REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Federal Short Takeoff And Landing Transport Programs--Status And Needs

Department of Transportation
National Aeronautics and Space Administration
Department of Defense

The 1971 civil aviation research and development policy study concluded that a new short-haul air transportation system employing short takeoff and landing aircraft was needed.

The multiagency effort to define elements for the new system was discontinued in 1974.

Although several agencies are continuing to develop short takeoff and landing aircraft technology, the Department of Transportation is supporting continued improvement of rail transportation and better use of existing air transportation facilities as preferred solutions to short-haul transportation problems.

The Congress and the agencies involved need to reassess the needs and priorities for short-haul transportation systems based on market conditions.

PSAD-76-172

OCT. 4,1976

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-187185

To the President of the Senate and the
Speaker of the House of Representatives

This report describes Federal efforts to develop a new short takeoff and landing aircraft for use in a short-haul air transportation system. The report questions the relevance and effectiveness of civil research and development that does not fully consider (1) the social and economic priorities of the user market and (2) the emerging national transportation policy which seems to prefer alternative means for solving short-haul transportation problems.

Since 1970 Federal agencies have incurred obligations of about $400 million to study, develop, and test short takeoff and landing transport technology. Our review was made because the technology, if applied, will require substantial additional Federal investments.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of Transportation; the Secretary of the Air Force; and the Administrator, National Aeronautics and Space Administration.

Comptroller General
of the United States

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ABBREVIATIONS

AMST	Advanced Medium STOL Transport
CTOL	Conventional Takeoff and Landing
FAA	Federal Aviation Administration
GAO	General Accounting Office
NASA	National Aeronautics and Space Administration
QCSEE	Quiet Clean STOL Experimental Engine
QSATS	Quiet Short-Haul Air Transportation System
QSRA	Quiet STOL Research Aircraft
QUESTOL	Quiet Experimental STOL Transport Research Airplane
RTOL	Reduced Takeoff and Landing
STOL	Short Takeoff and Landing
V/STOL	Vertical/Short Takeoff and Landing

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

FEDERAL SHORT TAKEOFF AND LANDING TRANSPORT PROGRAMS--STATUS AND NEEDS

Department of Transportation
National Aeronautics and Space Administration
Department of Defense

D I G E S T

Plans to fulfill national short-haul transportation objectives should be clarified and coordinated. Presently, each of several agencies is pursuing its program based on its own perception of present and future needs.

Two agencies--Air Force and National Aeronautics and Space Administration--are expending about $430 million in separate programs to develop and test short takeoff and landing transport aircraft. Although the military need for such aircraft is under study, the use of short takeoff and landing technology in the civil transportation field will require new route networks, close-in airports, and better ground transportation, in addition to commercially feasible short takeoff and landing aircraft and improved air traffic control procedures. None of the Federal, state or local government agencies are making any effort to define and assess the system elements needed for commercially acceptable operations.

Developing aircraft technology for the air transportation field while deferring assessment of the system within which it will operate and the market which it seeks to influence has resulted, and will continue to result, in rejection of the technology or failure to develop other technologies more acceptable to users.

Rather than supporting development of the system required for short takeoff and landing aircraft operations, the Department of Tranportation supports improved rail transportation and better use of existing air

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transportation facilities as preferred solutions to the short-haul transportation problems. In commenting on this report, however, the Department stated that even though there is no agreement on when or if the short takeoff and landing aircraft technology will be applied, the technology is needed to provide future policy choices. (See p. 24.)

In view of its preferred solutions and the lack of any effort to define the system in which the aircraft would operate, GAO recommends that the Department of Transportation

--assess the social, economic, and jurisdictional factors influencing system development in order to determine the policy choices that could be provided by the emerging short takeoff and landing aircraft technology; and

--establish priorities for short-haul transportation systems and their related research, development, and demonstration programs based on anticipated market conditions.

Because of the need to set priorities based on an understanding of the user market, GAO also recommends that the appropriate congressional committees and the other agencies involved reassess the Federal programs for improving short-haul transportation.

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CHAPTER 1

INTRODUCTION

Since 1970 Federal agencies have been studying, developing, and testing short takeoff and landing (STOL) transport technology to improve commercial passenger service in high-density markets and to improve and modernize military tactical airlift capabilities. If pursued, these programs will require substantial additional Federal resources.

Since 1955 civil aviation has become the dominate mode of intercity common carrier transport. In 1972, about four times the number of domestic trips in excess of 100 miles were made by air as were made by a combination of all other carrier modes--rail, bus, and water. The trend from 1955 to 1972 is shown in the schedule below.

Mode Of Transportation

For Trips Greater Than 100 Miles

Year	Auto	Air	Bus	Rail	Other (note a)
	(percent)				
1955	81.0	6.0	5.0	8.0	-
1963	78.0	10.2	4.2	3.4	4.4
1967	82.0	11.4	2.2	1.6	2.8
1972	85.2	11.8	1.7	.4	.9

a/Consists of trips by water and also trips in which two or more modes were used.

A 1971 Government study reported that approximately 60 percent of all domestic air passenger movements and 80 percent of all domestic air carrier aircraft movements covered less than 500 miles. Our analysis of data compiled by the Civil Aeronautics Board on domestic passenger trips for the year ended June 1975 showed that about 40 percent of the passenger trips were for trips of less than 500 miles. Approximately half of these were trips of less than 300 miles.

A major constraint to the growth of air transportation has been airport congestion. In 1971 the cost to carriers

of aircraft terminal-area delays due to congestion was estimated at over $150 million. Without corrective action, these costs were forecasted to increase to about $600 million in 1980. Because of marginal profitability, the short-haul portion of air transportation was considered to be particularly vulnerable to these operational inefficiencies. Several Federal agencies concerned with the congestion problems undertook to establish a coordinated program to develop an improved short-haul (approximately 500 miles) air transportation system to serve high-density markets and alleviate airport congestion. A new STOL system was considered to be the leading contender for this application.

Also, in 1970 the Department of the Air Force determined that it would need a new jet STOL transport to modernize and replace aircraft in its tactical airlift fleet. In November 1972 the Air Force awarded contracts to two contractors to design, develop, fabricate, and flight test two prototypes each.

EXPLANATION OF STOL, RTOL, AND CTOL CLASSIFICATIONS

Designation of transport aircraft as STOL, reduced takeoff and landing (RTOL), or conventional takeoff and landing (CTOL) indicates the field lengths that the aircraft are designed to operate from. For the purpose of this study, aircraft capable of operating from field lengths of 1,500 to 3,000 feet are designated STOL. To achieve these field lengths, jet aircraft must be designed to use powered-lift concepts to augment aerodynamic lift. Aircraft capable of operating from field lengths of 3,000 to 5,000 feet are referred to as RTOL. Large jet RTOL aircraft could be developed as derivatives of existing aircraft and would not represent a major technology step from conventional jet aircraft. Aircraft capable of operating from field lengths of more than 5,000 feet are referred to as CTOL which are the jet transport aircraft in service today.

The National Aeronautics and Space Administration (NASA) points out that there are no generally accepted definitions for these categories of aircraft in terms of field lengths, especially for dividing the STOL and RTOL categories. The agency suggests using the following table to explain the classifications.

CATEGORY	ABBREVIATION	APPROXIMATE RANGE OF FIELD LENGTHS	AEROPROPULSION TECHNIQUE
Conventional Takeoff & Landing	CTOL	Greater than 5000 feet	No Powered Lift
Reduced Take-off & Landing	RTOL	Decreasing from 5000 to 1500 feet	
Short Takeoff & Landing	STOL		Powered Lift

CHAPTER 2

INITIAL EFFORTS--COORDINATED FEDERAL ACTION (1970-73)

In 1970 and 1971 a joint Department of Transportation and National Aeronautics and Space Administration study group undertook a comprehensive review of problems and policies affecting civil aviation. 1/ The study concluded that seeking solutions to the air and ground congestion problems at major hub airports should have the highest priority, second only to seeking solutions to the aircraft noise problem.

The study also concluded that a new short-haul air transportation system, separated as much as possible from the present long-haul system, would help to relieve congestion at existing airports, especially those in areas of high traffic density. The study concluded that short takeoff and landing vehicles offered great promise for the proposed new short-haul system and was the leading contender for this application.

The study noted that a STOL short-haul air transportation system would be justified economically if it could provide better overall service to travelers (by providing service closer to their origins or destinations and/or by reducing terminal delays), and if the aircraft could be made more compatible with the air traffic control, airports, and ground feeder systems. It also pointed out that there was a need to assure that development of all components of the system were integrated and proceeding at a consistent pace. (See fig. 1 for components of a STOL transportation system.)

In April 1971 the Federal Aviation Administration (FAA) established a new Vertical/Short Takeoff and Landing Special

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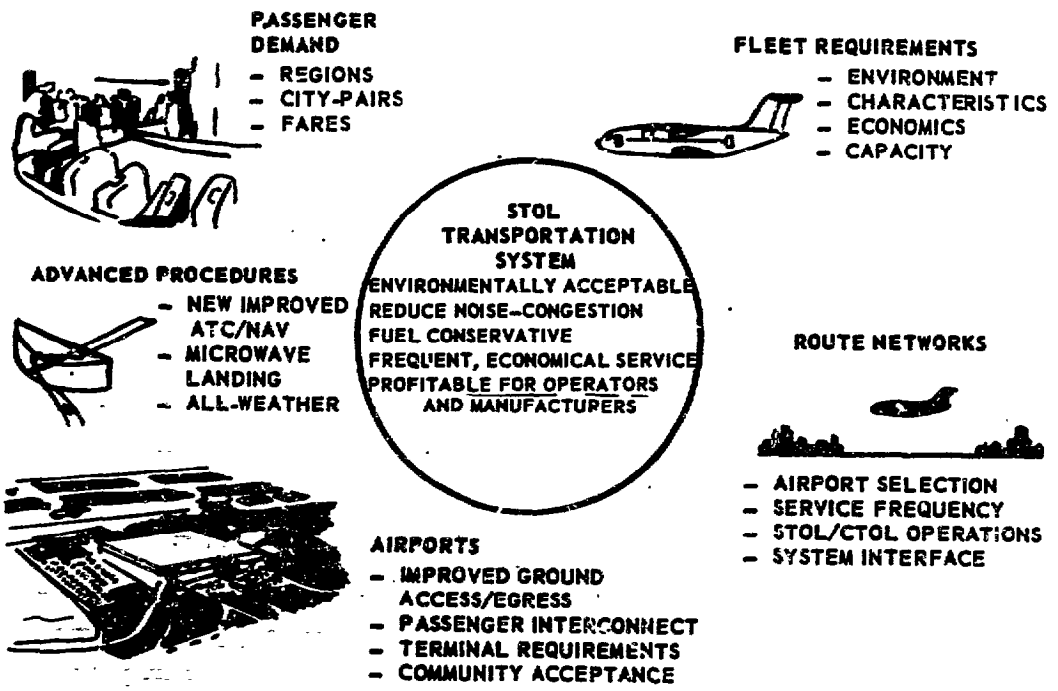
1/Study undertaken in response to recommendation of the Senate Committee on Aeronautical and Space Sciences (90th Cong.). Results of study by Subcommittee on Advanced Research and Technology of House Committee on Science and Aeronautics (now the Subcommittee on Aviation and Transportation Research and Development, House Committee on Science and Technology) were used to guide the study effort. (H. Rept. 91-932, 91st Cong., 2d sess., Mar. 23, 1970.)

