake of less noise. A drill rig or production platform is not a quiet place to work and our people recognize a certain level of noise is necessary to get the job done.

WHERE DO WE GO FROM HERE

The simple answer is into deep water further and further out. By 1985, drilling and production will be in water in excess of 1,200 feet and 200+ miles offshore. By 1990, we could be at 2,000 feet and 300 miles offshore. By the year 1995, we could be in 2,500 feet of water and 400-500 miles offshore. Where will it end? Well probably no one knows the answer to that question.

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CORPORATE/EXECUTIVE

John A. Anderson
Corporate Aviation Manager
Digital Equipment Corporation

Biographical Resume

John Anderson has been involved in aviation for over 25 years. Following a 10 year career as a U.S. Naval officer and pilot, he spent 5 years as an experimental test pilot on rotary wing research programs. He currently manages a world wide corporate flight department that flys over 10,000 flight hours annually. He is an Associate Member of the Society of Experimental Test Pilots, is the current President of the New England Helicopter Pilots Association, and was named the 1980 Professional Pilot of the Year by Professional Pilot magazine.

Abstract

Digital Equipment Corporation operates an internal "commuter" airline that currently consists of 9 rotary wing and 6 fixed wing aircraft, and moves over 80,000 passengers annually. By the mid eighties, the rotary wing group will nearly double in size, moving approximately 150,000 passengers per year.

The purpose of the operation is to facilitate "true" communication among our employees, which we believe can only occur when people relate face-to-face.

The growth of the operation is paced primarily by the growth of the Corporation, but is limited in capability by the current technology of aircraft and support systems. The national airport and commercial air transportation systems have progressively deteriorated in value as airports become more difficult to transit and airlines reduce frequency of flights to smaller airports.

Digital needs a high speed, pressurized, vertical lift aircraft capable of operating between facilities that range from 100-900 miles apart. This aircraft must be supported by a navigation system that permits high accuracy approach guidance to many non-airport locations.

It is believed that vehicles such as the tilt-rotor can meet this need, and that systems such as NAVSTAR can provide the required support.

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DIGITAL EQUIPMENT CORPORATION, headquartered in Maynard, Massachusetts, employs over 57,000 people worlwide in over 500 facilities. Its formulas for success include a strong requirement for clear, concise, and complete communication, both internally among its employees, and externally with its customers and vendors. At DIGITAL, we believe that true communication can only take place with face to face interaction, and it is in support of this belief that the aviation department was born, and has grown in proportion to the corporation.

Today, the aviation group manages 9 Bell 206B Jet Ranger helicopters, 2 Beechcraft Super King Air 200's, a Merlin IV, a Westwind 1124 Jet, a DeHavilland Twin Otter, and 2 Piper Aztecs. This fleet, in conjunction with a broad local vendor base, transports 80,000 passengers each year, flying more than 10,000 flight hours. Although the operation is a Part 91 service for company business only, in terms of passengers carried, DIGITAL is the 30th largest commuter airline in the United States.

Looking ahead into the eighties, this operation is expected to nearly double in size, both in equipment and capability. Our next generation of short range (20-100 miles) rotary wing aircraft will be twin engine units in the 5 passenger size category. Our requirement for flexibility and service to multiply destinations is expected to minimize our need for larger helicopters, although a few of these units are likely to be placed in service.

Our helicopter system is operated VFR only, primarily because of the limitations imposed by the lack of adequate navigation and approach aid systems. Although we only lose about 9 percent of our flights to weather, we anxiously look forward to the economic resolution of this shortcoming. DIGITAL employees plan their day around our schedule, and we seriously disrupt business when we don't fly. We strongly support advancement of the NAVSTAR navigation system!

A less obvious problem, but potentially having far more impact, is the progressive deterioration in the national airport and commercial air service systems. As the major airlines focus on the larger cities, these airports become increasingly difficult to use due to congested ground traffic and overloaded airline support systems. The bottom line of this to DIGITAL is long frustrating days in cars, taxis, airports, and overcrowded airliners. In spite of this, we have consistently adhered to our policy that we do not attempt to compete directly with the airlines, and will not operate scheduled aircraft on routes that are covered by direct airline service. We do however, operate our own "airline" routes to destinations that create a payoff to us in valuable time saved.

I should insert at this point that the DIGITAL "airline" is available to all employees without regard to position or organization, and is provided on a first come, first served, reservation only basis, with no "bumping" allowed.

To illustrate our reason for existence, I would like to use as an example our scheduled service between Hansom Field in Bedford, Mass. and Kanata, Ontario. (Illustration 1.) Thirteen round trips each week are offered in a Beechcraft King Air, taking just over an hour flight time one way. At each end of this trip is a 1/2 hour ground trip, totalling a 2 hour journey. By comparison, to make the trip via commercial air, one has to travel by ground to Logan Airport in Boston (through the "famous" tunnel), cope with the airport, fly to Montreal, change aircraft (with an average wait of 1 hour), then on to Ottawa. This trip takes nearly 6 hours, and essentially destroys a business day.

These are 2 possible ways to make this trip. We believe that there is a better way! The old rule is that "the shortest distance between 2 points is a straight line." We would like to extend the operating philosophy that has been so successful for us in our rotary wing operation and provide door to door service out to 900 miles or more. To do this, we support continued development of the tilt-rotor concept!

Our specification for such a vehicle would be as appears in Illustration 2.: A twin engine, pressurized VTOL aircraft with valid single engine safety at gross weight (i.e.: Category A certified), cruising at 300 knots, with a weather topping service ceiling of 25,000 feet. This 8-15 passenger aircraft, piloted by a crew of 2, will feature a jet smooth, jet quiet ride for the passenger, and will be barely heard by neighbors adjacent to our facilities. This is a critical point-noise standard that currently exists and may be acceptable for airport environments, but we will have to do much better to operate successfully in Mr. and Mrs. USA's back yard. DIGITAL plant locations are selected to integrate harmoniously with the community, with a high priority placed on minimizing the hassle of employee commuting. Generally speaking, DIGITAL plants are not industrial parks or in remote locations.

This aircraft must be reasonably economical. A $400 per hour (1980 $) direct operating cost (DOC) would translate into a cost effective vehicle for use on our routes.

And finally, as I referred to earlier, such a vehicle must be supported by a navigation/approach system such as NAVSTAR.

At this point in time, our operation is somewhat unique, but I have to believe that our methods will become more commonplace as corporations react to the limitations imposed on them by our national transportation system. The pace of this process will be directly related to the technological progress of the VTOL aircraft industry, which to no small degree is in the hands of many people attending this workshop.

I encourage you to respond to our needs.

MAYNARD-KANATA SERVICE

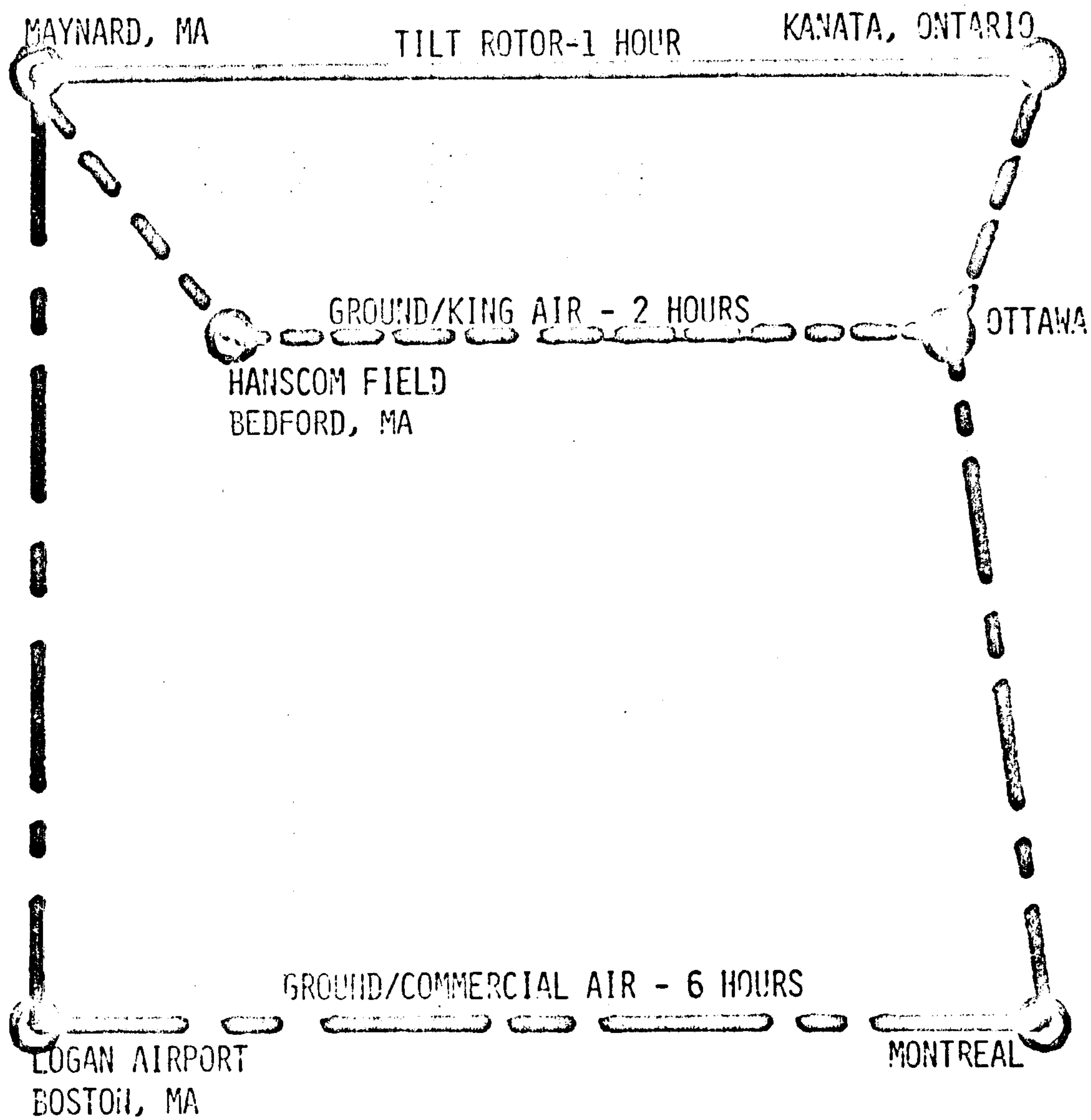

ILLUSTRATION 1.

DIGITAL EQUIPMENT AIRCRAFT ON THE EIGHTIES

"MODEL SPEC"

- VTOL CAPABILITY
- TWIN ENGINE
- 300 KNOT CRUISE
- 25,000 FOOT SERVICE CEILING
- 8 - 15 PASSENGERS
- CREW OF 2
- SMOOTH RIDE
- QUIET !
- $400/HOUR DOC
- NAVSTAR AVIONICS

ILLUSTRATION 2

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HEAVY LIFT HELICOPTERS

James Lematta
Director of Safety
Columbia Helicopters, Inc.

Biographical Resume

One of the original partners with Columbia Helicopters dating back to 1957, the year Columbia started business. Holds Commercial Rotorcraft Rating in U.S. and Canada. 6,000 hours total time, 3,000 hours - external-load operations, majority in large helicopters. Flew on first North American logging project. Flew on first Canadian powerline construction project. Flew first water bucket on a forest fire. Member HAA Safety & External-Load Committees. Chairman on HAA F.A.R. 133 Rotorcraft Regulatory Review Program.

Abstract

Discussion of heavy lift helicopters (rotorcraft) in the commercial market with Columbia Helicopters, Inc. as case study. Aspects include logging, power line, and oil exploration. Problems encountered in these heavy lift operations are detailed with suggestions for the future.

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During my presentation, I use slides showing Columbia's major heavy lift operations. . . along with cartoon illustrations representing heavy lift operation problems.

Figure #1: Vertol 107 hauling logs

Helicopter logging has been Columbia's primary business for the last nine years. We operate eleven Vertol 107's; normally we use seven vertols for logging. The majority of these projects are in the Nothwest, including Alaska and Canada. We have also had logging projects in Southeastern USA.

We average approximately nine flight hours per day per aircraft, which represents approximately 8,000,000 pounds daily, averaging 950 trips per day.

Figure #2: Vertol on power line construction project

Power line projects represent around 20% of our business. We have been doing these types of projects for 20 years.

Figure #3: Vertol on Jungle oil exploration project

Columbia has been on oil exploration projects in New Guinea, Peru, Sudan, Alaska, and presently in the Gulf of Mexico.

These projects get maximum utilization from vertol capabilities by carrying both external and internal cargo, plus passengers.

My program continues on to point out problems heavy lift external-load operators encounter, along with possible solutions. Also included are recommendations as to what Columbia feels would be improvement for future helicopter operations.

Figure #4: Slinging heavy load with single line

The heavier the load, the more difficult it becomes for ground crews to assist in landing the load. In the future, as our helicopters become larger, the pilot will need assistance on handling these loads by more positive control. New inventive guide systems will need to be applied to replace ground crews.

Figure #5: Heavy load slung by multi-lines

Future helicopters will need multi-lines, such as the Chinook helicopter will have.