FIGURE 1

COMPONENTS OF A STOL TRANSPORTATION SYSTEM



SOURCE: National Aeronautics and Space Administration

Projects Office (later named the Quiet Short-haul Air Transportation System (QSATS) Office) to plan for the development of a vertical/short takeoff and landing (V/STOL) system. The office was to encourage industry development of V/STOL aircraft and to provide direction for all activities related to V/STOL system development. Also, in September 1971 a working group (FAA, NASA, Civil Aeronautics Board, Department of Defense, and the Office of the Secretary of Transportation) was formed to coordinate Government actions for improving short-haul air transportation systems.

After many discussions and studies, FAA and NASA prepared a plan, dated March 1973, for joint actions to develop a V/STOL short-haul transportation system. Also, in 1973 the working group drafted a Federal plan for short-haul air transportation improvement. This plan defined a coordinated multiagency approach toward improving short-haul air transportation in particular and increasing national airport operating capacity in general. The proposed plan set forth the following integrated Federal/public/private sector responsibilities:

1. NASA would take the lead in providing technology in aerodynamics, handling qualities, propulsion, operating systems, and avionics.

2. NASA and the Air Force would maintain a close relationship to insure maximum utilization of their STOL technological programs.

3. The Office of the Secretary of Transportation and the Urban Mass Transportation Administration would plan for the necessary interconnection with other modes of transportation.

4. FAA would establish the airworthiness, operational, and environmental requirements; operating standards; develop and provide the air traffic control systems; and certify airport developments.

5. The Civil Aeronautics Board would establish and regulate the economic and route structure for the short-haul system.

6. Evaluation of specific metropolitan sites would be the mechanism for the direct involvement of the public and private sectors--metropolitan area authorities, community interest groups, local government groups, and airlines.

A steering committee composed of prominent people in the aviation community was organized in 1973 to provide industry's advice and counsel to the FAA Administrator and the working group.

Although the subject of improving the short-haul air transportation system was extensively studied and discussed, no Federal plan for coordinated action was ever adopted. A divergence of opinion had surfaced concerning solutions to short-haul transportation problems. A Department of Transportation official said that management saw improvement of rail transportation in heavy density corridors and better use of existing air transportation facilities as preferred solutions to short-haul transportation problems. (See ch. 3.)

CHAPTER 3

A PARTING OF THE WAYS

(1974-76)

In 1974 the Federal Aviation Administration abolished the Quiet Short-haul Air Transportation System Office which had been established to provide communication between the Federal, public, and private sectors. Since that time, each sector has pursued its own programs to improve short-haul transportation.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

The National Aeronautics and Space Administration has been pursuing a program to develop technology for quiet, short-haul short takeoff and landing jet aircraft to serve high-density markets since 1971. NASA estimates that it will have expended approximately $203 million from fiscal year 1971 through fiscal year 1979 on its STOL program. Follow-on efforts from 1979 through 1984 are under study.

Actual and projected funding by program activity from fiscal year 1971 through fiscal year 1979, along with a description of each activity, is provided as appendix I.

DEPARTMENT OF THE AIR FORCE

The Department of the Air Force is continuing its program to evaluate STOL transport prototypes by employing two different concepts of powered-lift. These prototypes are being developed to demonstrate that the aircraft can be built at reasonable cost to deliver large payloads into short, unimproved runways (about 2,000 feet). If successful and cost-effective, the Air Force intends to procure STOL aircraft to modernize its tactical transport fleet. (See p. 18.)

Contract costs through the completion of the prototype program will be about $229 million. NASA is participating in the Air Force's flight testing of the prototypes, and the Air Force will provide one or more prototypes for a NASA flight test program following completion of the Air Force tests. (See app. I.)

PUBLIC AND PRIVATE SECTORS

With the exception of the two contractors who are investing some of their own funds in the Air Force's prototypes, the public and private sectors have not been willing to invest in any segment of a civil STOL transportation system. Representatives for the two contractors said that the market for civil derivatives is a long way off and that coordinated action is needed from the public and private sectors to develop a STOL passenger system.

States and municipalities have projected airport developments of about $24 billion for the period from 1972 to 1990. Approximately $11.2 billion is for capital improvements at primary airports in large metropolitan areas. The plans call for adding 5 new airports serving air carriers and 35 general aviation reliever airports to serve large metropolitan areas by 1990.

The plans to develop additional airports and to improve existing ones, if implemented, will postpone the need for STOL aircraft operations.

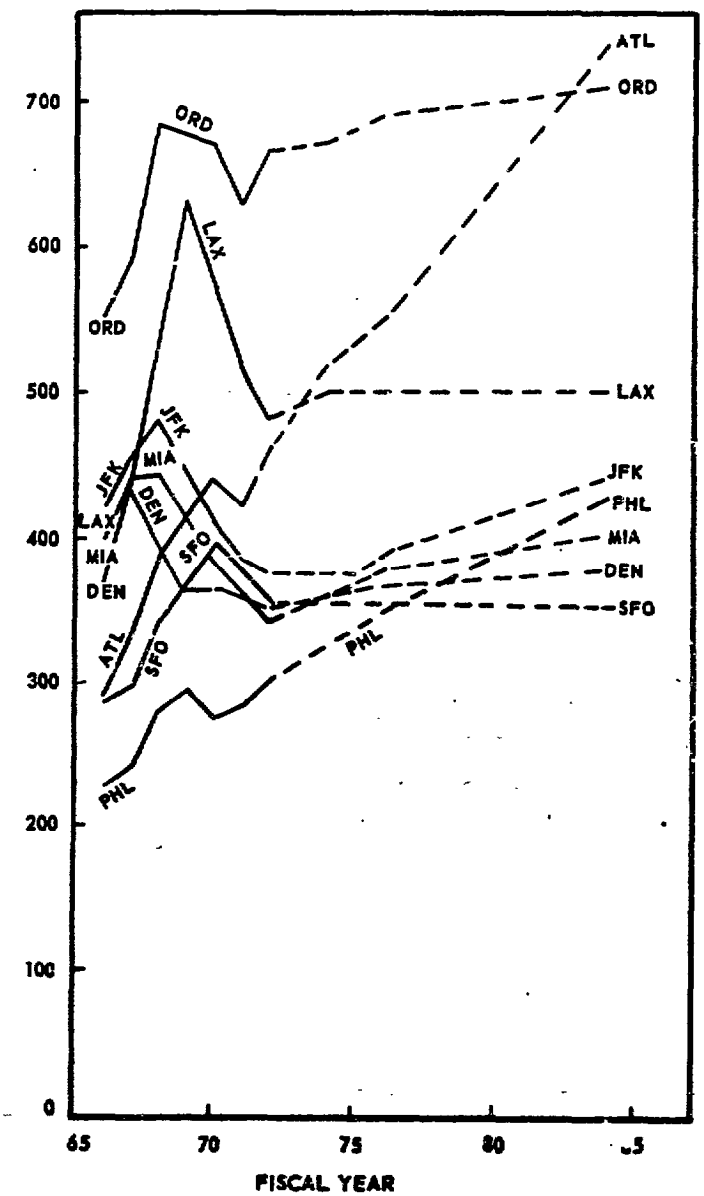
DEPARTMENT OF TRANSPORTATION--FEDERAL AVIATION ADMINISTRATION

The FAA's efforts to provide leadership and direction for the multiagency approach to improve short-haul air transportation, including development of the elements and concepts for a new STOL system, ended with the abolishment of its OSATS Office. The Department of Transportation stated that the office was abolished because the short-haul program depended upon the airlines perceiving the type of service and the aircraft required, and that this perception did not develop.

FAA considers the problems of airport congestion to be less urgent than previously stated because of (1) the introduction of wide-body jets, (2) the economic downturn, and (3) the 1973-74 fuel crisis, all of which have contributed to a reduced number of aircraft operations. (See fig. 2.) FAA does, however, forecast an 80-percent increase in domestic passenger enplanements over the next 10 years.

FAA reported to the Congress in 1974 that it will be able to extend the major airports' capacity through improvements to enroute and terminal air traffic control systems that will greatly improve runway acceptance rates. The

FIGURE 2 TOTAL OPERATIONS FOR EIGHT SELECTED AIRPORTS



CODE:

ATL – ATLANTA, HARTSFIELD INTERNATIONAL
ORD – CHICAGO, O'HARE
LAX – LOS ANGELES, INTERNATIONAL
DEN – DENVER, STAPLETON INTERNATIONAL
JFK – NEW YORK, JOHN F. KENNEDY INTERNATIONAL
PHL – PHILADELPHIA, INTERNATIONAL
MIA – MIAMI, INTERNATIONAL
SFO – SAN FRANCISCO, INTERNATIONAL

SOURCE: FAA REPORT ON AIRPORT CAPACITY, VOLUME I NATIONAL SUMMARY, JANUARY 1974

improvements will meet the mid to late 1980s projected demand, provided the wake vortex 1/ problem is solved.

The FAA report noted that most of the major airports will exceed their ground capacity before the planned extension of air capacity levels are reached. The airports ground systems included terminal buildings and aircraft boarding areas, on-airport access and parking, and off-airport access or feeder systems. A Department of Transportation study (September 1973) found that while a number of major airports reporting current ground access problems have congestion away from the airport, a greater number have internal congestion problems.

When FAA abolished its QSATS Office, it also reduced the priority given to STOL systems. However, staff members are participating in NASA's efforts to identify STOL avionics and operating procedures and to develop the information needed to formulate STOL airworthiness certification standards. (FAA participation is described in app. I.) FAA officials also said that ongoing research, engineering, and development programs will produce an air traffic control system capable of handling STOL operations by the mid-1980s.

DEPARTMENT OF TRANSPORTATION--
OFFICE OF THE SECRETARY

An official of the Department of Transportation said that he did not see the need for developing or implementing a STOL short-haul system before 1990. He pointed out that this position is reflected in the Department of Transportation's "A Progress Report on National Transportation Policy" (May 1974):

> "There is generally adequate capacity in the aviation system, although there may be pressure on capacity at peak periods at a few key airports. Improved air traffic control

1/Wake vortex is the violent trailing air currents generated by aircraft. Entrail and lateral separations between aircraft which are required to avoid these currents limit runway acceptance rates and airport capacity. Use of wide body aircraft adds to the severity of the wake vortex problem and could seriously inhibit the goal of increasing airport and airway capacity.

systems, plus the use of larger aircraft and improved operational scheduling should serve to accommodate this pressure for the coming decade. Beyond these measures, the preferred means of accommodating increasing pressures on airport capacity are diversion of short trips from aviation to other modes and the spread of aviation traffic into additional existing airports, as the market may dictate. Better management and utilization of existing facilities may also be accomplished through the concentration of general aviation at secondary airports in major metropolitan areas and the distribution of traffic away from peak periods."

The Department of Transportation also believed that plans for airport improvements submitted by the States and municipalities (see p. 9) were far too ambitious because they were based on passenger projections made before the fuel crisis. The Department's more current projections are 46 percent lower. In addition, the Department stated that most capacity-related development at large airports could be avoided by making operating improvements at existing facilities.

With regard to diverting short trips from aviation to other modes, the Department of Transportation stated in its "1974 National Transportation Report" that:

"Amtrak's [a national Railroad Passenger Corporation created by the Rail Passenger Service Act of 1970] greatest potential appears to be in providing short-haul service in selected high-density corridors, where the service can compete with air and bus modes, especially where the air and highway facilities are congested. This is particularly the case in the Washington-New York-Boston corridor, where rail service provides relief from increased congestion in these modes. Amtrak's long-haul routes would not appear to offer the same opportunity to reduce highway and air congestion. * * *"

In September 1975 the Department of Transportation stated that its immediate policy was to support Amtrak as an intercity rail passenger service and to study proposals for developing high-speed, short-haul rail service in selected high-density corridors. It also stated:

"Finally, special Federal assistance may be appropriate to support development of high speed trains in certain densely traveled regions, such as the Northeast Corridor, where improved service promises to become economically viable and Interstate highway and airport congestion can be alleviated by such rail service. A substantial Federal investment in high speed rail passenger service, however, raises again many of the complex issues of equal competitive opportunity among the modes, Federal priorities of energy and environmental conservation, what corresponding changes, if any, should be made in other Federal transportation investments in the corridor (i.e., highways, airports) and the appropriate sharing of Federal and State responsibility."

CHAPTER 4

CIVIL NEED FOR JET STOL TRANSPORT

Several studies have been conducted to determine the feasibility and economic viability of short takeoff and landing systems. Some of these cast considerable doubt on the need for STOL aircraft.

Government-sponsored studies have reported that the commercial market for jet STOL aircraft is the short-haul (less than 500 miles) passenger market. One study characterized the market to be primarily a business travel market that is highly concentrated among a few busy city pairs and is relatively insensitive to total trip cost but sensitive to door-to-door travel time. Because of this market, Federal Aviation Administration and National Aeronautics and Space Administration officials initially thought that aircraft should be operated from downtown STOL-ports located near the central business districts. The FAA officials now state that new downtown STOL-ports are not feasible because of economic and environmental considerations and, consequently, are not likely to be developed or operational in the 1980s.

Other Government-sponsored studies have concluded that a STOL system would succeed best where conventional aircraft congestion is high and where geography or land use makes the operation of "real-estate stingy" aircraft necessary. However, the few broad studies of existing airport facilities, passenger demand, routes, and environmental problems do not convincingly show that future savings would offset the costs of a complete new STOL system and offer an opportunity for profit commensurate with the risks involved. Consequently, the need for a STOL system has not been translated into a clear market to which public and private sectors can respond.

A major cost element of a new STOL system would be the costs incurred to develop and produce the aircraft. A market of 300 to 400 production aircraft would be required to permit recovery of the costs. Because of the volume requirement costs of research, development, and production for jet STOL aircraft could only be recovered if intercity satellite airport services using more efficient reduced takeoff and landing and/or conventional takeoff and landing aircraft were not developed. A survey of existing airport facilities showed that there were 2,000 airports with runways

of 4,000 feet or more and only 510, or about one-fourth, were being served by scheduled carriers. A further examination of 11 metropolitan areas in the top 10 short-haul city pairs showed that each had one or more airports with field lengths of 4,000 feet or more that were accessible for use by short-haul traffic. (App. II diagrams survey of metropolitan airports in top 10 city pairs.) (Fig. 3 illustrates comparison of direct operating costs between STOL and RTOL aircraft.)

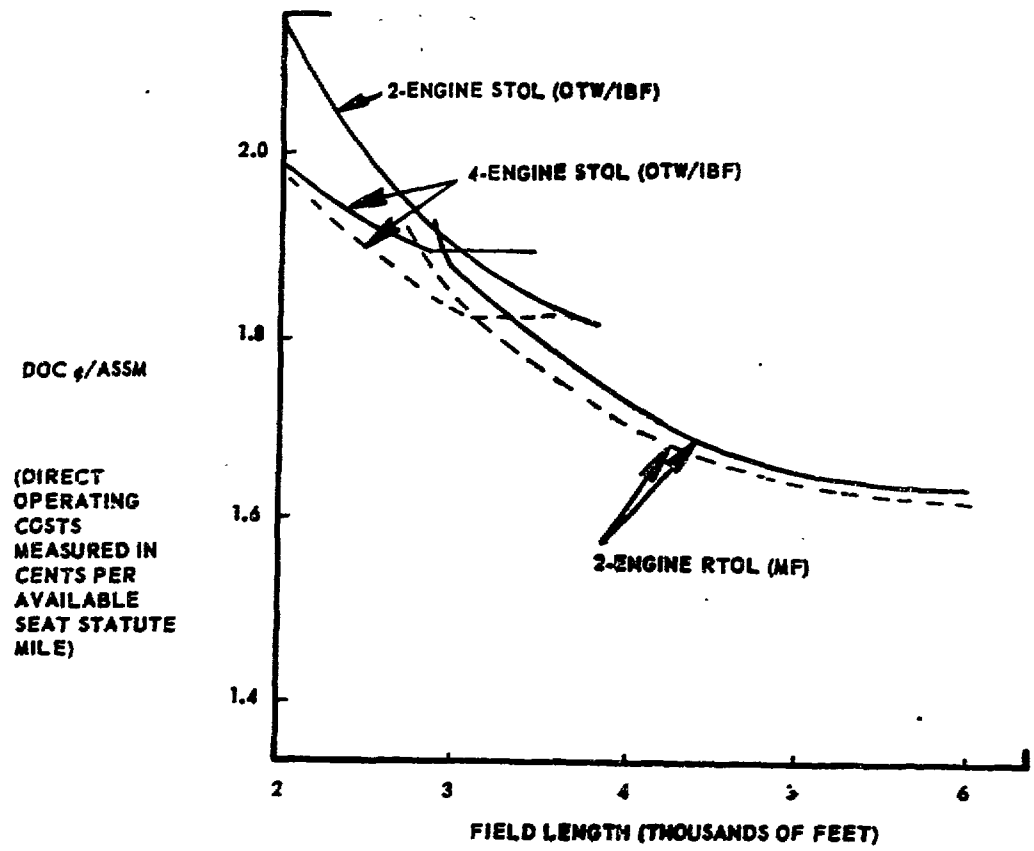
In addition to the absence of a discernible market, there may be other reasons for not supporting the development of a new short-haul air transportation system. In commenting on Federal subsidies, the Department of Transportation's "A Statement of National Transportation Policy" suggests:

> "(6) Where the political process determines that a subsidy is essential to the national interest because a particular form of transportation serves these interests more effectively, we should be prepared to take the next step in order to get the full benefit of the subsidy. This involves compatible adjustments in the Federal support of competing modes (for example, by way of illustration only, perhaps the discouragement of radially-oriented commuter roads into metropolitan centers that compete with mass transit or of new highways, or short haul air traffic, competing with a subsidized high-speed rail system in the Northeast Corridor). We should not be inconsistent by continuing to subsidize competing modes, thereby diverting traffic away from the preferred mode and decreasing its chances of economic self-sufficiency."

As noted in chapter 3, the Department of Transportation concludes that improved air traffic control systems, use of large aircraft, and improved operational scheduling could accommodate pressures at the few key airports experiencing congestion for the coming decade. Beyond these measures the Department believes that a preferred means of accommodating increasing pressures on airport capacity may be diversion of short trips from aviation to other modes, such as improved rail passenger service in the Northeast Corridor and the spread of aviation traffic into additional existing (satellite) airports as the market may dictate.