Figure #6: Shows problems pilots have while flying, looking out bubble to observe load

It is paramount that the pilot is able to observe their load. Presently, this is done by leaning over and looking through a bubble that replaces the left cockpit window. Present day helicopters were not designed for this, which creates physical problems for some pilots.

Figure #7: Shows H.L.H. type helicopter with A[illegible] pilot station

By having the crane pilot's station aft of load, he certainly would be more comfortable and able to observe the whole operation. The concept where the pilot sits facing aft is not feasible to commercial operations. Columbia did a comparison test with one pilot faced aft and the other looking out the bubble. The pilot looking out the bubble was approximately 80% faster.

Figure #8: Strong rotor wash with heavy loads

Chances of injuring ground personnel and damaging property is high. The larger our helicopters get, the more our chances of rotor wash accidents increase.

Figure #9: Shows comparison of downwash - single rotor vs tandem rotor

Columbia discovered years ago that rotor downwash was dispersed better with tandem rotor aircraft.

Figure #10: Shows man getting static shock

An ever constant problem is static electricity.

Figure #11: Shows hook being grounded

Presently we dissipate this charge by grounding hook. Not all times can this be done. We need to research a better solution to this problem.

Figure #12: Shows single engine out

At high density altitude, single engine performance is marginal. Future helicopters need to be designed with more emergency performance.

Figure #13: Shows H.L.H. type helicopter with removable cabin

Heavy lift helicopters should not be designed just for external loads. Commercial operators must have a product that can carry both internal and external cargo, plus passengers. We have discovered these capabilities to be an invaluable asset while supporting the petroleum industry.

Figure #14: Shows multi-lift concept

For those projects where the lift is too heavy for one aircraft, a good safe multi-lift concept needs to be designed. Perhaps with present day electronic technology this method is practical.

Figure #15: Shows helicopter rotors driven by engine exhaust thrust

A revolutionary breakthrough would be eliminating those heavy, noisy, power robbing transmissions. We would have greater payload and less cost of operation.

CONCLUSION

Even though our major helicopter manufacturers have designed and built small and medium size helicopters for the commercial market, we have yet to see heavy lift helicopters that were not an offshoot from military design or requirements. If our helicopters are to be competitive with conventional lift methods, future heavy lift helicopters must be simplified in nature and have high cruise speed.

Construction costs have climbed tremendously because of environmental restrictions and labor costs. Because of this, helicopters will become the major heavy lift machine in power line construction and other lift applications. When this happens, let's hope the cost of operating a helicopter will not be so totally unreasonable, because everyone will be affected by these costs.

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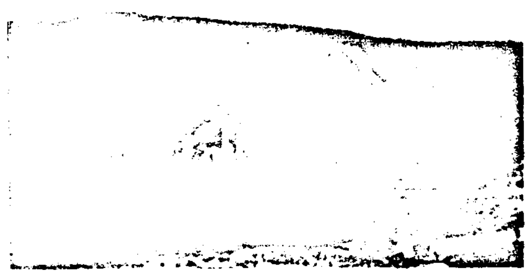

Figure #1

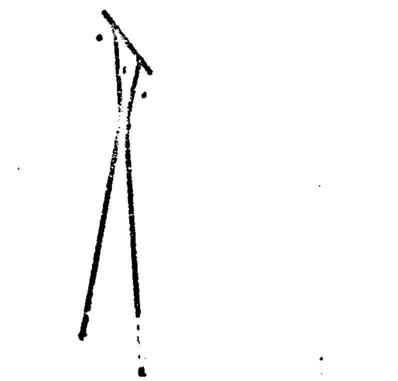

Figure #2

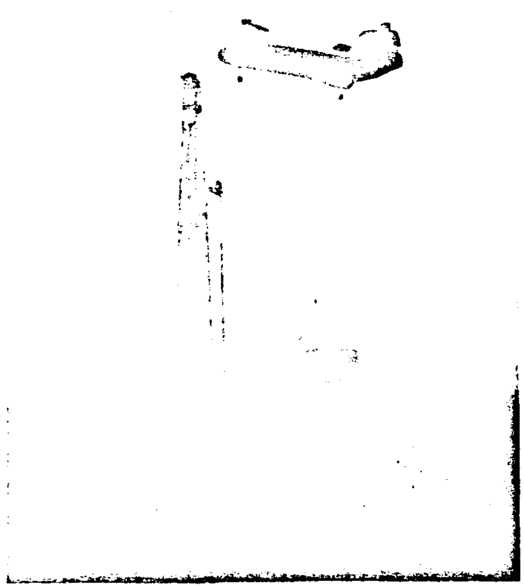

Figure #3

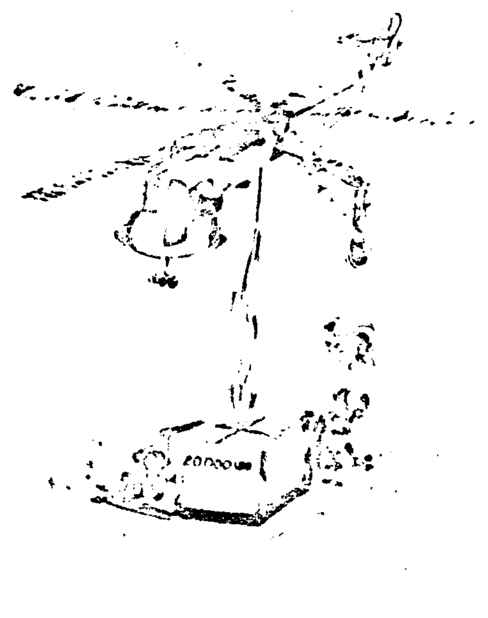

Figure #4

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Figure #5

Figure #6

Figure #7

Figure #8

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Figure #9

Figure #10

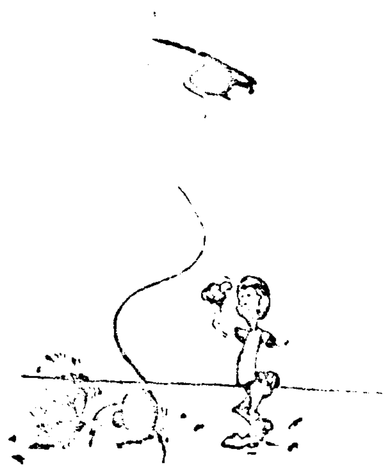

Figure #11

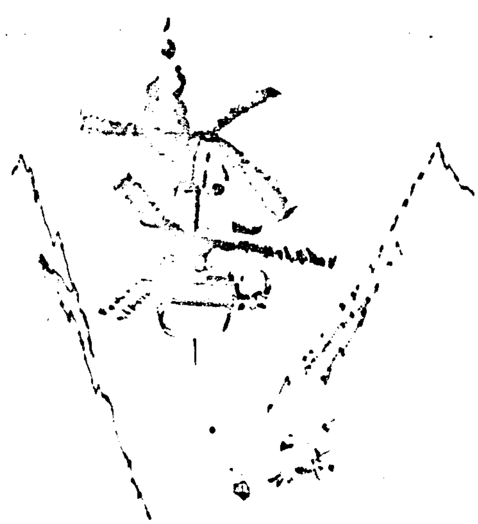

Figure #12

Figure #13

Figure #14

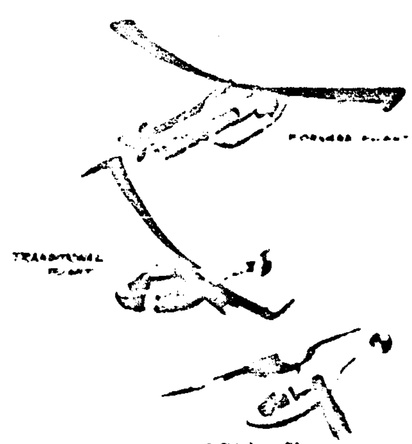

Figure #15

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AGRICULTURE

Walter N. Attebery
President
Condor Helicopters & Aviation, Inc.

Biographical Resume

Walter N. Attebery, 58, founder and president of Condor Helicopters and Aviation, Inc., Oxnard, California, also is president of Arctic Air Service, Inc., Anchorage, Alaska. A licensed pilot since 1940 and a U.S. Marine Corps fighter pilot from 1942 thru 1945 when Attebery retired from active duty as a Major. Graduated from Oregon State College (now OSU), Corvallis, Oregon with a Bachelor of Science degree in 1947 and then spent 11 years as a special agent with the FBI before entering the helicopter business in 1959. Past president of the Helicopter Association of America (1964). Condor Helicopters has engaged in general helicopter contracting and aerial application since 1965. Walt and Pauline Attebery have 3 grown sons all residing near their home in Ventura, California.

Abstract

The contribution of rotorcraft to a quality harvest in agriculture is discussed, including aerial application, granular application, frost control and air circulation. Minimum drift and reduced noise pollution are seen as advantages. Significant increases in agricultural productivity can result from helicopter (rotorcraft) utilization.

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I am indeed privileged to be included with such a distinguished panel presenting views to an assemblage of operators, engineers, manufacturers and rotorcraft experts representing the mainstream of our industry.

Agriculture without the glamour and public acceptance, in some instances, as our other endeavors such as off-shore, external lift, exploration, ambulance and commuter is still a bread and butter operation for many of the operators. This renders out to commercial success for the operator and contributes to quality harvesting for the farmer-grower. The end result is greater yield of foodstuffs for the ultimate consumer.

Our good friend, Joe Mashman of Bell Helicopters, in 1945 test flew the first aerial application unit on a Bell Model 30 and helicopters were introduced to aerial application. From that beginning its growth as a foe of the 686,000 known species of insects and 9,000 species of ticks and mites numbering in the multi-billions per specie is impressive as is the control of weeds and grasses costing farmers more than 3 billion dollars annually.

The helicopter is a newcomer compared to fixed wing application which dates to 1927, but without drawing comparisons, both methods are useful, productive and usually cost effective.

When acreages are confined by windrows, topographical obstructions, wind machines and subdivisions, the helicopter is up to the challenge.

For many areas, such as Southern California, commercial and domestic subdivisions are encroaching on the green belts of row crops, orchards and even grain fields creating drift and noise pollution complaints difficult to control for the operator. Turbine helicopters in our experience generate fewer noise complaints and for the chemical salesman ease market resistance.

Penetration provided by helicopter spray is well known and useful in orchard spraying and the control of blight and other pest-induced problems in leafy vegetables.

Granular applications of fertilizer, baits, seed and liquids using externally slung buckets and tanks adds another dimension for the helicopter from the Bell 47, Hiller 12E models up through the larger machines manufactured by Bell, Hughes, Aerospatiale and Sikorsky.

During the period December through March, frost control becomes a helicopter market in California and some other states.

The wind machine was invented in Middlesex, England during the 1700's and was designed to move odiferous air from the holds of ships. In 1914, a prominent materological physicist suggested artificial mixing of air could provide frost protection. The first wind machine was built and installed in California in 1916.

Citrus growers in California were the first group to make extensive use of wind machines. By the time the first wind machine was being installed in Florida (1952), there were 4,000 in operation in California. A 1972 estimate placed more than 10,000 wind machines in California and Arizona and around 1,000 in Florida.

Escalating fixed operating costs make growers less able to sustain a crop loss due to frost or freeze, leading to frost control installations. Capital investment in the machinery, its maintenance and the electric standby charges for electric driven machines, and fuel costs for oil and gasoline burning machines has brought the helicopter into the air circulation business.

Helicopters best suited for frost control are the larger heavier gross weight machines with rotor systems moving the maximum volume of air. Often after sunset, the atmosphere becomes layered as warm air rises, leaving a layer of cooler air between the warm air and the ground. The warm air rises until it encounters air of the same temperature. In a condition of this type, particularly if it is a low ceiling inversion where the air just above the tree level is warmer, the helicopter can move the warmer air down mixing the inversion levels, thereby warming the crop.

Many newly planted groves of avocados and citrus are protected now by helicopters, the grower realizing that standby and flight charges are less than wind machine costs. In many large orchards, covering the area is impractical by any other means. The average wind machine will cover 10 acres while one helicopter, depending on its size, can control temperature conditions over 150 to 400 acre areas. The wind machine rotating in a vertical or nearly vertical plane does certainly circulate air but without the horizontal plane component provided by the helicopter. Agricultural developers and speculators today often resist the permanent wind machine investment to cover 3 to 4 months protection and opt for tne helicopter that is no longer a financial burden when the frost season concludes.

Operators in agriculture will always need greater lifting capacity in a helicopter that is maneuverable, hopefully as quiet as the state of the art will permit and at a capital acquisition cost commensurate with the economics of his business. This latter element may very well keep the ag operator where he is "equipment wise." Application rates, though rising annually, have not kept pace with industry equipment, fuel and support equipment escalations.

As in the nuclear power field, the public is not realistic when they believe beneficial insect and nature-evolved methods of pest control can be totally effective. If this land of ours was in its natural state, then the balance of nature probably could prevail. The tilling, planting and force feeding of untold millions of acres makes such idealistic solutions unworkable. Organic foods are great, but can they feed the world?

Regulations, as strict in California as any place in the U.S., at first seemed impossible but are manageable. Total closed systems for mixing and loading chemicals is a reality in California and many other states.

I have touched on noise as a problem and it is necessary for the industry and NASA to address these additional problem areas:

1. Smaller, lighter, more reliable power plants providing more power. Less weight, which means more spray capacity.

2. Better methods and quality control on the design of main rotor blades and tail rotor blades to reduce external noise and to inhibit corrosion and lamination separation. Rotor blades rarely run their overhaul interval.