On the other hand, NASA believes that the future solution to aircraft noise and airport congestion lies in providing STOL aircraft which can operate in a separate but

FIGURE 3
EFFECT OF FIELD LENGTH
ON DIRECT OPERATING COSTS



——— CRUISE SPEED OF 0.8 MACH

- - - - - - - - - CRUISE SPEED OF 0.75 MACH

OTW/IBF = OVER THE WING/INTERNALLY BLOWN FLAP

MF = MECHANICAL FLAP

NOTE: TABLE ASSUMES COST OF FUEL AS 23¢ PER GALLON

SOURCE: *Sweet, et al, "Evaluation of Advance Lift Concepts and Potential Fuel Conservation for Short-Haul Aircraft," Lockheed Report for NASA-AMES, February 1975, p. 52.*

compatible traffic pattern with conventional aircraft. NASA points out that a quiet STOL aircraft which is environmentally acceptable to the community in the vicinity of airports could be sufficiently attractive to bring about the development and implementation of STOL operations independent of the States' and municipalities' planned airport developments. (See p. 9.) They also believe that ground congestion at major hub airports (see p. 11) could be a significant impetus for developing and implementing quiet short-haul STOL aircraft operations at satellite and/or reliever airports.

NASA believes that the existence of STOL vehicle technology will encourage and facilitate development of the system needed for its application. Accordingly, NASA activities are being paced to provide the technology by the early- to mid-1980s that will minimize the risks of developing a commercial jet STOL aircraft and permit FAA to establish standards for certification, noise, and operating procedures.

CHAPTER 5

MILITARY NEED FOR JET STOL TRANSPORT

Under the Air Force's advanced medium short takeoff and landing transport (AMST) program, four prototypes employing two different concepts of powered lift are being built to determine if an advanced technology aircraft can be built at a reasonable cost to deliver large payloads into short (about 2,000 feet) unimproved runways. The program began in 1972 with the intent of providing an option to modernize the present tactical airlift fleet, if the technology proved feasible and if the aircraft was cost-effective as a replacement for existing aircraft.

A recently completed Air Force study showed that a mixed force of AMSTs and existing aircraft would be slightly less costly than an equal force (in terms of average tons per day) of existing and modified aircraft based on 20-year life cycle costs. The study showed that the AMST's larger acquisition costs would be offset by its expected lower operating costs and by its higher productivity. This small difference, however, could be either negated or increased by uncertainties in cost data, cost estimating methods, and in the assumptions on how the AMST would be used. For example, the increased size of the AMST and the complexity in its propulsive-lift system raises doubts about the estimated savings in maintenance man-hours per flying hour.

Although the need to support the Army is a key factor in determining AMST cost-effectiveness, the Army is still studying how it could use the AMST and whether it has a need for the short takeoff and landing capability.

The Office of the Secretary of Defense has begun an independent evaluation of AMST cost-effectiveness which will be completed before AMST full-scale development is authorized.

CHAPTER 6

CONCLUSIONS

A short takeoff and landing short-haul air transportation system has long been discussed as a possible solution to existing and forecasted constraints on the growth of air transportation.

The actions being taken to improve existing airport capacity and to develop competing rail passenger service, if successful, will tend to postpone the need for a STOL short-haul passenger system. In view of these actions and the other alternatives available for alleviating congestion at existing airports, the limiting factor to the development of a STOL system will continue to be the absence of a discernible market or need to which the public and private sectors can respond. Without a major Federal commitment to develop the system, we do not believe the National Aeronautics and Space Administration's continuing efforts to reduce aircraft manufacturers' development risks will be sufficient inducement to create a market that does not appear to exist.

Because of the progress being made by NASA and the Air Force, development of jet STOL transport technology appears to be ahead of other long-lead time system components--airports, terminal facilities, routes, air traffic control, and connecting transportation. Development of these other components are tied to complex governmental decisions at the Federal, State, and local levels that have not been made and it is uncertain when they will be made, if ever.

Neither the Department of Transportation nor NASA agree that the STOL transport technology is ahead of other system components. The Department states that the current national aviation system can accommodate STOL transport technology today. Both state that the technology for a commercially viable STOL aircraft has not been developed, and NASA believes it is the most time-critical element for developing an operational system.

Although STOL transports could be used in the existing system, they would not realize the full benefits of their unique capabilities and would probably interfere with current operations. We recognize, however, that the state of technology readiness for the aircraft cannot be fully assessed until

performance requirements are defined. However, we believe that the aircraft's performance requirements should be based on the system in which it is to operate.

In view of the current NASA projections for technology readiness by the early 1980s, we believe the technical means if not presently available could be made available, with sufficient funding, before the other system elements are ready.

In our opinion, plans to fulfill the national long-term short-haul transportation objectives should be clarified and coordinated so that STOL aircraft technology and techniques, as well as other short-haul transportation modes, can be paced and made part of a fully integrated system. Presently, each of several agencies is pursuing its program based on its own specific areas of responsibility and perception of present and future needs.

We, therefore, proposed that the Department of Transportation clarify its position concerning the possible need for a STOL system in accordance with its emerging policy position regarding long-term transportation needs, constraints, and investments. We also suggested that NASA reassess the scale and pace of its research directly supporting the development of a STOL system to bring it more in line with the emerging Department position.

We stated further that the Office of Management and Budget and the appropriate committees of the Congress should reassess the Federal agencies' research, development, and demonstration activities for improving short-haul transportation. Based on our review, we believe particular consideration should be given to

--the relative costs and benefits of, and the long-term potential for developing intercity rapid rail passenger service as an alternative to major increases in short-haul air transportation;

--the relative cost and benefits of developing short-haul intercity air services using existing airports and aircraft technology as an alternative to a STOL system;

--the investments needed to assure that the Federal Aviation Administration's proposed increases in air traffic capacities will be balanced by increases in ground capacities;

--the possible timing and amounts of Federal resources that would be needed to develop and implement a STOL system, which in addition to aircraft technology, air traffic control systems, and airport development may include Federal participation in the development of production aircraft, market demonstrations, and ground feeder systems;

--the pacing of NASA's development of jet STOL transport technology as compared with developing other system components--airports, routes, air traffic control, and ground feeder systems; and

--the extent to which NASA's present and future STOL activities could be deferred, redirected, or paced to coincide better with the Department of Transportation concepts of long-term transportation objectives.

CHAPTER 7

AGENCY COMMENTS AND OUR EVALUATION AND RECOMMENDATIONS

The Department of Transportation, National Aeronautics and Space Administration, and Office of Management and Budget disagreed with statements in the report concerning the (1) lack of coordination among agencies, (2) need for a new civil short takeoff and landing aircraft and system, (3) scale and pace of NASA STOL technology program, and (4) need to reassess Federal activities for improving short-haul transportation. Their comments are presented in appendixes IV, V, and VI and are summarized below along with our evaluation.

The Director of Defense Research and Engineering did not disagree with the recommendations insofar as they pertain to the Department of Defense. The Director noted that (1) the Department of Defense must look at STOL usage from a military requirements point of view, (2) NASA representatives are participating in the Air Force flight test program, and (3) although designed to meet military requirements, the advanced medium STOL transport aircraft design could be converted for civil use if a commercial need arises for an aircraft of its characteristics. (See app. VII.)

LACK OF COORDINATION AMONG AGENCIES

The agencies do not agree with our statement that after the multiagency approach was abandoned in 1974, each agency and organization concerned with improving short-haul transportation has pursued its own programs based on its perception of present and future needs. They cite organizational arrangements and other mechanisms that seek to insure coordination and cooperation among the agencies. In summary:

--Department of Transportation believes the report confuses the relationship of a technology program with policy related to implementation of a specific operating capability.

--NASA states that excellent coordination by the Federal agencies involved in STOL programs existed well before establishment of the Federal Aviation Administration's Quiet Short-haul Air Transportation System Office and has continued since its dissolution.

--Office of Management and Budget, noting that the agencies were given an opportunity to comment, referred to various mechanisms which seek to insure effective coordination of transportation programs.

Our report does not imply that there is no coordination or cooperation between the agencies' research and development staffs when they have related interests. Cooperative efforts between the Air Force and NASA and between FAA and NASA were evident.

The present cooperation, however, including the activities of interagency research and development coordinating boards and committees and advisory councils differs materially from that proposed and initiated during the period from 1970 through 1973. As discussed in chapter 2, the former effort was an attempt by the Federal agencies to overcome the problems of coordination by developing interagency objectives and programs based on problems and priorities identified in the Department of Transportation and NASA civil aviation research and development policy study. The overall objective was not to implement improvements, but to define and assess options for improving the short-haul air transportation system so that policymakers at all levels could determine whether the identified changes would produce results worth investing public and private funds.

The former effort was a systems approach that crossed organizational lines and involved undertakings much broader than technology alone. The need for this approach was stated in the 1971 policy study:

--It is unlikely that STOL aircraft development itself can solve the problem. Any new short-haul aircraft that must operate in the same air traffic control, runway, and airport environments as long-haul aircraft will continue to be subject to most of the same delays experienced by current short-haul aircraft. A new short-haul system is needed that can function compatibly with the long-haul system.

--The development of such a system, however, transcends technology alone and involves institutional factors, including economic regulation, legal structures, multiple political jurisdictions,

changing social priorities, and complex interactions among multiple Federal agencies.

--In the air transportation research and development field, where products must be responsive to public needs and values, social and physical science considerations should be explored simultaneously. Ignoring or deferring the latter has inevitably resulted, and will continue to result, in either the rejection of technologies that have been developed or the failure to develop needed technologies.

When the multiagency effort to develop a new short-haul system was discontinued in 1974, the systems approach--capable of defining and assessing options for improving the air transportation system--was also discontinued. As a result, NASA continues to develop STOL technology for civil applications without supporting analyses of the institutional factors that will determine its acceptance.

If the STOL vehicle technology program is to provide future policy options, it should be guided by the requirements of the transportation system within which it will operate and by assessments of the market which it seeks to influence. This is particularly the case when its application depends upon decisions made by public and private sectors rather than the Federal Government.

NEED FOR NEW STOL TRANSPORTATION SYSTEM

While there is no agreement among the agencies on when or whether the technology will be applied, there is general agreement that the technology is needed to provide future policy choices.

--Department of Transportation does not anticipate the introduction of STOL aircraft into the air transportation system before 1985-90 and sees no immediate need to plan for such an implementation. It sees STOL as only one alternative being investigated to provide options for the longer range future. Although agreement exists over the need for research and development, establishing agreement over the timing and extent of implementation is more difficult. The future is uncertain. A commitment now for or against a specific technology which has not yet matured to marketability would be premature.

--NASA states that interagency and in-house teams, advisory councils, and others have reviewed and endorsed its aeronautical programs, including its STOL research program, as addressing significant national needs. NASA states that quiet STOL aircraft and operating technology is the most time-critical element for potential domestic cargo and/or passenger operations.

--The Office of Management and Budget does not feel that sufficient information is available to assess the potential of such technology. The Office states that while all involved agencies are hopeful that significant technology advances will result from the NASA and Air Force STOL programs, it would be unwise to make a premature Federal commitment to develop a total STOL transportation system until more information is available.

We agree with the Department of Transportation and the Office of Management and Budget that a new STOL transportation system is only one alternative for solving the problems of air transportation, and that not enough information is available to assess its potential for this application. We also agree that the need and timing for such an application is uncertain and that it would be premature to make a Federal commitment to such a system. It is for these reasons that we question abandoning the multiagency approach to define and assess all the options for improving short-haul air transportation, while at the same time continuing to develop STOL transport technology.

Because of the institutional factors, the current state of STOL technology, and the variety of options available for improving short-haul air transportation, we believe that a systems approach is needed to assure more collaborative efforts between the Federal agencies working on various elements of the national air transportation system and the public and private sectors that are expected to implement changes and operate the system. The systems approach would also provide a focus for the continuing evaluation of agencies' research and development efforts on the basis of the changing and uncertain social and economic conditions.

SCALE AND PACE OF NASA STOL TECHNOLOGY PROGRAM

In general, the agencies concur with the scale and pace of the NASA STOL technology program.

--The Department of Transportation concurs with the timeliness and pace of the NASA STOL technology program to provide vehicle technology by the early 1980s. The Department states that since economic viability of a generic STOL transport design has not yet been established, a demand does not now exist within the private sector. However, congestion expected to develop over the next decade could lead to the development of a market, provided the airlines are confident that an appropriate aircraft will be available. The Department concludes that a comprehensive research and development program in the 1970s is important to its ability to make policy choices in the 1980s.

--NASA states that it has recently completed an evaluation of its program and believes its scale and pace are correct and in consonance with Department of Transportation, FAA, and Department of Defense positions and programs. It states that quiet STOL aircraft and operating technology is the most time-critical element for potential cargo and/or passenger operations. Its program, which is aimed at technology readiness by the early 1980s, recognizes that it will take about 7 to 10 years from technology availability to operational implementation. Because of this time factor, NASA and Department of Transportation state that the planned readiness of the vehicle technology is in consonance with Transportation's position vis-a-vis a STOL system implementation.

--Office of Management and Budget indicates that it believes NASA's advanced technology program should continue so that sufficient information can be obtained to assess its potential.

As stated in the civil aviation research and development policy study and subsequent studies, a civil STOL transport requires a new short-haul air transportation system that is separated as much as possible from, but compatible with, the long-haul system if it is to realize its full benefits. These studies also pointed out that the introduction of a new STOL system presents so many uncertainties that no single participant seems capable of taking the lead to produce the operating system. Without some assurance that all other elements of the system will be ready when the aircraft is ready, no aircraft manufacturer or airlines will undertake to implement or acquire the new vehicle technology when available.

In addition, because of the less expensive alternatives that have been suggested for alleviating congestion at existing airports during the next decade, the limiting factor in the utilization of STOL technology will continue to be the absence of a discernable market.

NEED FOR REASSESSMENT OF FEDERAL RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACTIVITIES FOR IMPROVING SHORT-HAUL TRANSPORTATION

--Department of Transportation agrees with the basic recommendation for a reassessment of the Federal STOL program by both the Department and NASA. The Department believes, however, that it is adequately addressed in the normal research and development process and that a special reassessment is unnecessary.

--NASA basically agrees with the intent of the recommendation calling for a reassessment of the Federal agencies' research, development, and demonstration activities related to STOL systems and short-haul transportation. It believes, however, that such a reassessment should not be made solely by considering potential future domestic passenger transportation, but must also consider the relationship, impact, and timeliness of NASA's research program to the AMST development; to sales of AMST civil cargo and/or passenger derivatives to foreign countries; and to quiet U.S. civil cargo operations.

--Office of Management and Budget recognizes and agrees that NASA research and development programs on STOL require a careful assessment of the technology's potential implementation in the national transportation system. The Office of Management and Budget states that it will continue to reassess each agency's research and development and demonstration activities for improving short-haul transportation. Furthermore, it will continue to encourage interagency coordination of transportation programs to insure that such programs are productive and that limited resources are wisely allocated.

In our opinion, agency officials need more information on the potential end-uses to realistically assess Federal programs to improve short-haul transportation. The Department of Transportation states that a thorough understanding

of the options and operational impacts is needed when the time comes to promulgate regulations and develop operational plans. We believe this understanding is also needed to initiate and sustain research and development programs that look to others, especially the private sector, for application of the technology produced.

Developing aircraft technology for the air transportation field while deferring assessment of the system within which it will operate and the market which it seeks to influence has resulted, and will continue to result, in rejection of the technology or failure to develop other technologies more acceptable to users.

RECOMMENDATIONS

For the development of an integrated and balanced national transportation system, we believe the Department of Transportation should coordinate and monitor all Federal research, development, and demonstration programs seeking to improve segments of the national system. In view of its support of improved rail transportation and better use of existing air transportation facilities as the preferred solutions to short-haul transportation problems, we recommend that the Department:

--Assess the social, economic, and jurisdictional factors that will determine the policy choices to be provided by the emerging STOL aircraft technology. We also believe this is necessary to determine technology requirements.

--Establish priorities for short-haul transportation systems and their related research, development, and demonstration programs based on market conditions.

Because of the need to set priorities based on an understanding of the user market, we also recommend that the appropriate congressional committees, the Office of Management and Budget, and NASA reassess Federal programs for improving short-haul transportation.

CHAPTER 8

SCOPE OF REVIEW

Our study of the civil short takeoff and landing transportation programs included an analysis of Government-sponsored studies and reports which examined the need for and economic viability of a proposed STOL transportation system, a review of Department of Transportation reports and statements regarding airport congestion and the need for a STOL system, an examination of the Federal Aviation Administration's role in developing a STOL system, and a survey of the National Aeronautics and Space Administration research projects to develop the technology for powered-lift STOL transport aircraft.

We also discussed prospects for a STOL system and the status of the current STOL effort with officials of the Office of the Secretary of Transportation, FAA, NASA, the Department of the Air Force, and the two contractors developing the Air Force's STOL prototypes. We did not examine alternatives to NASA STOL research activities or t e extent to which the activities could be deferred or redirected.

Our study included a review of the Air Force's advanced medium STOL transport program and NASA's participation in the program. A separate staff study has been issued on the current status of the Air Force program.

NASA STOL Technology Development Funding
Fiscal Years 1971-79
($ 000)

Activity	1971	1972	1973	1974	1975	1976 (note a)	1977-79 (note b)	Total
STOL aerodynamics--research and technology base activity	$ 2,425	$ 2,325	$ 1,816	$ 1,755	$ 3,200	$ 2,205	$ 4,215	$ 17,941
STOL system studies	-	2,400	500	433	-	-	-	3,333
C-8 augmentor wing, research aircraft & flight experiments	2,800	2,570	1,310	530	350	-	-	7,560
Flight characteristics and operational criteria	940	800	655	750	630	1,120	2,125	7,020
STOL operating systems technology	2,365	3,205	4,372	4,667	2,468	3,917	3,300	24,294
Quiet experimental STOL (QUESTOL)	1,150	12,200	2,968	-	-	-	-	16,318
Quiet propulsive lift technology--AMST experiments (QPLT--AMST)	-	-	-	750	950	1,200	300	c/3,200
Quiet propulsive lift technology--quiet STOL research aircraft (QPLT--QSRA)	-	-	-	11,550	7,050	11,100	2,300	32,000
Quiet clean STOL experimental engine (QCSEE)	-	-	1,868	6,000	10,000	12,000	4,000	[illegible]
Aeronautical life sciences	-	-	1,000	1,240	760	405	750	4,155
Research and development (contractual)	$ 9,680	$23,500	$14,489	$27,675	$25,408	$31,947	$16,990	$149,689
Research and program management (note d)	3,810	5,350	5,602	6,310	7,745	9,500	15,349	53,666
Total	$13,490	$28,850	$20,091	$33,985	$33,153	$41,447	$32,339	e/$203,355

a/Includes the transition period.

b/Because of the opportunistic nature of research, other efforts not listed here could be initiated during this time frame.

c/Represents Air Force-led flight tests of AMST; nothing is included for NASA-led flight tests, which if undertaken could start as early as 1977.

d/Represents costs for NASA personnel supporting projects.

e/Does not include FAA research and development efforts pertaining to STOL.

Source: National Aeronautics and Space Administration.

NASA STOL TECHNOLOGY DEVELOPMENT PROGRAM

The objective of the NASA STOL technology development program is to provide by the mid-1980s the technology required (1) by industry for successful development and operation of environmentally acceptable, economical, and safe powered-lift, short-haul transport aircraft and (2) by Government to assure that such aircraft will be adequately regulated.

STOL-related research efforts have been conducted by NASA since the 1960s but following the civil aviation research and development policy study of March 1971, NASA expanded its efforts substantially.