3. Revising overall manufacturers attitudes that operators must pay for, buy if you will, their engineering deficiencies.

Over 150 operators and well over 500 helicopters are providing agricultural services throughout the U.S., doing what we believe to be a significant service for the American consumer. With the support of the manufacturers and the legislators this segment of our industry will continue to grow and prosper.

Thank you.

AMBULANCE

Kenneth F. McFadden
Marketing Director, Evergreen Life Line
Evergreen Helicopters, Inc.

Biographical Resume

Currently serving as Marketing Director for the Life Line Division of Evergreen Helicopters, Mr. McFadden has worked to develop the Emergency Medical Helicopter Program at Evergreen. His previous marketing experience includes nearly ten years in the retail and insurance industries. A fixed and rotary wing pilot, he has flown a broad spectrum of aircraft. He received a Bachelor of Science Degree in economics and mathematics from Portland State University and has completed graduate studies toward his Master's Degree in economics.

Abstract

The military utilization of technology to reduce casualties is a documented fact. The reduction in time between a trauma injury and definitive care from World War I to the Vietnam conflict contributed significantly to a reduction of the mortality rate from 8.75 to 1.3. The civilian applications, however, have yet to be nearly so dramatic. Certainly a well trained and responsive Emergency Medical Service is a vital community asset. But the past four years have seen an increasing perception of a complete EMS system as one that includes helicopter transport. As the civilian industry assumes greater role, demand for more advanced aircraft increases. The history of aeromedical evacuation reflects an adaptation of existing aircraft designed for purposes other than a medical mission. Newer second, third and yet to come aircraft generations with advanced technology may lend themselves to better perform the life saving function of the older proven workhorses.

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HISTORY

In 1970, the University of Maryland Shock-Trauma Unit inaugurated a joint law enforcement Med-Evac program in the State of Maryland. The Maryland Institute of Emergency Medical Services (MIEMS) pioneered a clinical study of the life saving qualities inherent in a helicopter transport system. In 1972, St. Anthony's Hospital in Denver, Colorado and Florida Hospital in Orlando, Florida both initiated hospital sponsored helicopter programs. The ability of St. Anthony's to maintain the dedication of its program to medical purposes may have contributed to the longevity of that particular program.

Also affecting the civilian sector has been the general acceptance of helicopters as medical transport vehicles as projected by the MAST program. The result of a joint DOD, DOT and HEW study conducted in 1969, the Military Assistance to Safety and Traffic program was designed to supplement the existing EMS system. Utilizing existing military aircraft, primarily UH-IH's (Bell 205A1's), the helicopter service was available to the community subject to several constraints. As the importance of the relationship of time to the probability of survival of trauma patients became more defined, the demand for more responsive, more medically acceptable and more refined aircraft became apparent.

INDUSTRY DEMANDS

The lessons learned by the various users reflect certain consistent annoyances that could be observed in virtually any airframe currently in use. Most noticeable are:

A) The external noise signature of the helicopter evoked unfavorable public response.

B) The internal noise level and associated vibration levels were bothersome.

C) Cabin configuration did not allow optimal patient access or attendant comfort.

D) Aircraft has high rate of fuel consumption.

E) Civilian aircraft had no IFR capability.

F) Ineffective or nonexistent anti-icing systems.

These respective areas have been addressed in the context of the Advanced Rotorcraft Technology Report, dated October 15, 1978. Specifically, NASA has identified as a goal the reduction of the noise footprint intensity of from 85-95 EPNdB to 75-85 EPNdB for improved community acceptance. NASA has also identified as a goal the reduction of vibration from 0.1 - 0.3g to 0.01 - 0.05g for improved passenger acceptance and comfort. Additional emphasis has been placed on developing CAT II and CAT III approaches (CAT II without terminal navaids) in light to moderate icing conditions. And in times of increasingly more costly fuel, NASA has adopted as a goal the long term fleet fuel savings of 20% per year. However, various hospitals have expressed other concerns regarding aircraft design.

A key element in most programs is the ability of the craft to transport two patients. The medical condition of those requiring transport necessitates the ability to adequately care for patients including administering IV's, oxygen and resuscitating non-responsive patients. This requires sufficient access for two attendants plus space to allow storage and use of sophisticated medical gear Thus, an increase in cabin volume becomes a goal. As a minimum, allowance should be for 24 cu. ft. for the pilot and each attendant, plus 30 cu. ft. for each patient. That would establish a minimum cabin volume of 24x3 ÷ 30x2 which equals 72x60 or 132 cu. ft. No conclusive evidence has produced a medical necessity for either lateral or longitudinal patient loading. Medical crew members have shown adaptability to either patient configuration.

SAFETY

The prime concern of any helicopter operator is safety. The hospital environment is no different. Basically, this concern for safety can be reflected in three areas: Powerplant Philosophy, Design Considerations, and Man-Machine Interface.

A. Powerplant Philosophy:

A proven powerpack with twin engine reliability provides redundancy not only in power availability, but also independent hydraulic and electrical systems. While few twin engine helicopters have single engine OGE hover capability at max gross weight, they do exhibit the ability to maintain single engine flight on one engine. The higher maintenance cost associated with more complex systems must be considered as an additional economic cost of reliability.

B. Design Considerations:

Since hospital transports typically operate in urban environments, safety in the form of rotor disc with high terrain clearance would increase safety margins. Tail rotor awareness and safety through either high ground clearance or partial shrouding would minimize any change for a tail rotor strike. However, the high disc loading necessitated by shrinking disc diameter and loss of aerodynamic efficiency of a tail rotor may increase power requirements or construction costs beyond reasonable economic constraints.

C. Man-Machine Interface:

One area conspicuously absent from the NASA goals is improving the pilots visual field of view. Newer generation aircraft seem to engage the pilot in such an instrument conducive cacoon that little improvement has been made in the ability of the pilot to scan in the full unobstructed forward hemisphere. To further assist the pilot in maintaining aircraft control and awareness while maintaining visual contact in a close to the earth environment, consideration should be given to the development of a Head-Up Display (HUD) similar in application to that used by fighter pilots to aid in keeping a full outside visual scan in a high-stress environment. Such an interface could incorporate elements of an integrated flight director system. Future applications would couple with such advanced avionics systems as time-reference-signal-beacon and/or Navstar Global Positioning

System. Use of such a system will reduce pilot workload factors and decrease fatigue in a characteristically high-stress flight regime.

CPERATORS REQUESTS

From an operator's position, the desirable ship factors would include dependability, reliability, and decreased maintenance per flight hour. Certainly the NASA goal of reducing engine failures from 15-20 accidents/100,000 hours to 3-6 accidents/100,000 hours will favorably reduce insurance rates. Any improvement that will reduce direct operating cost must serve as an offset to the pressures which inflate basic airframe costs each year. Use of composite airframe materials should assist increasing TBO's for airframe components.

SUMMARY

Current NASA goals address the majority of hospital expressed concerns regarding applicability of helicopters to the civilian medical mission. Specific redirection of work effort should address the volume requirements and field of view increases to provide a more compatible and more safe airframe.

Regardless of the simulation test and development programs, any new technology engine or airframe typically requires a significant period of field testing to refine various gremlins. While the demand for an aircraft that exhibits notable improvements in technology is high, there is not a willingness on the part of the hospital to offer medical staff as test crew for unproven machines. This conservative attitude may well prolong the placement of newer generation aircraft until adequate reliability and safety has been demonstrated through use history.

UTILITY HELICOPTERS

Mrs. Wanda Rogers
Secretary/Treasurer
Rogers Helicopters, Inc

Biographical Resume

Mrs. Wanda Rogers is Secretary-Treasurer and Chief Financial Officer of Rogers Helicopters, Inc.; a Board Director and Secretary of the Helicopter Association of America; President of the California Commercial Helicopter Operators Corporation; and Chairman of the Board of the Clovis Community Bank.

Abstract

Versatility and affordability are the two characteristics most needed in helicopters designed to meet the needs of utility helicopter operators. During the 1980's, NASA technological efforts should be guided by these two characteristics. Attempts to optimize specific performances, at the expense of versatility, should be avoided. NASA efforts should be devoted to improving avionics systems in reliability, simplicity, maintainability, commonality and interchangeability. New investigations should be undertaken on helicopter GPS equipment requirements, on a universal helicopter 3-axis simulator, and on propulsion systems with improved fuel consumption specifics and modular modification capabilities. Improved product assurance methods and techniques and reduced noise levels are two areas in which NASA could make meaningful contributions. Affordability could be enhanced by NASA technological efforts concerning lower cost manufacturing techniques, reduced costs of composites and their fabrication processes, and modularized design features. In addition to technologically oriented efforts, NASA could do much to help correct an erroneous public image of the helicopter industry. Of most importance is that all of NASA's efforts be guided by consideration of versatility and affordability.

It certainly is a fortuitous opportunity to share with you a few cogent thoughts about the utility helicopter's role and some of the things that NASA might consider during the course of its activities over the next ten years.

Our first order of business should be, I think, to share with you what I mean by the "Utility Operational Category." Utility, of course, means being useful. When we reflect on the operational categories that this panel has and will discuss, we note that their most common characteristic is that they are all useful. What could be more useful than the offshore transportation that has been discussed by Bob Suggs and Mike Evans or the remote area work described so well by Carl Brady and Nick Crawford; usefulness describes energy exploration and production, and heavy lift, and agriculture, and ambulance work. In fact, everyone on the panel so far has described useful--or utility--operations.

With this in mind, I have decided to talk about everything that the other members of this panel have not talked about. I guess there is one major exception to what I have just said. I feel certain that Duane Moore's discussion of publically owned helicopters will overlap some of my discussion of utility helicopters. (It seems that today civil agencies are more and more doing quite a few things with helicopters that commercial operators have been doing successfully for a long time.) So my discussion will focus on helicopters that are used for a variety of purposes. Let me list a few of the missions that are included under the rubric, "Utility Operational Category."

-- Forestry Management--includes fire fighting, seeding, fertilizing, and back firing.

-- Wildlife Management--including herding, tagging, surveying and relocating animals; fish stocking, and spraying.

-- Surveying and photography.

-- Support for utility companies--including power and pipeline patrol, maintenance of remote site equipment, and supervisory transportation.

-- Search and rescue and emergency medical evacuation.

-- Recreational transportation of skiers, hikers, campers, hunters, fishermen, and sightseers.

-- Public Relations, news reporting, traffic watch, and electronic news gathering.

-- Banking--including check transfer and ADP records movement.

-- Commercial fishing support.

-- Harbor pilot transfers.

-- And many many more uses too numerous to list.

My point in going on and on with such a long list of the things that make up "Utility Operations" is simple--the next-to-the-bottom line for utility operations is versatility. The bottom line is, of course, affordability.

Lets concentrate on versatility first.

Because the list of missions performed in the Utility Operational Category is so long, it would be natural to assume that a large number of helicopter designs should be studied by NASA. Nothing could be farther from the truth. A single helicopter can perform every mission I have listed. And this fact is at the root of the way a successful commercial utility operator must organize and operate. A successful commercial operator must have a versatile helicopter with design flexibility built in.

With this in mind, NASA should structure its technological work during the 1980's to increase versatility and flexibility.

Specifically, in investigating aerodynamics and structures, NASA should strive for designs and materials that yield versatility. Specific aerodynamics that optimize a single characteristic--for example speed--may be intellectually interesting but may be practically useless if the design sacrifices crashworthy ruggedness or internal volume or external lift capability. Similarly, a rotor blade optimized for lift would perhaps sacrifice too much in the way of speed or autorotational capabilities. More light weight structures are desired but they must also be stronger for safety reasons, and less susceptible to corrosion and weather extremes for economic reasons, and easier to maintain for obvious reasons.

Flight controls and avionics systems are areas where NASA can accomplish much during the 1980's to increase versatility. The best thing that NASA can do is develop ways to increase the reliability and reduce the maintenance requirements of instruments and avionics. Most of what has been developed to date stems from items designed for fixed wing aircraft. Instruments and avionics have not been designed for the environment of the helicopter. Work should be done that will produce items that are rugged and stable enough to handle the vibrations and the relatively dirty close-to-the-earth air that characterizes the helicopter world. Avionics commonality and quick interchange capabilities can be improved. This will enhance versatility. The opening world of multiple display units with built-in navigation capabilities offers great promise. The black boxes helicopters will need for Global Positioning Systems should be on NASA's list of priorities.

One area about which I have great concern is human factors. We are approaching a problem of major proportions. Helicopter pilots are scarce and getting scarcer. Military trained Vietnam-war helicopter pilots are no longer entering the commercial helicopter world. They have either already been absorbed or they have gone elsewhere. The commercial helicopter fleets have been increasing at a compound rate of about 15% per year. The number of pilots is not increasing at anywhere near this rate. With more inexperienced pilots flying, insurance rates are soaring. NASA should tackle this problem in two ways. First, technology for very much simplified cockpit displays and instruments must be developed; second, NASA should develop a relatively low cost universal helicopter 3-axis simulator (not tied to any specific model) (not a procedures trainer) that can qualify to enable young pilots to build up their time.