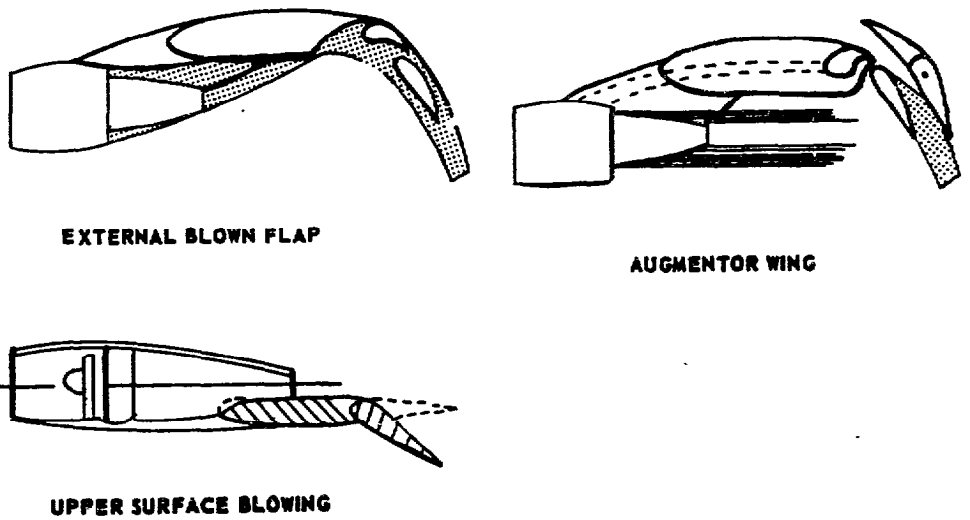
NASA's total funding from fiscal year 1971 through 1979 for its present STOL technology development program is estimated to be $203.4 million. As of April 30, 1976, a total of $146.3 million has been obligated. NASA officials anticipate that a number of its research efforts will continue through 1983-84. NASA could not supply cost data for the 1980 to 1984 time frame because its plans were not yet defined due in part to the opportunistic nature of the research work that will be performed.

The actual and projected funding through fiscal year 1979 is shown on the opposite page, and a brief discussion of each of the present activities comprising the STOL technology program follows. The funding data ard description of the activities are based on information provided by NASA and has not been independently verified by us.

STOL AERODYNAMICS--RESEARCH AND TECHNOLOGY (R&T) BASE ACTIVITY

Over the past 20 years this research activity has investigated and identified several promising approaches for providing the powered-lift required for jet STOL aircraft. Powered-lift concepts use jet propulsion system air flow to augment the wing aerodynamic lift. In recent years such research has concentrated on three powered-lift concepts (1) the jet augmentor wing internally blown system, (2) the externally blown under-the-wing system, and (3) the externally blown over-the-wing system (upper surface blowing). (See fig. 4.)

Powered-Lift Concepts



Source: Civil Aviation Research and Development Implementation Plan, March 1973, p. 42.

Figure 4

In fiscal years 1975 and 1976, large-scale low-speed wind tunnel and static tests will be essentially completed on the augmentor wing and over-the-wing blown concepts. Smaller-scale high-speed wind tunnel and analytical studies were initiated to improve the cruise performance of transport configurations using such STOL devices. Contracted analytical and wind tunnel studies were also begun, aimed at reducing the noise of the over-the-wing blown concept. Although no NASA aerodynamic studies are now directed at the under-the-wing blown concept, initial studies are planned in fiscal year 1976 to determine the potential of a hybrid system combining under-the-wing and over-the-wing blowing.

STOL SYSTEM STUDIES

The STOL system studies were performed to evaluate the environmental and economic viability of STOL aircraft and to identify the critical technology needs for developing high-density short-haul air transportation systems. The reports

included estimates of demand and comparisons of alternative aircraft designs. The reports concluded that there was a need for perhaps hundreds of jet STOL aircraft, sized for about 150 passengers, primarily to relieve expected congestion at the major hub airports in the mid-1980s. Summary comments on these studies and others are stated in chapter 4.

The studies also identified critical technology needs that require additional research and development. These needs were incorporated in the research and development activities described below.

C-8 AUGMENTOR WING RESEARCH AIRCRAFT

The objective of this program was to provide proof-of-concept of the jet augmentor wing approach to powered-lift flight. A Buffalo C-8 was modified into a jet augmentor wing research aircraft. The flight research program evaluated the augmentor wing aerodynamics, defined takeoff and landing distances, climb out and descent capabilities, and safe operational boundaries and procedures for the aircraft.

The proof-of-concept effort was completed in fiscal year 1975. The jet augmentor wing research aircraft is now being employed in a variety of STOL experiments under NASA's flight characteristics and operational criteria and STOL operating experiments activities described below.

FLIGHT CHARACTERISTICS AND OPERATIONAL CRITERIA

NASA and FAA are participating in a long-term effort to develop airworthiness certification standards for powered-lift STOL transports. Work on developing tentative criteria has proceeded since the 1960s. Tentative criteria for low-speed performance and safety margins have been formulated from studies using the NASA flight simulator for advanced aircraft.

In fiscal year 1976 the C-8 jet augmentor wing research aircraft will be used in "flight verification" of these tentative standards.

FAA personnel have participated in the planning and monitoring of flight tests. FAA has contributed approximately $240,000 toward the cost of conducting tests on the NASA Ames Research Center's simulation facilities and has otherwise shared in the joint NASA/FAA project costs in the amount of

$348,000. In addition, FAA has spent over $200,000 in other activities relating to STOL flight characteristics.

Simulation and flight research using the C-8 jet augmentor wing aircraft to acquire data necessary to revise and extend current handling qualities criteria for powered-lift STOL aircraft will be completed in fiscal year 1976. As the Air Force's AMST and the NASA's quiet short takeoff and landing research aircraft (QSRA) become available, they also will be used in handling qualities research. (See p. 35). NASA expects that this comprehensive data base on handling qualities will facilitate a relatively risk-free design of a powered-lift STOL aircraft.

STOL OPERATING EXPERIMENTS

The objective of these experiments is to develop avionic and maneuvering requirements for integrating STOL transports into a complex enroute and terminal control environment. The unique role of STOL aircraft is to take off and land from restricted sites, to follow steep descent and ascent flight paths, and to perform tight turns or decelerating turns in limited airspace. This requires developing a data base that will define safe and efficient operating modes and guide the development of navigation guidance and control systems.

Simulation and flight experiments are being conducted using a flexible, integrated, digital avionics research system called STOLAND. System flexibility permits experiments to be conducted at various levels of sophistication and complexity, which range from providing the pilot raw data for manual flying to a capability for fully automatic maneuvering and landing.

Successful automatic landings have been made with a STOLAND-equipped modified C-8A Buffalo, employing the augmentor wing concept. A STOLAND system is also being tested on a DHC-6 Twin Otter aircraft.

The STOL operating experiments are expected to be completed in 1977. A STOLAND system will then be placed on NASA's QSRA for further testing. A STOLAND system may also be installed on one of the AMST prototypes in order to study operational aspects of automated STOL systems on a large powered-lift STOL aircraft.

FAA participation in the program has included providing (1) a Twin Otter research aircraft, (2) an estimated $235,000 toward modification of the research aircraft, (3) an estimated

$400,000 to the Transportation Systems Center for visual flight rules (VFR) non-precision approach work, (4) a modular microwave instrument landing system (MODILS), (5) an estimated $485,000 to upgrade and maintain the MODILS (which is also used in other FAA activities), (6) an estimated $100,000 to help produce STOLAND, and (7) 1 or 2 man-years in helping NASA to initiate and design the flight experiments.

QUIET EXPERIMENTAL STOL (QUESTOL)

The objective of this program was to advance STOL technology to a point where industry could embark on its own commercial STOL projects. It was felt that this available technology would encourage manufacturers to develop aircraft which could alleviate congestion and noise at busy airports--the two top priority needs identified in the joint Department of Transportation and NASA civil aviation research and development policy study.

To accomplish its objective, NASA planned to design, fabricate, and extensively test two quiet experimental jet STOL research aircraft. Costs were estimated at about $100 million. NASA released requests for proposals to design the aircraft in August 1971.

Funds were impounded by the Office of Management and Budget in October 1972, and NASA canceled the program in January 1973. The stated explanation for the cancellation was that the QUESTOL program had a lower priority relative to other NASA aeronautical activities and that there were uncertainties in timing the need for commercial STOL aircraft in the 1980s. It was also thought that NASA could use the Air Force's AMST prototypes to develop and test STOL technology for commercial applications.

Following cancellation, remanents of the program were transferred to NASA's Quiet Propulsive Lift Technology (QPLT) program. The objective of this program was to provide, by the 1980s, the technology base required by industry for the successful development of an environmentally acceptable, economical, safe, quiet, new short-haul civil air transport. As described below, it consists of two experimental activities involving full-scale flight research using (1) the Air Force AMST prototypes and (2) NASA's low-cost replacement for the QUESTOL, the QSRA.

NASA officials have stated that both the QSRA and the AMST programs have benefited from the early design data developed in the QUESTOL program.

QPLT-AMST EXPERIMENTS

In February 1973, following the cancellation of the QUESTOL program, the Air Force and NASA signed a memorandum of understanding which permits NASA to participate in the Air Force flight testing of the AMST prototypes on a noninterference basis. This means that any NASA experiment that would affect cost, schedule, or performance of the Air Force program may not be allowed. Following completion of its flight test activities, the USAF would provide NASA with one or more prototypes, as mutually agreed, for a NASA-led flight test program.

The first of the AMST prototypes, the McDonnell Douglas YC-15, is being flight tested, and the other prototype, Boeing's YC-14, is scheduled to commence flight tests in mid-1976. The NASA experiments to be conducted on the prototypes have been developed for the Air Force-led portion of the testing, but are subject to the Air Force's approval.

NASA has installed instrumentation on the YC-15 to measure noise and aerodynamic effects. The instrumentation will be activated during flight tests in 1976. NASA instrumentation will also be employed during YC-14 flight tests scheduled for fiscal years 1976 and 1977. NASA instrumentation has been employed since December 1975 in propulsion static tests on the YC-14 nacelle and flap hardware.

It is anticipated that, following the Air Force AMST evaluation phase, there will be a follow-on flight test program wherein NASA will further expand the technology data base.

QPLT-QSRA

NASA initiated design work on the QSRA in 1974 as a low-cost replacement for the canceled QUESTOL program. The QSRA, which employs an advanced hybrid over-the-wing and through-the-wing powered-lift concept, will permit propulsive-lift research with emphasis on noise reduction, handling qualities, and terminal area operations. The QSRA, however, will not provide the high-speed data that would have been provided by the QUESTOL program. NASA expects to obtain the high-speed data during its flight testing of the AMST prototypes.