NASA can do much to increase the versatility of propulsion systems. Each helicopter engine must do many things in many environments. NASA could do much to improve the reliability of jet turbine engines in the dirty, close-to-the-earth environment. Our current turbines were designed for continuous work in the pristine atmosphere of 15,000 feet and higher. In addition to improving basic propulsion performance and fuel consumption, NASA should investigate the concept of modular modifications that would enhance engine performance in specific environments. It may be possible to create relatively simple modifications that would optimize a basic engine's performance for high altitude, or snow, or saltwater, or dry desert environments. Such an approach would greatly add to versatility.

The modular approach could also enhance versatility in helicopter configurations. Instead of designing a helicopter that is optimized to perform a single dedicated mission, work should be devoted to designing modules or modifications that, when added to the basic vehicle, would improve performance in a specific mission profile. This will require technological emphasis on commonality, interchangeability, and standardization.

So far, I have discussed things that NASA can undertake during the 1980's to increase versatility within the four technological fields that are the subject areas of the individual workshops of this meeting. Let me now mention two areas that transcend the limitations of each workshop.

The first area pertains to reliability. It has various titles. Some call it product assurance. Others call it quality control. No matter what name you choose, I am referring to the techniques, procedures, tools, and training that are employed by manufacturers to assure reliable products that perform to specification. Perhaps NASA could undertake new investigations of ways to add advanced technology to this important work.

The second area pertains to a subject of utmost importance to all of us--noise reduction. With our growing populations, remote areas are becoming more remote. We must become quieter if we are to survive and flourish in ever-increasing population densities. Much work has to be done to reduce noise. NASA can play an important role.

So much for versatility, the next-to-the-bottom line. What about affordability--the bottom line.

I have no doubt that NASA, the organization that put the United States on the moon, can accomplish just about anything in the technological fields. That's easy. But to accomplish in an affordable way--that's difficult.

Let's look at aerodynamics and structures. Its probably easy to determine that flush rivets will improve aerodynamics. If so, then NASA should investigate manufacturing techniques that will give us flush rivets at the same, or less, cost as current riveting techniques. If composites can give us added strength, reduced maintenance, and lighter weight, then NASA could help determine ways to reduce the costs of composite materials and the costs of fabricating these materials.

In the areas of flight controls and avionics systems the same principle applies. Affordability should drive NASA studies in these areas. It would be vacuous to design instruments and radios that can do everything at an unaffordable cost. In these areas simplicity and interchangeability and reliability may be the keys to affordability.

I've already mentioned a universal helicopter 3-axis simulator as necessary when considering human factors. Let me underscore my point. Today it costs too much to accomplish basic helicopter training. It costs too much to provide cockpit time to build up the experience needed by a young pilot. It costs too much to provide needed refresher training--and tragically too many commercial operators are ignoring this need because of the costs involved. NASA could do much to make our pilots affordable and safe. We need helicopter simulators.

The best thing that NASA can do to make propulsion systems more affordable would be to improve fuel consumption. The next best thing would be to develop modular modifications to optimize performance for specific mission environments.

Improved affordability can be achieved in the area of vehicle configuration. We don't need a $100,000 rescue hoist and we don't need a $1,000 clock. We do need modular configurations to meet mission requirements in an affordable manner.

Whatever helicopter work NASA undertakes during the 1980's, let that work be driven by the dictates of affordability.

Because this is a rotorcraft technology workshop, most of the work we will do during the next two days will be concerned with hardware. I would be remiss if I did not mention a pressing need in another area--an area I call "software." We need much work, and NASA could do much to help, in the area of image improvement.

Today, we do not enjoy the public image we deserve. The public does not perceive the helicopter as a useful and necessary transportation machine. Hollywood has done much with its magic eye to distort the helicopter. The public is exposed to barrel rolls, excessive g-turns, cowboy antics, leather helmets and white scarfs. We are shown as second class citizens. The public does not know our capabilities; they do not know of our contributions; they have a hugely distorted picture of our safety record.

NASA is undertaking an extensive study of helicopter benefits. This is a greatly needed first-step. Upon this study should be built a program of educating and informing our city officials and our citizenry. NASA could well undertake additional efforts to ensure that we are perceived to be what we really are--a necessary component of our nation's transportation and work systems--a vital part of commerce and industry.

I have appreciated this opportunity to outline some new roads that NASA may travel down during the 1980's. With "Versatility" and "Affordability" as signposts along those roads, NASA can do much to increase the "utiles," to expand the usefulness, of Utility Helicopter Operations.

STATE GOVERNMENT

Daune Moore
Chief Helicopter Pilot
Illinois Department of Transportation

Richard Wray
Helicopter Pilot
Illinois Department of Transportation

Biographical Resume

Duane Moore has served as Chief Helicopter Pilot for the Illinois Department of Transportation since 1969. He serves as Chairman of the Heliport Research and Development Council. He is a member of the Helicopter Association Instrument Flight Rules Committee, the Board of Directors of the Illinois Chapter of the America Trauma Society, and the editorial Advisory Board of Rotor and Wing International Magazine. He is an advisor to the Department of Health, Education and Welfare regarding hospital heliports and air ambulance programs. He holds ATP Helicopter and Commercial Fixed Wing ratings.

Richard Wray has been employed as a helicopter pilot by the Illinois Department of Transportation since 1977. He served as a U.S. Army helicopter pilot in the Republic of Vietnam, with subsequent civilian experience including mountain flying in Colorado and offshore support in the Gulf of Mexico prior to his employment with the State of Illinois. He holds ATP Helicopter and Commercial Fixed Wing ratings and is a paramedic certified by the National Registry of Emergency Medical Technicians.

Abstract

Sharing the concerns of all rotary wing operators, the desire of governmental agencies for improved helicopter utilization is by no means novel.

Governing agencies must allow helicopters to be operated to their full capability, including realistic IFR regulations and encouragement of urban heliport development.

With this fuller utilization, it will be the industry's responsibility to bring the helicopter to expected corporate reliability and comfort levels. Significant advances can be made in areas such as vibration and noise levels, avionics, and all-weather capability, specifically anti/de-ice systems.

Better communication between powerplant and airframe manufacturers should serve to help eliminate many of the design and performance discrepancies which now exist in the industry. Such communication can only serve to speed the development of new concepts such as the ABC and Tilt Rotor; concepts which will take rotary wing aircraft into a new era.

We look forward to the faster, more reliable, economical helicopters envisioned in this report, and hope the suggestions put forward herein will aid in their development.

INTRODUCTION

The current, and future, governmental uses of helicopters present virtually no novel or peculiar demands, but rather reflect those of the entire rotary wing industry.

Similar to any major corporate executive, the government official expects rapid, reliable transportation, whether in fixed or rotary wing aircraft. He places quantifiable value on his time and unwarranted or avoidable delays place the offending aircraft (or type aircraft) in a very bad light indeed. Thus, throughout listings of desirable helicopter features governmental agencies transporting elected and appointed officials will consistently list at the top those features which enable a passenger to travel where he wants to go, when he wants to go, and in as much comfort as possible. "Where he wants to go" is dependent on such factors as available landing areas, especially certificated heliports. "When he wants to go" considers such matters as ability to routinely fly in IMC, including icing conditions. "As much comfort as possible" simply means as little difference as feasible between that environment in which the passenger routinely works (his office) and the aircraft in which he is riding. Each of these facets will be discussed in more detail further on in this paper.

Many government agencies also appreciate the helicopter for its unique ability as an ambulance for critically ill and injured patients. The Illinois Department of Transportation has been utilizing helicopters in this role since 1971 with some 2500 patients transported to date. Obviously, speed is of the essence on such flights, as is dependability, landing area accesibility, and other features also necessary in executive transport.

In conjunction with air ambulance utilization, some agencies, including Illinois Department of Transportation, use the helicopter for rescue missions in which other methods are inadequate due to either impracticality or unacceptable time delay. Thus along with the operator transporting executives and the agency carrying the medical emergency patient, we also have a common ground with external load operators. The use of external rescue devices, e.g. the Billy Pugh net, is very similar to any other external load operation.

We can see that new helicopter features desired by charter, air ambulance, or part 133 operators will also benefit the governmental user and, hopefully, vice versa. We will now address these features by the following categories: Aerodynamics and Structures, Flight Controls and Avionics, Propulsion, and Vechicle Configuration.

AERODYNAMICS AND STRUCTURES

Of major concern to governmental agencies is the field of aero/acoustics. Nothing molds the passengers impression of helicopter flight more than noise and vibration levels. Since most executives have first taken to the skies in turboprop or pure jet aircraft, they will expect the same degree of comfort and amenities in a helicopter.

Along with reduced interior noise and vibration levels, a concomitant lowering of exterior noise is of major concern. Governmental agencies, along with all conscientious operators, are acutely aware of the publics concern over noise pollution, and try to maintain a "good neighbor" policy in light of safe operating practices. The government official will have little appreciation of an internally "whisper quiet" ride if he anticipates angry telephone calls concerning external noise from his constituents upon arrival at his destination.

We therefore urge the development of technology which will meet and hopefully exceed the goals for vibration and noise reduction set forth in the Task Force Report of 1978. The attainment of lower noise and vibration levels will raise the esteem in which a passenger, and the community as a whole, views the helicopter more, we believe, then any other area of improvement.

In addition to aerodynamic designs which will lower noise and vibration the government, as other operators, seeks features such as reliability, cost effectiveness, and increased efficiency. Recent advances in airfoil and structural materials and design are to be applauded and further research encouraged.

An area of design which concerns us deeply is the current trend toward decreased outside visibility. Designers take great care in including the optimum number of windows in the passenger area while simultaneously widening instrument panels and obscuring downward visibility. Helicopters do not always operate in improved areas and crew visibility is essential. Chin bubbles should be treated with more importance than a mere cosmetic touch. The versatility of helicopters will be seriously hampered if designers persist in limiting crew visibility.

Lastly, we strongly advocate research and development which would render the standard tail rotor less susceptible to object strikes and personnel hazards. Possibilities in this area include proliferation of designs such as the Fan-in-fin tail rotor and new design advances which would eliminate the tail rotor in its current form.

FLIGHT CONTROLS AND AVIONICS

Since, as previously mentioned, governmental helicopters are used extensively in executive transportation, air ambulance, and rescue roles, all-weather capability is not just a desireable attribute - it is of complete and urgent necessity.

We feel that while future programs and goals should indeed be set, the most pressing concern to the helicopter community regarding IFR flight is full utilization of existing capabilities. The helicopter is not an airplane and must not be so treated in the establishment of flight procedures, particularly in the IFR environment. Two areas in particular are subject to improvement: enroute routes and minimums, and helicopter instrument approach procedures.

The helicopter need not be confined to fixed wing airways and minimum enroute altitudes. A realistic goal of 500 ft. above the highest terrain or obstacle four miles either side of a course centerline (non-mountainous terrain) should be examined and pursued enthusiastically with the appropriate authorities. Navigation systems must be developed which allow point to point flight at this altitude. Systems such as Loran-C and GPS offer the brightest future for such capabilities and experimentation, including flight testing, should be instituted to evaluate their respective merits. The realization of lower MOC's and MEA's will serve to decongest the ATC system, save fuel now spent in IFR climb and descent, and aid in keeping helicopters out of unfavorable meteorological conditions such as thunderstorms and known icing conditions.

Along with lower enroute altitudes and more direct routing, programs of development and testing should be pursued which will lead to Category II and lower instrument approach minimums for helicopters. The maneuverability and low approach speeds of helicopters lend the aircraft beautifully to the IFR environment, and decision heights of 50 ft. in terminal operations and 100 ft. at remote sites are certainly realistic. Advances in avionics, both on-board and remote, will enable these goals to be realized. Systems such as Loran-C and GPS must be totally evaluated and their acceptance by authorities encouraged. Landing aids such as 3D/4D guidance and microwave landing systems must likewise be evaluated. A low cost IFR approach system for remote sites must be developed and evaluated. For current use, we strongly urge the development and production of a modestly priced radar beacon for use at remote landing sites. Illinois would use such a system extensively for its 78 hospital heliports were its cost not prohibitive (approximately $6,000 to $7,000 per site).

A long range program of evaluation of advanced cockpit displays is also desireable. Recent advances such as the CRT system should be examined for possible use in rotary wing aircraft, with specific emphasis on their promotion of lower IFR minimums.

Another major area of concern exists in the industries development of effective anti/deice capabilities. While the advent of some heated rotor systems is encouraging, icing remains the major deterent to IFR flight in many parts of the world. Aggresive research must be conducted in this area, with a practical anti/deice system for light and medium helicopters as the goal.

In conjunciton with an effective anti/deice system to take the helicopter through the weather, we also envision future cabin pressurization to enable the helicopter to fly above much of the weather. Oftentimes, meteorological phenomena such as icing could be avoided were the aircraft able to climb above it. Without pressurization, rotary wing aircraft will forever be doomed to fly through whatever weather exists while executive fixed wing fly comfortably above it. Even if flying below mandatory pressurization altitudes, passenger comfort can be seriously compromised when a descent is initiated from 10,000 ft. to an airport 500 ft. above sea level. As with noise and vibration, a passenger is unable to understand why his ears hurt in his two million dollar helicopter and not in his one million dollar King Air.

Aside from pure passenger comfort and improved IMC operations, the role of air ambulance would be enhanced by pressurization. Many injuries including air embolisms, decompression sickness, and pmeumothorax prohibit flight with decreased cabin pressure. While some decrease in pressure is, of course, unavoidable, pressurization would greatly benefit the helicopters ability to fly in IMC in an air ambulance capacity.