The research aircraft will be a modification to a surplus C-8A Buffalo airframe and includes new wing and nacelles and four surplus jet engines for propulsion and lift augmentation. Flight tests to determine the research capability of the aircraft will begin in 1978 and be completed in 1980. After establishing research capability, a flight experiment program will be initiated. The amount of further modification and testing is dependent upon the baseline flight data.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE)

The objective of the QCSEE program is to consolidate and demonstrate by 1979 the technology needed for very quiet, clean, and efficient propulsion systems for powered-lift, short-haul aircraft. The program involves the design, fabrication, and testing of two types of engines that can be used for powered-lift applications--over-the-wing to achieve upper surface blowing effects and under-the-wing for the external blown flap concept. Design of both engine versions will be completed in fiscal year 1976; fabrication and testing of some engine components have already begun.

The environmental technology is concentrating on obtaining low exhaust pollutants and meeting the Civil Aviation Research and Development Implementation Plan noise goal of 95 effective perceived noise level, in decibels (EPNdB) at 500 feet side line distances. Recent tests of the QCSEE combustor have indicated that difficulties may occur in meeting pollution emission goals. A NASA official said that QCSEE should achieve its noise level goal, but only by a small margin.

NASA expects the QCSEE engine to be available after 1979 for inserting and testing new technological developments.

AERONAUTICAL LIFE SCIENCES

Efforts of the aeronautical life sciences projects relating to STOL aircraft include concern for developing ride quality for STOL aircraft which is equal to CTOL aircraft and for assuring that the noise levels will be acceptable to affected communities.

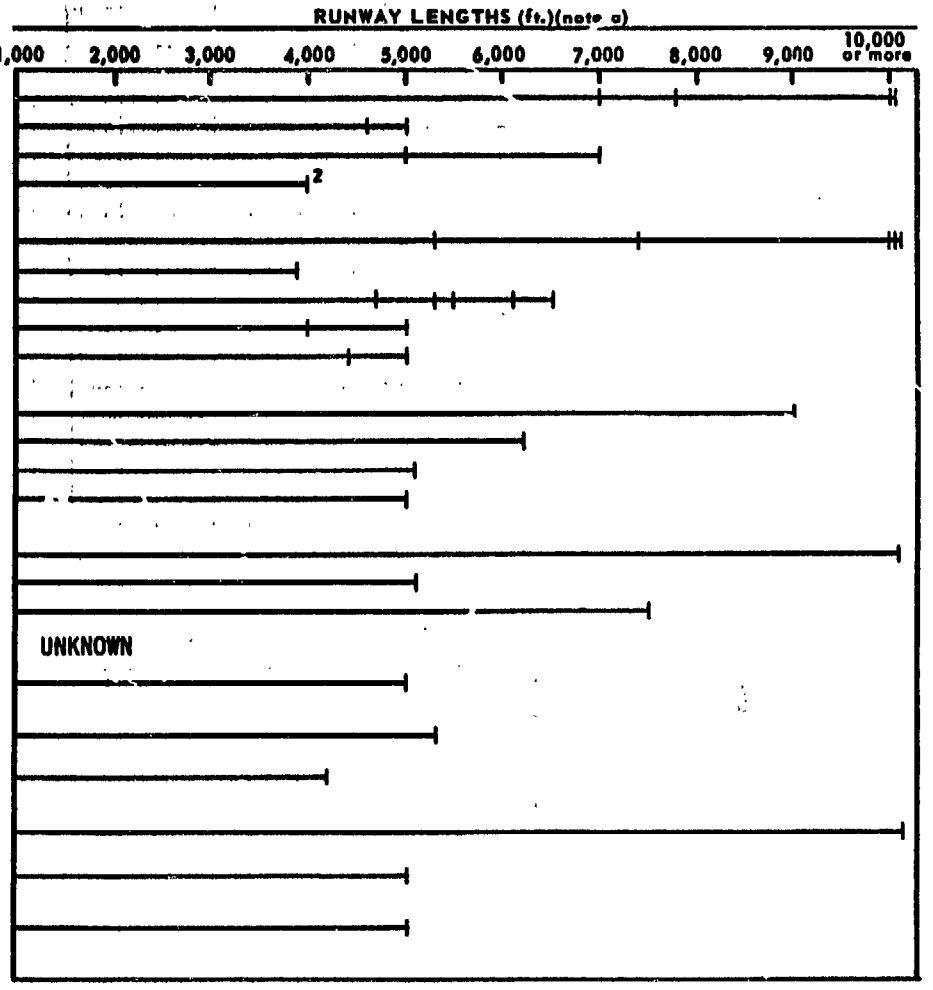
In the area of ride quality, studies have indicated that the use of an onboard computer to both anticipate aircraft motion and make the necessary adjustments can prevent a rough ride. The computer system will be tested on a DHC-6 Twin Otter research aircraft in 1978.

The NASA simulator at Langley is being used to develop techniques designed to accurately measure passenger acceptability and define ride quality boundaries. Vibration and acceleration are being studied individually and in combination. This research will be completed in approximately 3 years.

Research is also being conducted to provide acceptable noise levels for passengers. This research will identify how noise is transmitted through the structure of the aircraft, how such noise can be controlled, and what the human response will be to the noise environment. This research is expected to be completed in 1980.

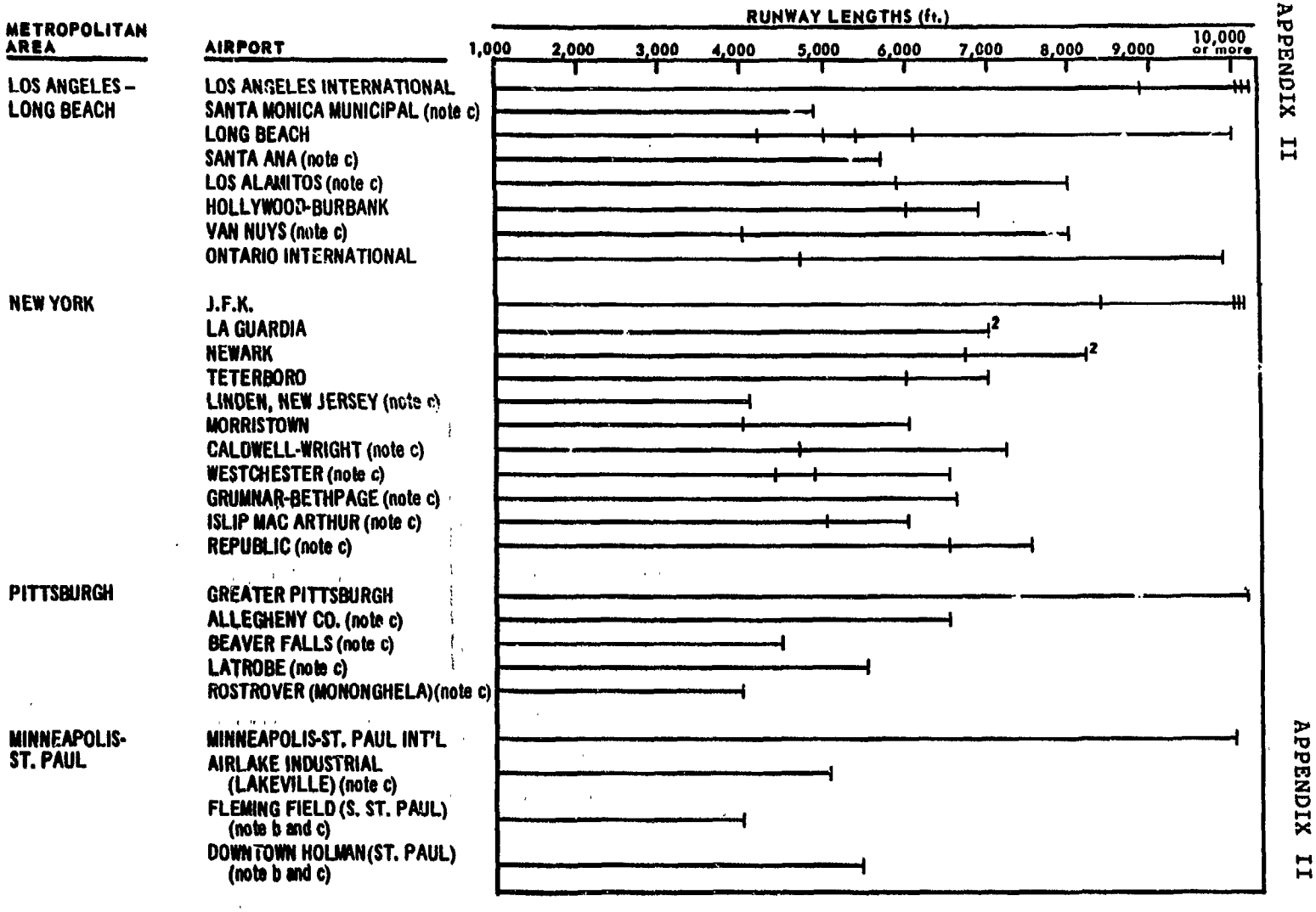
NASA also reports that it has improved its capability to forecast the annoyance to communities caused by aircraft noise such as STOL which is predominantly found in the low frequency spectrum. Research has shown that STOL noise is generally more annoying than CTOL noise for the same perceived noise level.