PROPULSION

Engine manufacturers have been maintaining a respectable pace in the development of improved designs and materials. Unfortunately, the ability to maintain these improved engines is being hindered by poor airframe design. Examples include Bell aircraft which necessitate removal of exhaust stacks prior to removal of engine cowling, and Sikorsky aircraft which cannot ground run engines with the engine cowling open. Such lack of maintenance considerations only negate advances made in other areas of engine and component design. Obviously, better communication between engine and airframe manufacturers is necessary to help alleviate such problems.

It is also essential that the industry strive for true twin engine reliability in the new generation of helicopters. Manufacturers are justly concerned with such matters as engine fuel economy and high payloads and ultimate engine selection is certainly a compromise involving these factors. Yet time and again over recent years we have witnessed the introduction of "new" helicopters which in reality are merely more highly powered "old" helicopters. Customer optional powerplants for the same model aircraft would allow the customer to choose the features desireable for his operation at the time of initial aircraft order. Despite detriments such as higher weight and lower fuel economy, we believe many operators would opt for a true single engine capability. Examples would include operations from congested urban areas and rooftop heliports. Rather then wait several years for a "new" model, manufacturers should avail themselves to current production engines as customer options. Governing agencies should adopt certification procedures which would facilitate such a program.

Engine and airframe manufacturers must also greatly improve spare parts accessability. Too often we envision new programs to improve helicopter reliability when in fact no program will succeed without adequate parts support. A corporate president has little understanding when his two million dollar helicopter is unusable because the manufacturer can't supply a five dollar part. We would like to see manufacturers pledge that no new aircraft deliveries will take place when a similar model aircraft is AOG for parts. Instead of a part going to build another new aircraft, that part would be putting an operator back in business. While this concept could cause some minor delays in the delivery of new aircraft, the operator would be assured that once he takes delivery that aircraft will be kept operational.

Other areas of engine and power transfer systems designs and developments, such as those elaborated in the 1978 Task Force Report, need to be pursued. Hopefully such research will help realize even more dependable engine and transmission systems, with benefits including more cost effective and easily maintainable components.

VEHICLE CONFIGURATION

The current experimentation with innovative configurations, including the ABC and Tilt Rotor, hold the promise of a bright future for the rotary wing industry. Transport category helicopters should realize the more immediate benefits of these advanced configurations. While light helicopters may not benefit immediately, such innovative technology will most certainly futher the design of all aircraft in the future.

At this time, we are extremely pleased with design configurations of the so-called third generation helicopters. Aircraft such as the Sikorsky S-76 and Bell 222 offer unprecedented advances in speed, twin engine reliability, and passenger comfort. We encourage the continued refinement of such designs for the operator unable to utilize the larger transports. We would very much like to see an interior configuration which permits rapid transition from executive to utility mode.

In closing, we feel the major areas of concern are decreasing external noise, a practical de-ice system, greater engine reliability, and improved tail rotor configurations.

SCHEDULED COMMUTER

J. Dawson Ransome
Chairman and President
Ransome Airlines

Biographical Resume

J. Dawson Ransome is Chairman and President of Ransome Airlines, a Philadelphia based commuter service operating as an Allegheny Commuter. The airline began operation in March of 1967, became an Allegheny Commuter in August of 1970, and as of June 1979, is the largest commuter airline in the world. Mr. Ransome first soloed in 1938, earning a civilian pilot's license. In 1941, he served with the RCAF as a Civiliam Flight Instructor and later contracted with the U.S. Air Corps as a Civilian Flight Instructor, eventually progressing to Flight Command Check Pilot. In 1944, Dawson received a direct commission as an officer in the U.S. Air Corps. His service career included transporting aircraft over most of the flying world for the U.S. Air Transport Command. During the period 1944-45, he flew over 1,000 hours between the Assam Valley of India over the "hump" to China. He is a recipient of the Air Medal and Distinguished Flying Cross. After World War II, he was active in the Pennsylvania National Guard as an Instrument Check Pilot flying B26-type aircraft. Mr. Ransome was a member of the Board and Vice President of the Aerobatic Club of America and was Fund Raising Chairman and Advisor to the 1970 U.S. World Team and Official United States Delegate to the Championship 1972 World Aerobatic Team. He also is a past member of the Board of Directors of the National Aviation Club, the National Aeronautics Association, Mohawk Air Services, and the Commuter Airline Association of America, where he is currently Chairman of the Government Relations Committee.

Abstract

The role of short haul (fixed wing) commuter airlines in the aviation industry focusing on airport compatibility is analyzed. Congestion, airport access, separate routes and approaches, MLS, RNAV, and other factors are discussed. Ransome Airlines is used as specific case study. Commuter application of helicopters (rotorcraft) may be drawn.

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I am very happy to have the opportunity to participate in the 1980 HAA Rotorcraft Workshop. Although we do not operate rotorcraft in our system at this time, it is hoped that our work with 3-D RNAV and MLS will be of interest to you. It seems to me that it would have application in your industry as well.

Today, I would like to give an overview of our industry's explosive growth, its impact on our ATC system, and a few things we at Ransome are doing to help solve our rapidly growing ATC and airspace problems, (Figure 1)

The combination of airline deregulation, the uncertain availability and price of automotive fuels, and, importantly, surging public demand for air travel have spurred the growth of the commuter airline industry beyond our wildest dreams of just a few years ago. As a result, we are gearing up to implement better service. with greater frequency to more airports than ever before. In fact, by year-end, we forecast that U.S. commuter airlines will have carried more than 15.5 million passengers, up 11.3 percent over 1979, and 500 million pounds of cargo to approximately 850 domestic destinations. (Figure 2) In so doing, commuter airlines will have reliably performed approximately 2.7 million revenue flights, logged 2.1 million flight hours and accounted for nearly one-third of all U.S. scheduled airline service.

The twelve Allegheny Commuters will transport approximately 2.5 million passengers in 1980; operate 85 aircraft; serve 55 communities with over 600 daily flights, representing 20% of total commuter passengers in the U.S. Ransome is very proud of its association with USAIR, formerly Allegheny Airlines. The relation has been good for both parties, as well as the communities served.

Ransome Airlines, an Allegheny Commuter, serves twelve cities with almost 200 flights per day in the Washington to Boston Corridor. To date, we have transported almost 4 million passengers since beginning business in March of 1967. During 1967, we transported just 6,318 passengers. Today, we expect to carry at least 815,000 passengers in 1980 and over one million in 1981. (Figure 3) That represents an average rate of increase in passenger service of about 60 percent each year we have been in business. I might note, it has not been too many years since some local service carriers were transporting one million passengers per year.

Since enactment, deregulation has resulted in the local and trunk carriers reducing or eliminating service to about 130 cities. (Figure 4) Surprisingly, these service reductions have included not only small, but also medium-sized communities such as Hartford, Providence, Trenton, and New London. The high cost of operation, inadequate return on investment, and low yields inherent in operating the modern jet airplane at lower altitudes on short hauls, are forcing the major airlines to carefully scrutinize asset allocation -- that is, in what markets they can profitably use their aircraft. The simple fact is, operating the jet airliner on stage lengths of under 200-300 miles has simply become financially unsound not only from the standpoint of cost of operation, but also asset allocation.

Where is this leading? It's leading to a greater dependency by the small and medium communities on the major hub airports for access into the mainstream of the nation's air transportation system. Then where does it lead us? It leads us into greater competition for presently available enroute and approach airspace, gate space, terminal space, and other airport facilities. In fact, it is estimated that, unless something is done, and done soon, the direct cost of air traffic delays to our industry could reach an estimated $1.5 billion by the mid-1980's. This figure does not take into account the tens of billions of dollars lost by our customers in terms of time, productivity, missed connections, and out-of-pocket expenses. I am sure you will agree, this is a waste of our resources we simply cannot afford! One solution is the greater use of currently available reliever airports (Long Island/MacArthur; Mercer County/Trenton; North Philadelphia; Wilmington, Delaware, etc.), but they will take time to develop. However, they are assets we must begin protecting now for the future.

In the meantime, we at Ransome Airlines are embarking on the most ambitic program in our history. It involves investment by our airline of some $40 million for new high technology aircraft and flight control systems. It is an effort on our part to find a solution to this ever-growing and serious problem of air traffic delay and airport access. (Figure 5)

Just over a year ago, Ransome Airlines introduced into service the first of a number of De Havilland Dash-7, four-engine, quiet, short takeoff and landing, 50-passenger aircraft into the Philadelphia/Washington market. This remarkable aircraft has the ability to land with comfort and safety within 1,000 feet or less - maneuver at 100 knots with a full gross load - and turn in a radius of only 2,000 feet. (Figure 6) Coupled with all of this performance, the aircraft will be equipped with three-dimensional RNAV system capable of storing 200 non-volatile way points integrated into the automated flight control system. Ransome has secured an agreement with FAA to utilize special RNAV route and microwave approaches for service between Philadelphia and Washington, D.C. (Figure 7) These routes and approaches are removed from the conventional route and approach systems and are, therefore, termed "non-interfering." The Dash-7 aircraft will be equipped with airborne computer-generated pictorial route display on the aircraft's radar that can be used concurrently with the weather avoidance function of the radar display. These functions will drive the auto pilot producing an automated flight path from takeoff to landing. Yet, you might logically ask -- "What will this do to improve airport access?"

<u>FOR COMMUTER AIR CARRIERS, THERE IS</u>: (Figure 8)

A) Reduced fuel consumption - 40 miles less travel through the enroute airspace on each PHL-DCA leg.

B) A minimum of traffic delays since operations are to be conducted outside congested airways.

C) Greater potential for increased commuter operations with virtually no impact on existing airline traffic.

D) As a result, there is increased capacity for all air carriers since Ransome and potentially other commuters are diverted from the present ILS equipped runways.

FOR THE AIR TRAFFIC CONTROLLER:

A) There is less need for communication and, therefore, the benefit of a reduced workload.

B) The consistent use of standardized RNAV routes and microwave approaches allows controllers to monitor rather than vector traffic.

C) There is greater control flexibility through simplified procedures due to a wide range of holding, approach and landing speeds available.

FOR THE FLIGHT CREW:

A) There is substantially reduced workload. The automated system requires a minimum of pilot input. The crew, therefore, is free to manage the aircraft systems and monitor the flight's progress through the congested airspace.

B) The visual flight path display on the radar screen provides valuable backup information to the crew for greater confidence.

C) And, the excellent flight characteristics of the Dash-7 at low airspeeds makes possible the use of simplified procedures and virtually automated flight.

AND, OF SPECIAL INTEREST FOR THE AIRPORT OPERATOR:

The Dash-7 is a good neighbor since it is the quietest airline ever built. (Figure 9)

The routes between Washington and Philadelphia are generally outside the conventional enroute and approach paths used by other airlines. Our aircraft will land on the so-called "non-precision" runways at National and Philadelphia (33 and 21 at National and 17 at Philadelphia). (Figure 10) Thus, our flights will be removed from the so-called "daisy chain," reducing up to 40 miles of travel through airspace and, as an added benefit, opening up additional capacity for the higher performance jet aircraft on the conventional ILS system. Further, by increasing the airport's capacity, this program will reduce fuel waste, time delay, and loss of human productivity.

The accuracy of the RNAV system enroute is measured in terms of hundreds of feet, not miles. One objective for our crews will be to fly a consistent pattern day-in and day-out in terms of speed, vertical and horizontal flight path in order to develop the confidence of the air traffic controller to the point that his function becomes one of monitoring the flight profile. Thus, this program should reduce ATC workload and moderate the need for extensive voice communications.

All the nation's airports are experiencing a greater number of commuter airline operations. We hope this program of ours will contribute to the solution of our airport capacity problems and encourage other airline operators and airports to develop similar programs. We also hope to encourage airport management and the FAA to build MLS-equipped short STOL, or reliever, runways at their airports and consider the use of existing taxiways and stub runways for this purpose. (Figure 11) As an example of this, at Philadelphia International, Ransome Airlines has agreement with airport management and FAA air traffic control personnel to make use of the existing taxiway A for departure.

Ransome Airlines will start its MLS evaluation program, working with the R & D arm of the FAA. (Figure 12) We will be operating six prototype airborne receivers installed in our Dash-7 fleet. Two ground units are now operational at Philadelphia International and Washington National. At National, they will service runways 33 and 21, and at Philadelphia, runway 17.

We at Ransome are concerned with the delay in getting the MLS programs underway. In spite of the projected cost to replace the present ILS system (600 million for gound stations and up to one billion for airborne equipment), the flexibility that MLS offers is important if we are to vastly improve our ATC system. We don't like what we are hearing -- that improvements to the present ILS system might be an alternative being considered by the FAA.

Our airline has a very heavy investment in the future in our 3-D RNAV and MLS programs. (Figure 13) We are concerned that the five billion surplus in the trust fund is being used by the Administration to help balance the budget and reduce the national debt and not being used to provide a more efficient airway system. The airway users and traveling public has been charged the tax to provide a vastly improved system and is not getting it.

While our airline is investing almost $500,000 per aircraft in new high technology equipment to help solve these airway and access problems, the Administration, through OMB, is holding over five billion dollars ADAP monies in the trust fund for the purpose of reducing the national debt. The airway users and the traveling public has been charged the tax to provide a vastly improved and safer airway system and simply are not getting what they paid for.

I consider this action on the part of the Administration, OMB, and Congress as being totally irresponsible and criminal in nature. I would urge you all to join the fight to unblock these funds, so we can get on with improvement of a seriously deficient system.

In summary, we at Ransome look to the future with great optimism. (Figure 14) Despite air traffic, fuel, and other pressing industry problems, we see great opportunity for growth for the commuter airline industry.

As a final word, I would like to go off the subject for a moment and address a subject that concerns us all. Our industry has had explosive growth in the past few years. What challenges does all of this growth present our industry and our company? Accelerated growth in any company presents major challenges to management. Of the many challenges our industry faces in the 1980's, our ability to manage growth and successfully transition from small to larger and more complex businesses will be our greatest. Managing growth requires identifying where the talent in your company is and then developing, motivating, and training these people to personally develop and accept greater responsibility and make decisions consistent with and contributing to corporate objectives.

Any airline or company has assets they must employ and properly allocate if they are to successfully grow. These assets in order of priority are: one, their human resources or people; two, their physical assets (planes, facility and tooling) and; three, their financial resources or money. Why do we place people ahead of physical assets or money? Simply because, without highly motivated and productive people, we can't successfully grow, compete, and develop the financial resources required to finance our growth. Our country today is in the sad shape it's in simply because we are no longer a highly productive nation, able to compete in the world marketplace. We simply must reverse this trend both as individuals and as a nation if we are to survive. I see a glimmer of hope that labor and management are waking up to this fact and are working more closely together to reverse this dangerous trend.

We at Ransome feel strongly that this must be done. In an effort to maintain the high personal productivity that has characterized our people, we have delivered a program to reward our people for their continued high productivity. About two years ago, we averaged the total labor cost percentage, as related to total sales over the past three years of our company operation. We then structured a program that would share on a 50-50 basis with our employees any reduction in our labor-to-sales ratio -- 50% accrued to our employees and 50% to the company. This year, the employees of our company in total will receive approximately $500,000 as their share of the pot for their continued high productivity. The continued high personal productivity of our people is absolutely essential if we are to continue to successfully grow.

We would hope that those who have the responsibility for the administration of our nation's airports will consider the needs of our industry in future airport planning, as well as keep an open mind in considering what solutions exist to provide expanded facilities.

It indeed has been a great pleasure to have this opportunity to give you this overview. I will be very happy to answer any questions you might have.

Thank you very much.

SLIDE PRESENTATION

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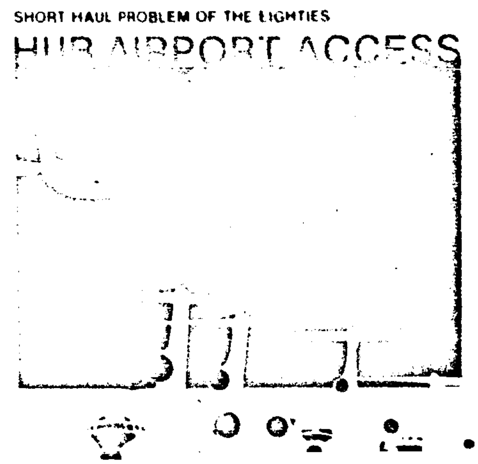


Figure 1

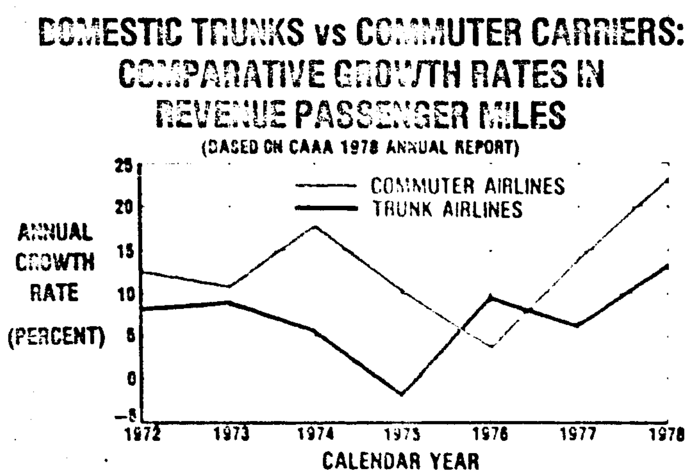


Figure 2

RANSOME AIRLINES — ENPLANED PASSENGERS

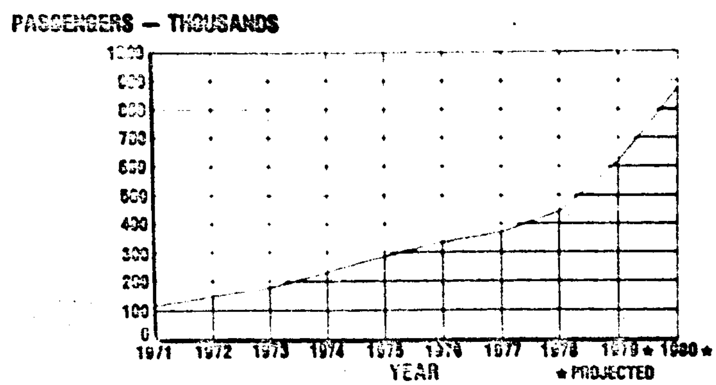
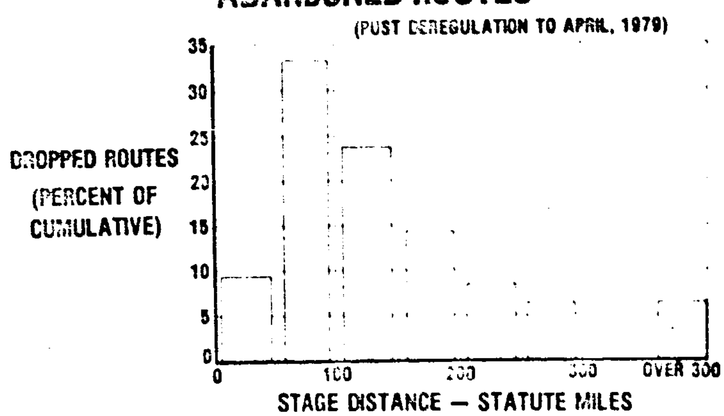


Figure 3

DISTRIBUTION OF US REGIONAL/TRUNK ABANDONED ROUTES



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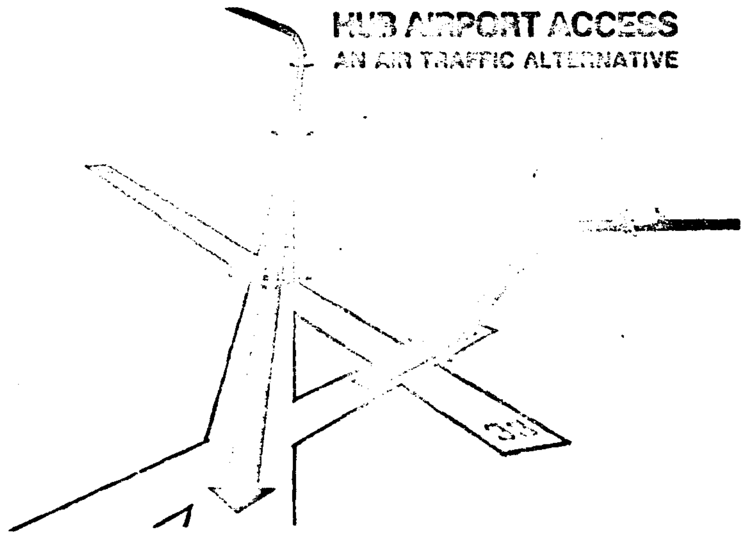

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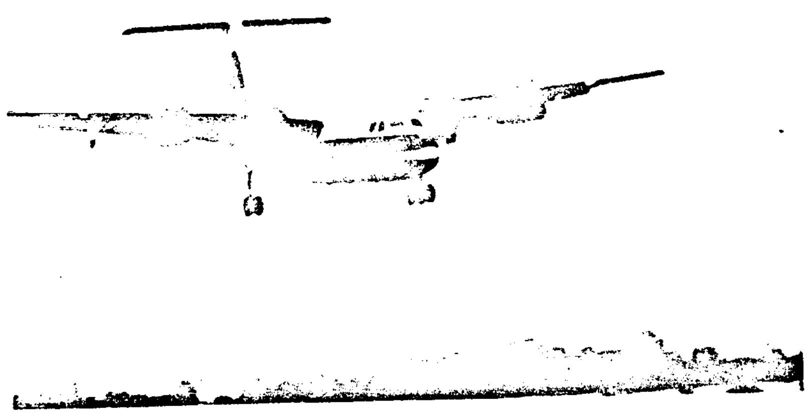

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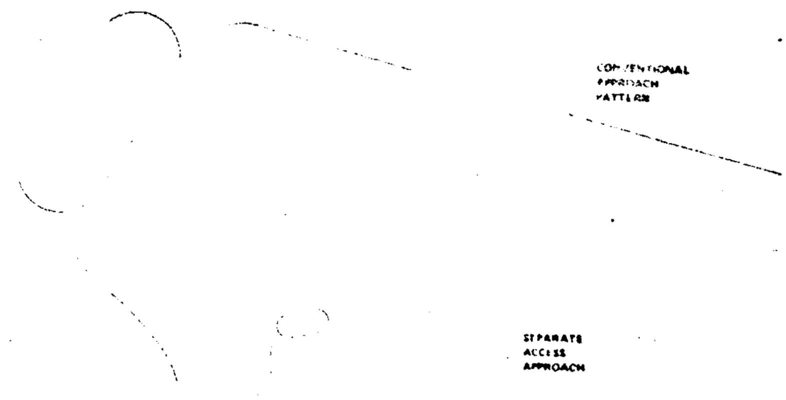

Figure 7

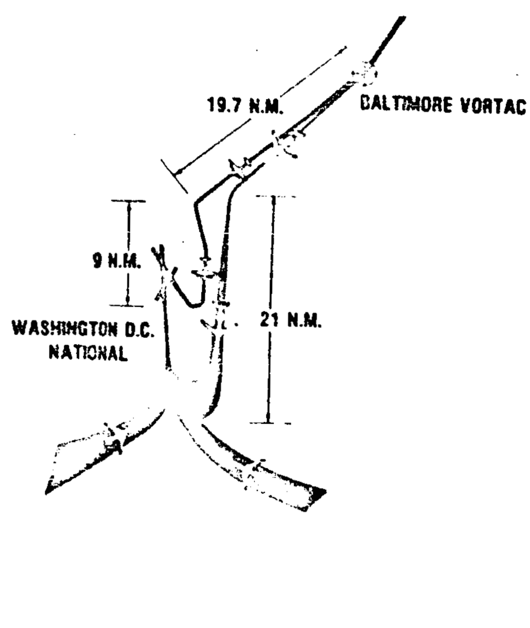

Figure 8

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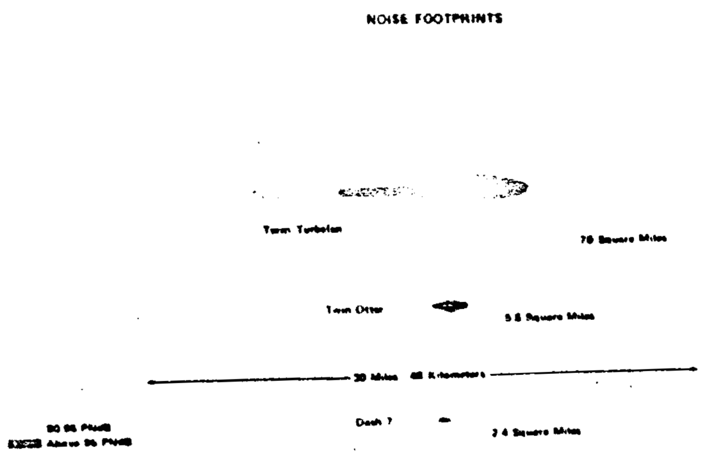

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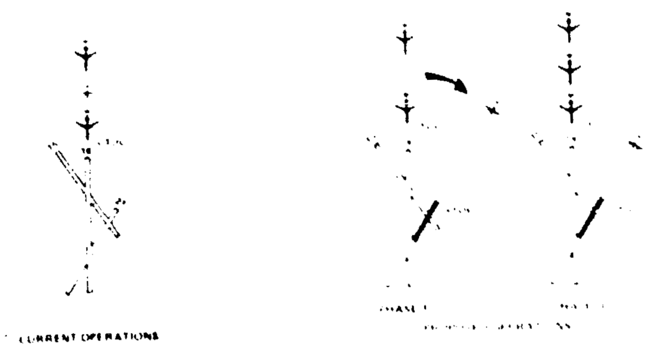

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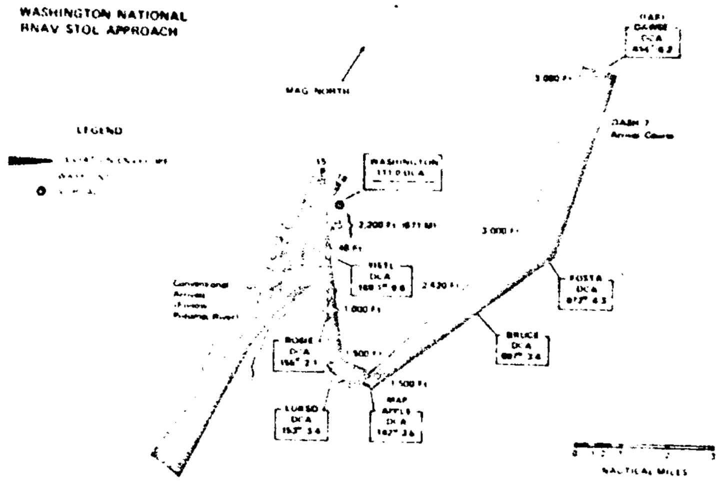

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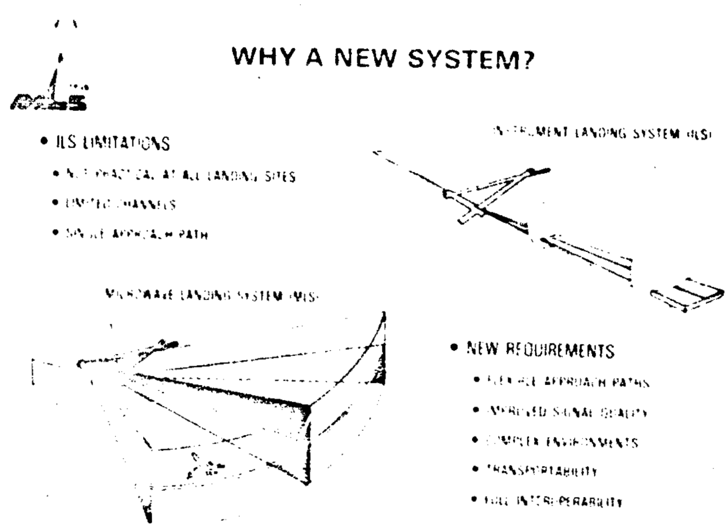

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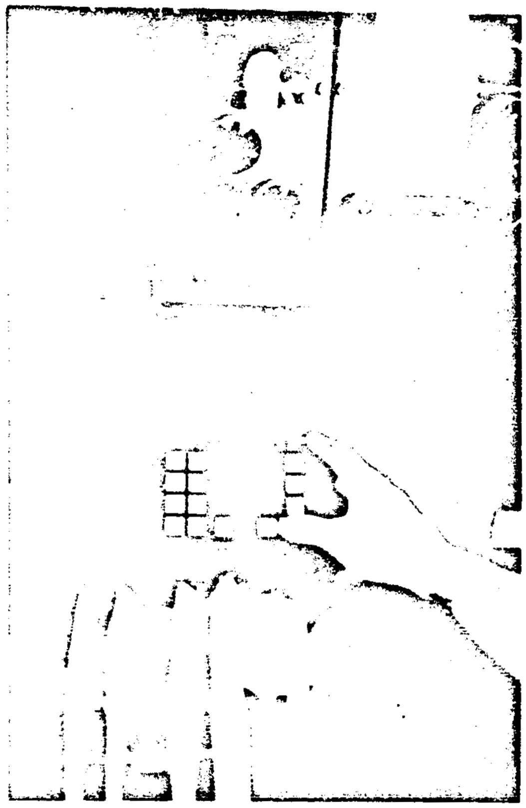

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Figure 14

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PUBLIC SERVICE USERS' WORKSHOP

Dr. John Zuk
National Aeronautics and Space Administration
Ames Research Center

A special workshop on public service helicopter technology needs was conducted by Ames Research Center on July 14-16, 1980. The workshop was attended by some 100 government and industry representatives interested in this subject. Following is an outline of the findings and conclusions of this workshop.

PUBLIC SERVICE HELICOPTER USES:

Law Enforcement & Public Safety:

A. Law Enforcement

1. Drug Enforcement & Detection
2. Security (buildings & VIPs)
3. Surveillance (general & covert)
4. Search (fugitives & vehicles)
5. Patrol
6. Observation Post
7. High Speed Pursuit
8. Command Post
9. Crowd Control (traffic & riots)
10. Pollution Control
11. Transport (VIPs & crime specialists)
12. Stolen Property Recovery

B. Public Safety

1. Ambulance Escort
2. Disaster Warning & Relief
3. Emergency Cargo Transport
4. Fire Detection
5. Rescue
6. Search (people lost)
7. Traffic (emergency)
8. Water Area Patrol
9. Aerial Photography

Medical Services:

A. Emergency Medical Services

1. At the Scene Accident Pick-Ups
   a) traffic
   b) occupational
   c) residential
   d) recreational

2. Interhospital Transfers
   a) critical patient transfer
   b) neonatal transfer
   c) burn patient transfer
   d) organ/blood transport
   e) medical supply transport
   f) medical equipment transport

B. Search and Rescue

1. Mountain Remote Site Rescue
2. Ocean/River Rescue
3. Missing of Late Vessels
4. Ship Collisions and Groundings
5. Missing Persons
6. Aircraft Accident
7. Endangered Fire Fighting Personnel

Environmental Control:

A. Wildlife Management

1. Herding Animals
2. Tagging Animals
3. Relocating Animals
4. Damage Control
5. Fish Stocking
6. Fish Management
7. Spraying Insecticide

B. Surveys

1. Animal & Fish Population
2. Inspect Oil Platforms
3. Inspect Strip Mines
4. Inspect Powerlines
5. Inspect Dams & Reservoirs
6. Aerial Photography
7. Factory Pollution Monitoring
8. Wetlands Inspection

C. External Loads

1. Tower & Pole Setting
2. Wire Stringing
3. Pipeline Laying
4. Liming Lakes
5. Seeding Forests
6. Remote Site Construction
7. Remote Site Supply
8. Snooding

D. Land Management

1. Fire Control
   a) Bureau of Land Management
   b) U.S. Forest Service
   c) Bureau of Indian Affairs
2. Geological Studies
   a) exploration
   b) earthquake research
   c) volcano research
   d) channel monitoring
3. Cadastral Surveys
4. Electronic Surveys
5. Resource Management

E. Transportation

1. Inspection
2. Work Crews
3. Survey Equipment
4. Survey Personnel
5. Resupply
6. Search & Rescue

Fire Fighting:

A. Transport Personnel

1. Fire Crews
2. Command Post
3. Firefighting Tools, Hardware & Supplies
4. Suspended Maneuvering System

B. Retardent Applications

C. Reconnaissance

1. Mapping
2. IR Sensing
3. Dry Season Surveillance

D. Backfiring

Disaster Relief:

A. Lifesaving People Transport

B. Life Sustaining Supply Transport

C. Evacuation

D. Early Warning & Response

E. Command Post

F. Post Disaster Clean-Up

KEY MISSION DATA:

Search and Rescue:

- U.S. Coast Guard - (1 yr. benefits - 1978)
  78,000 calls for assistance,
  4,300 lives saved.
  11,700 helicopter SARs, 1,953 lives saved
  Projected 25,000 helicopter SARs/yr. by 1990.
- Swiss Air Rescue - 1978
  Doubled rescues since 1975.
  Performed 3,482 SARs.
  Transported 3,242 persons.
- San Bernardino, California, County Agency - 1979
  71 takeoffs
  60 pickups
  85 transports
  24 lives saved
  28% survivability

Emergency Medical Service:

- Trauma kills 115,000 persons/yr.
- Trauma costs society $41.5 billion annually.
- Accidents are leading cause of death for people less than 38 years old.
- Accidents hospitalize 10.2 million people/year for one day or more.
- 1 out of every 8 beds in general hospitals are occupied by trauma victims.
- 50% of all accidental deaths are due to the automobile.
- Rural accidental death rate is 4 times urban.
- 51,900 people died on highways in 1978.
- The helicopter can reduce response time to accident scene by as much as 80%.
- Proper use of advanced helicopter technology can reduce mortality and morbidity by 50%.
  = $9B savings to nation/yr.
  = 9X total annual market value of helicopter production

C-2

Law Enforcement and Public Safety:

- $6 billion cost of crime in U.S. (burglary, robbery, theft, auto theft)
- 7% average reduction in crime using helicopter patrol for about 1% of police budget.
- $.4B annual savings potential nationwide using helicopter patrol.
- helicopter compared to patrol car:

  Surveys 30 times more area

  5 to 10 times faster response rate

  flys 3 times faster

Fire Fighting:

- 8,621 deaths, 1978
- $1.95 billion annually
- 32,023 people injured
- over $5 billion in lost property

<u>TECHNOLOGY NEEDS</u>:

Vehicle Design:

1. Increased speed (300 kt dash, 30 min. max., 200 kt max. continuous)
2. Hige 20000 feet (single engine)
3. Hoge 10000 feet (single engine)
4. Twin engine
5. Endurance - 4 hours
6. 10000 lb max. G.W.
7. 20' rotor diameter
8. Eliminate tail rotor
9. Internal cabin area (60' high X 52" wide X 96" long)
10. Modularized cabin
11. Pressurization*
12. Autorotation capability
13. Internal & external noise reduction
14. Pilot operated hoist

* Optional

15. Compatible electrical system
16. Shutdown power capability
17. Quick access maintenance
18. Water/retardant capability
19. Improved all terrain landing gear
20. Improved visibility
21. Improved maneuverability
22. Sliding cargo door
23. Internal access to cargo cabin
24. Equipment storage
25. Cold interior lighting
26. Hot refueling capability

Propulsion:

1. Non-petroleum fuels
2. Multiple fuel capability
3. Low fuel consumption
4. Dual power band
5. Increased shaft hp.
6. Lightweight power plant
7. Emergency power capability
8. Particle separators (fod proof)
9. Main rotor clutch
10. Minimal warm-up time

Safety and Reliability:

1. Crashworthy structure
2. Crashworthy seats
3. Crashworthy fuel system
4. Eliminate dynamic roll-over
5. Improved restraint system
6. Improved helmets
7. Improved egress system

8. Increased main rotor clearance
9. Reduced tail rotor hazard (remove tail rotor)
10. Birdstrike protection
11. Removable ballistics protection & detection
12. Fuel dumping capability
13. Fire protection
14. Hazardous material storage

Navigation/Guidance & Flight Controls:

1. Automatic flight control
2. Combined controls
3. Stabilization
4. All weather capability
5. Low airspeed measurement
6. Electronic map display
7. Precision location/navigation

Auxiliary Systems:

1. Hoist locations & capabilities
2. Rappel attachments
3. Improved litter
4. Litter suspension
5. Night vision system
6. Improved searchlight
7. Optical equipment
8. Photo/TV equipment
9. On-board APU
10. A/C visual identification
11. Car identifier
12. Car lock-on
13. Car stopper
14. Towing equipment

Human Factors:

1. Improved seats
2. Environmental control
3. Noise and vibration
4. Control standardization
5. Dual controls
6. Visibility
7. Integrated flight instruments

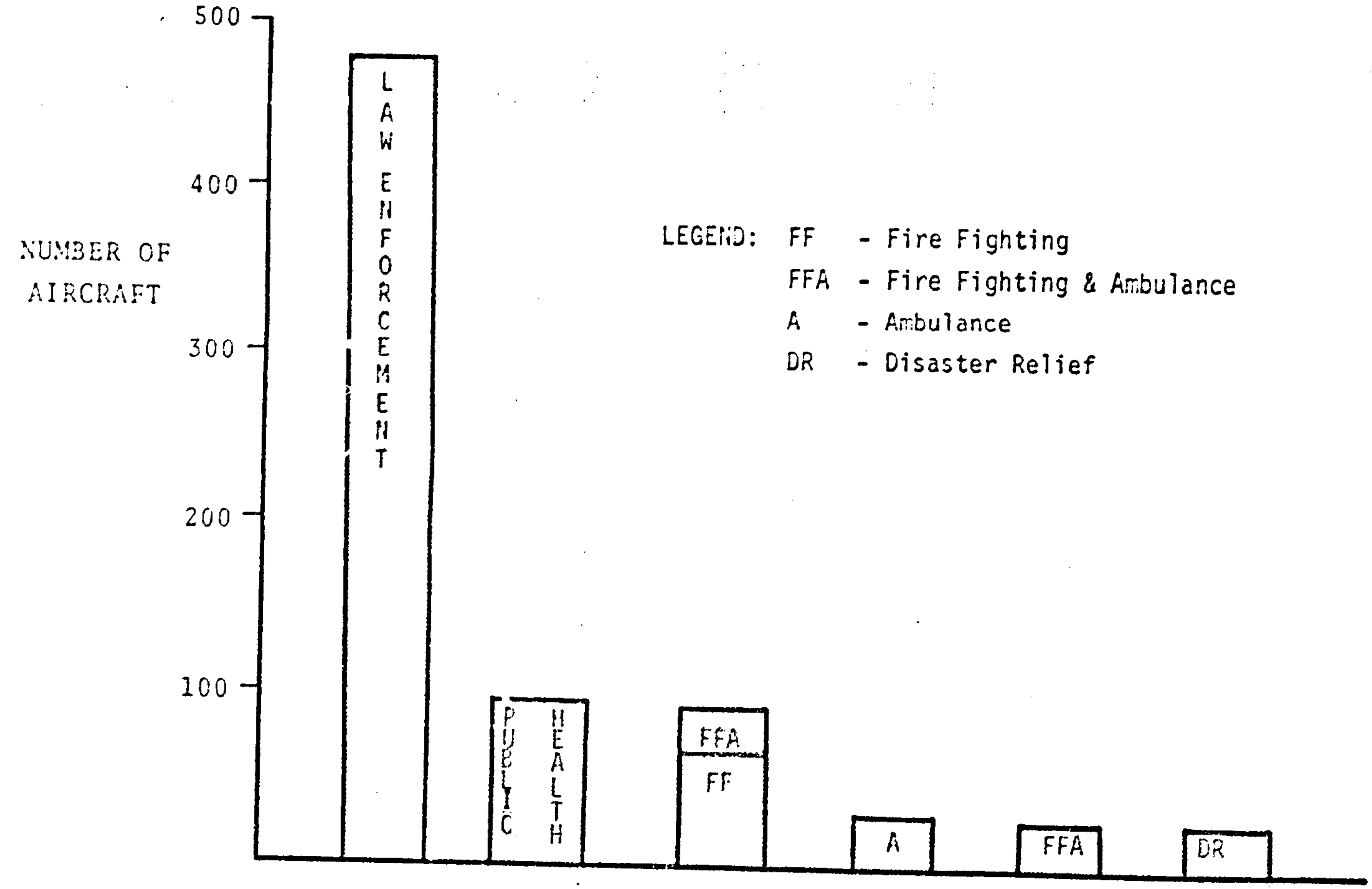
Monitoring & Diagnostic Systems:

1. Trend warning
2. Computerized monitoring system
3. Warning/caution system
4. Color coded annunciation
5. Aural warning
6. Head-up display
7. Performance limitations

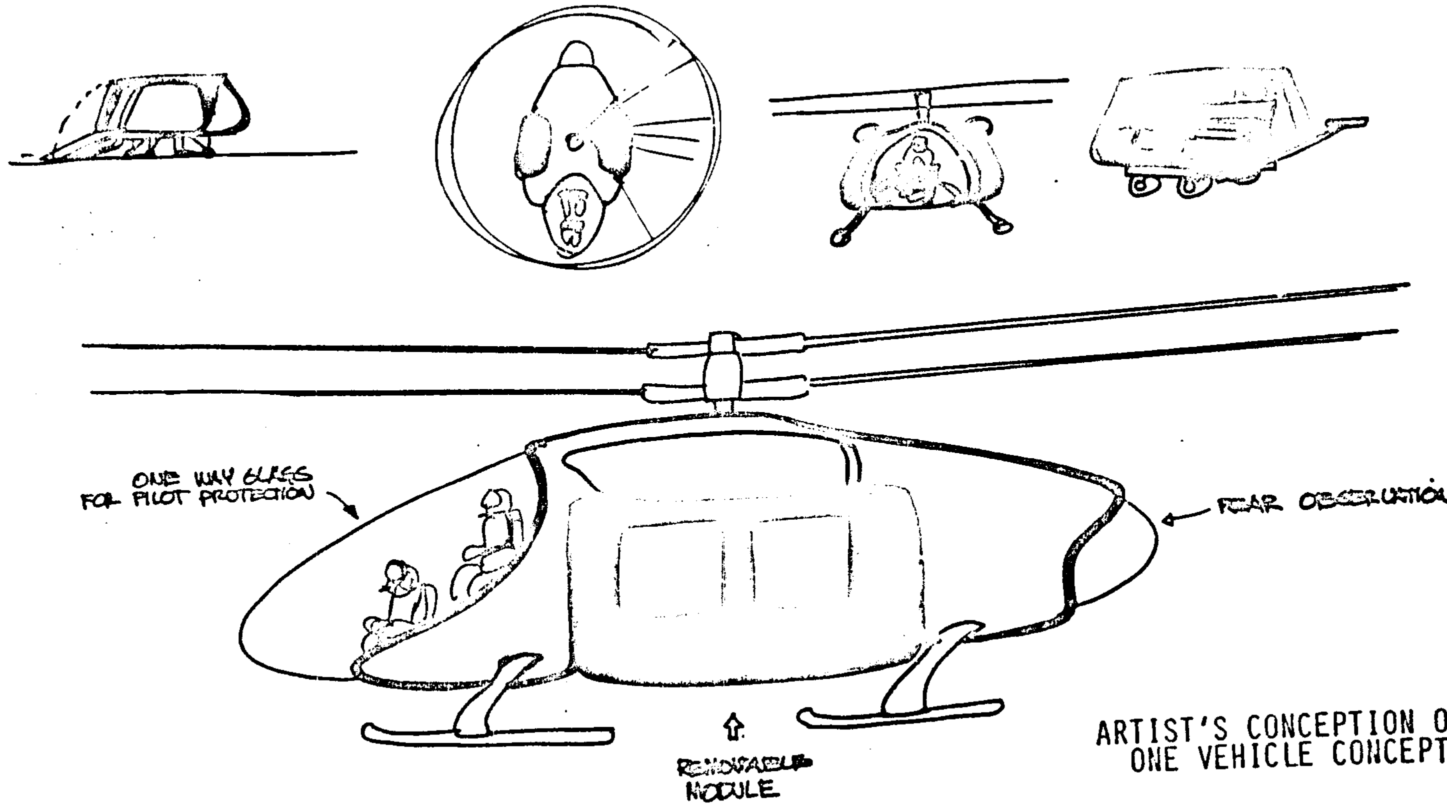
"THERE IS A STRONG PROBABILITY THAT ONE AIRCRAFT WITH MODULAR CAPABILITIES MAY BE SUITABLE FOR ALL PUBLIC SERVICE MISSION AREAS."

Working Group Chairman Consensus

PUBLIC SERVICE HELICOPTER STATUS: 1978*



*From 1978 AIA Directory of Helicopter Operators



ARTIST'S CONCEPTION OF
ONE VEHICLE CONCEPT

SUMMARY OF ADVANCED TECHNOLOGY ROTORCRAFT SPECIFICATIONS

	CABIN SIZE	NAV/GUIDANCE	SAFETY	PROPULSION
200 KNOTS MAX CONTINUOUS	MODULAR	IFR CAPABILITY	CRASHWORTHY STRUCTURE	MULTIPLE FUEL CAPABILITY
300 DASH 30 MIN MAX	2-4 CREW (BY MISSION)	ALL-WEATHER CAPABILITIES	CRASHWORTHY SEATS	NON-PETRO FUEL CAPABILITY
4 HOUR ENDURANCE	2-6 PASSENGERS	MORE AUTOMATION/ LESS WORKLOAD	CRASHWORTHY FUEL SYSTEMS	EMERGENCY POWER CAPABILITY
10000' HOGE (SINGLE ENGINE)	2+ LITTERS	REDUCED NOISE & VIBRATION	IMPROVED HOISTS	
20000' HIGE (SINGLE ENGINE)	INTERNAL MOBILITY	IMPROVED SEAT COMFORT	IMPROVED COMMUNICATION	
10000 LB MAX G.W.	ALL TERRAIN LANDING		IMPROVED VISIBILITY	
20' ROTOR DIAMETER (MAX)				

HELICOPTER ASSOCIATION OF AMERICA - GLEN GILBERT

BEGINNING THE DECADE OF THE 80S, THE HELICOPTER INDUSTRY IS GROWING AT THE RATE OF 12 TO 15%. THE U.S. CIVIL FLEET NOW NUMBERING 8000 SHOULD EXCEED 20,000 BY THE END OF THE DECADE. PUBLIC SERVICE HELICOPTERS, WHICH NOW NUMBER OVER 1200, SHOULD EXCEED 3000 AT THE END OF THE SAME TIME PERIOD. CONTINUING THIS INDUSTRY GROWTH RATE WILL DEPEND ON A NUMBER OF FACTORS. TWO IMPORTANT FACTORS INTERACT WITH PUBLIC SERVICE HELICOPTERS.

1. OBTAINING COMMUNITY ACCEPTANCE OF HELICOPTERS - THE PUBLIC APPRECIATES THE PUBLIC SERVICE MISSIONS, AND IN THE FUTURE, INCREASING SERVICES WILL INCREASE COMMUNITY AWARENESS AND ACCEPTANCE OF ALL HELICOPTERS.

2. PROVIDING MORE HELIPORTS - SORELY NEEDED ARE PUBLIC USE HELIPORTS TO ENABLE CITY CENTER-TO-CITY CENTER INTER-URBAN TRANSPORT. THE INCREASING VISIBLITY OF PUBLIC SERVICE HELICOPTERS WILL GREATLY AID IN APPROVING CITY CENTER HELIPORTS.

THE MANUFACTURER'S VIEWPOINT, PRESENTED BY MR. TOM STUELPNAGEL

PUBLIC SERVICE HELICOPTERS CURRENTLY COMPRISE ABOUT ONE-SIXTH OF THE TOTAL NUMBER OF HELICOPTERS FLYING IN THE U.S. HOWEVER, THE PUBLIC SERVICE HELICOPTERS FLY TWICE AS MANY HOURS, ON THE AVERAGE, AS COMMERCIAL HELICOPTERS. THEREFORE, THE PUBLIC SERVICE USERS ACCOUNT FOR AS MUCH AS 1/3 OF THE CIVIL FLIGHT HOURS. IN ADDITION, THE GROWTH RATE IN THIS SECTOR IS RISING AT TWICE THE RATE OF OTHER USERS. EVEN WITH ALL OF THESE POSITIVE INFLUENCES, THE MANUFACTURER CAN ONLY REALIZE NEW SHIP SALES TO THE PUBLIC SERVICE SECTOR OF ABOUT 5-10% SINCE SO MANY OF THE HELICOPTERS ARE SURPLUS OR USED. THIS TOTAL NEW SALES MARKET OF FROM 5-10% IS A VERY DIFFICULT ONE FROM A PROFITABILITY VIEWPOINT SINCE ALMOST NO HELICOPTER GOES OUT THE SAME IN THE PUBLIC SERVICE MARKET. FOR THESE REASONS, IT IS NECESSARY TO DEFINE AN ALTERNATIVE PATH IN ORDER TO SATISFY THE TECHNOLOGY NEEDS OF THE PUBLIC SERVICE HELICOPTER USERS. FIRST, THE USERS MUST ORGANIZE AS A GROUP AND APTLY EXPRESS THE REQUIREMENTS AND THE DESIRE TO FILL THOSE REQUIREMENTS. SECONDLY, THE USERS MUST COMPILE A DATA BASE TO JUSTIFY THOSE NEEDS IN TERMS OF LIVES AND PROPERTY SAVED. FINALLY, A MEANS MUST BE FOUND TO UTILIZE THE EXPERTISE AND HIGH TECHNOLOGY AID AVAILABLE FROM NASA. "THAT'S A VERY IMPORTANT FEATURE OF THE FUTURE. WE HOPE THAT IT CAN INCLUDE TECHNOLOGY. THIS TECHNOLOGY MAY GO TO THE MANUFACTURERS AND COME BACK TO YOU THAT WAY. IT MAY INCLUDE THE SPONSORSHIP OF A PUBLIC SERVICE HELICOPTER".

AIRBORNE LAW ENFORCEMENT ASSOCIATION OVERVIEW OF LAW ENFORCEMENT ROLES FOR ROTORCRAFT - LT. ROBERT MORRISON

THE EXPANDED USE OF HELICOPTERS AS A TOOL FOR LAW ENFORCEMENT WAS FIRST DEMONSTRATED IN 1966 WHEN THE L.A. COUNTY S.O. INITIATED "OPERATION SKYKNIGHT". THIS STUDY PROVIDED SUFFICIENT PROOF THAT HELICOPTERS, MANNED BY TRAINED POLICE OFFICERS, COULD GREATLY ENHANCE THE SAFETY AND ABILITIES OF THE "MAN-ON-THE-BEAT" IN HIS EFFORTS TO COMBAT CRIME.

THROUGH THE NEXT 15 YEARS, PUBLIC SERVICE AGENCIES ACROSS THE NATION EXPERIMENTED AND DEVELOPED NEW USES OF THE HELICOPTER TO THE POINT THAT IT BECAME AN INDISPENSABLE TOOL. NEW TECHNIQUES CREATED ADDITIONAL DEMANDS FOR SERVICES. FLIGHT HOURS EXCEEDED MILITARY UTILIZATION OF THE SAME EQUIPMENT, AND DESIGN LIMITATIONS OF THE VARIOUS HELICOPTERS USED WERE QUICKLY REACHED.

PRESENT DAY NEEDS REQUIRE EXTENSIVE MODIFICATION OF HELICOPTERS THAT WERE NOT DESIGNED FOR THE MULTIPURPOSE MISSIONS REQUIRED BY PUBLIC SERVICE AGENCIES. TO THIS END, IT IS THE VIEW OF THE ALEA, INC., THAT NASA IS THE LOGICAL AGENCY TO ASSUME THE DESIGN AND DEVELOPMENT ROLE, UP THROUGH A PROTOTYPE, OF THE FUTURE NEEDS OF AIRBORNE PUBLIC SERVICE AGENCIES. THESE NEEDS, BOTH SHORT AND LONG TERM, WOULD THEN BE PRESENTED TO THE MANUFACTURERS WHO ARE RELUCTANT TO UNDERWRITE THESE R&D COSTS BECAUSE OF THEIR PRESENT DAY LIMITED MARKET PROJECTIONS.