SURVEY OF METROPOLITAN AIRPORTS: CITIES IN TOP 10 SHORT-HAUL MARKETS

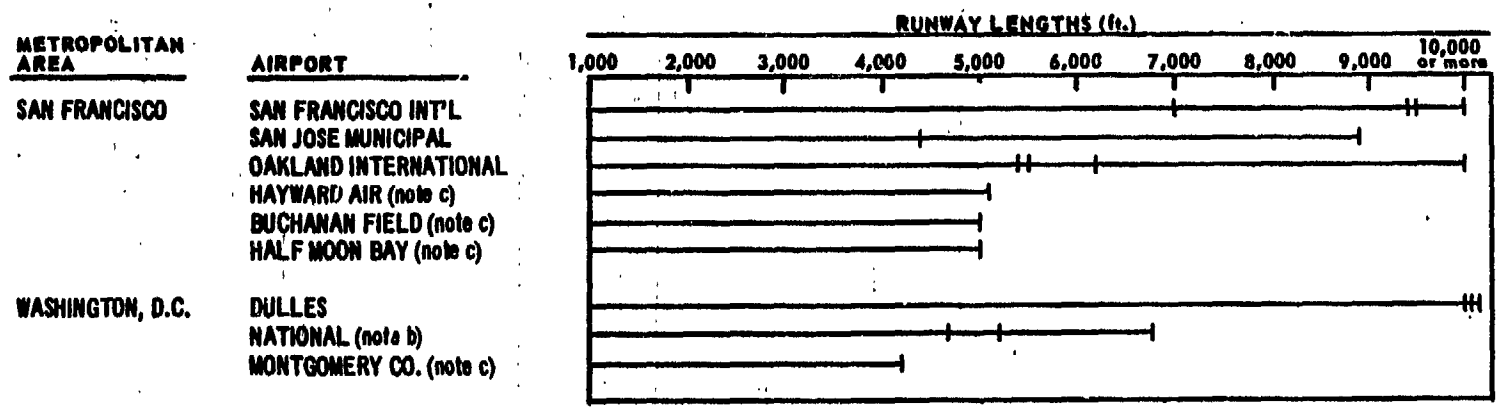


METROPOLITAN AREA	AIRPORT
BOSTON	LOGAN INTERNATIONAL (note b)
	BEVERLY MUNICIPAL (note c)
	HANSCOM (note c)
	NORWOOD (note c)
CHICAGO	O'HARE INTERNATIONAL
	MEIGS (note b)
	MIDWAY
	DU PAGE COUNTY (note c)
	PAR-WAUKEE (note c)
CLEVELAND	HOPKINS INTERNATIONAL
	BURKE LAKEFRONT (note b)
	CUYAHOGA COUNTY (note c)
	LORAIN CO. REGIONAL (note c)
DETROIT	METRO-WAYNE CO.
	CITY (note b)
	WILLOW RUN (note c)
	WINDSOR ONTARIO (note c)
	GROSSE ISLE MUNICIPAL (note c)
	OAKLAND-ORION (PONTIAC) (note c)
	BERZ MACOMB (UTICA)(note c)
LAS VEGAS	McCARRAN INTERNATIONAL
	HENDERSON SKY HARBOR (note c)
	NORTH LAS VEGAS AIR TERMINAL (note b and c)

APPENDIX II


METROPOLITAN AREA
AIRPORT
RUNWAY LENGTHS (ft.)
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000 or more
LOS ANGELES – LONG BEACH
LOS ANGELES INTERNATIONAL
SANTA MONICA MUNICIPAL (note c)
LONG BEACH
SANTA ANA (note c)
LOS ALAMITOS (note c)
HOLLYWOOD-BURBANK
VAN NUYS (note c)
ONTARIO INTERNATIONAL
NEW YORK
J.F.K.
LA GUARDIA
NEWARK
TETERBORO
LINDEN, NEW JERSEY (note c)
MORRISTOWN
CALDWELL-WRIGHT (note c)
WESTCHESTER (note c)
GRUMNAR-BETHPAGE (note c)
ISLIP MAC ARTHUR (note c)
REPUBLIC (note c)
PITTSBURGH
GREATER PITTSBURGH
ALLEGHENY CO. (note c)
BEAVER FALLS (note c)
LATROBE (note c)
ROSTROVER (MONONGHELA)(note c)
MINNEAPOLIS-ST. PAUL
MINNEAPOLIS-ST. PAUL INT'L
AIRLAKE INDUSTRIAL (LAKEVILLE) (note c)
FLEMING FIELD (S. ST. PAUL) (note b and c)
DOWNTOWN HOLMAN (ST. PAUL) (note b and c)

APPENDIX II



a/ Vertical lines indicate lengths of each runway at airport; figure 2 next to vertical line represents two runways of identical length.

b/ Airport is adjacent to or close to downtown.

c/ Airport without scheduled airline service according to Civil Aeronautics Board's "Airport Activity Statistics of Certificated Route Air Carriers" for 12 months ended December 31, 1974.

SOURCE: The use of Satellite Airports for Short-Haul Service report, dated February 1973, prepared for the Department of Transportation by Charles River Associates Incorporated.

APPENDIX II

BIBLIOGRAPHY

1. Charles River Associates, "Economic Analysis of Short-Haul Passenger Alternative," Department of Transportation report DOT-P-6000.3, Aug. 18, 1972

2. Charles River Associates, "The Use of Satellite Airports for Short-Haul Service," Department of Transportation report DOT-P-6000.2, February 1973

3. Department of Transportation and NASA, "Civil Aviation Research and Development Policy Study Report," March 1971

4. Department of Transportation and NASA, "Civil Aviation Research and Development Policy Study Supporting Papers," March 1971

5. Department of Transportation and NASA, "Civil Aviation R&D Policy (CARD) Implementation Plan," March 1973

6. Urban Systems Research & Engineering, Inc., "The Chicago-Midway Airport Study," Volume I, FAA report FAA-QS-74-1, July 1974

7. McDonnell Douglas, "Study of Quiet Turbofan STOL Aircraft for Short-Haul Transportation," (six volumes), NASA report NASA CR-114611, June 1973

8. Interagency Short-Haul Air Transportation Working Group, "A Federal Plan for Short-Haul Air Transportation Improvement" (Draft), July 1973

9. Department of Transportation, "1974 National Transportation Report," December 1974

10. Federal Aviation Administration, "FAA Report on Airport Capacity," National Summary, FAA report FAA-EM-74-5, 1, January 1974

11. FAA, "The National Aviation System Plan Fiscal Years 1976 - 1985," March 1975

12. Whitlock, Edward M. and Sanders, David B. "Airport Access/Egress Systems Study Volume I: Text" DOT report DOT-TSC-OST-73-32, 1, September 1973

13. Department of Transportation "A Progress Report on National Transportation Policy," May 1974

14. Paullin, Robert L. "The Airport/Urban Interface," DOT report DOT-TST-75-12, July 1974

15. Secretary of Transportation, "A Statement of National Transportation Policy," Sept. 17, 1975

16. Lockheed Aircraft Corporation, "Quiet Turbofan STOL Aircraft for Short-Haul Transportation" (two volumes), NASA report NASA CR-114613, June 14, 1973

17. Drago, Vincent J. "Impacts of Potential 1980's Aviation Technology on the Capacity of an Existing Airport," report DOT-TSC-FAA-AVP-75-1, 1 March 1975

18. Solomon, H.L. and Sokolsky, S. (The Aerospace Corporation) "An Economic Assessment of STOL Aircraft Potential Including Terminal Area Environmental Considerations," Volume I, NASA report NASA CR-2424, May 1974

19. Sweet, H.S. et al, (Lockheed Aircraft Corporation) "Evaluation of Advanced Lift Concepts and Potential Fuel Conservation for Short-Haul Aircraft," NASA report NASA CR-2502, February 1975

20. Department of Transportation, "Recommendations for Northeast Corridor Transportation" May 1971

APPENDIX IV

OFFICE OF THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

ASSISTANT SECRETARY
FOR ADMINISTRATION

June 10, 1976

Mr. Henry Eschwege
Director
Resources and Economic Development
Division
U.S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Eschwege:

This is in response to the General Accounting Office (GAO) draft report entitled "Federal STOL Programs--Status and Needs."

The report concludes that DOT and NASA should review their activities in this area along with other agencies and that DOT should clarify its position concerning the long-range need for a STOL system. GAO also recommends that consideration be given to alternative systems, such as inter-city rail.

The Department agrees that reassessment is needed, but believes that it is adequately addressed in the normal R&D process and that a special reassessment is unnecessary.

The Department does not agree with the basic tone of the report believing that it confuses the relationship of a technology program with policy related to the implementation of a specific operating capability. Specific comments on individual items are contained in the enclosed reply, in two copies.

Sincerely,

William S. Heffelfinger

Enclosure
(two copies)

APPENDIX IV

DEPARTMENT OF TRANSPORTATION REPLY

TO

GAO REPORT TO THE CONGRESS OF THE UNITED STATES

ON

FEDERAL STOL PROGRAMS -- STATUS AND NEEDS

DEPARTMENT OF TRANSPORTATION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DEPARTMENT OF DEFENSE

SUMMARY OF GAO FINDINGS AND RECOMMENDATIONS

The General Accounting Office (GAO) states that a STOL short-haul transportation system has long been advocated as a possible solution to forecasted constraints on the growth of air transportation. This has fostered technology programs in NASA which contribute to the civil options and are related to the military prototype (AMST) program. The report states that other alternatives available will tend to postpone the need for a STOL short-haul passenger system, and the limiting factor will continue to be the absence of a discernable market (or need) to which the public and private sectors can respond. The report states that because of the progress being made by NASA and the Air Force, development of jet STOL transport technology is ahead of the DOT's development of other long lead-time system components--airports, terminal facilities, routes, ATC and connecting transportation. The GAO infers that each of several agencies has pursued its own programs since 1974 based on its own perception of present and future needs and implies that these programs are non-cooperative and aimed at significantly different objectives.

The GAO recommends that (1) DOT clarify its position concerning the possible long-range need for a STOL system in accordance with its emerging policy position regarding long-term transportation needs, constraints, and investments, (2) NASA reassessthe scale and pace of its research directly supporting the development of a STOL system with the purpose of bringing it more in line with the emerging DOT position, (3) other agencies and the appropriate committees of the Congress reassessthe Federal research, development and demonstration activities for improving short-haul transportation, and (4) consideration be given to the long-term potential of intercity rail passenger service; the relative cost and benefits of developing alternative systems; the investments needed to assure balanced capacities; and the overall definition, timing, and amount of Federal resources needed to plan and implement an integrated STOL system to coincide with the long-term transportation objectives.

APPENDIX IV

SUMMARY OF DEPARTMENT OF TRANSPORTATION POSITION

We agree with the basic recommendation for a reassessment of the Federal STOL program by both DOT and NASA. Changing conditions of the economy, resource availability, environmental concerns, etc., provide continued impetus for reexamination. Such reexamination is an integral part of the R&D process and is done regularly. A special review at this time may be unnecessary.

We take exception to the basic tone of the report which is emphasized by inappropriate characterization of the several agencies' views. The report confuses the relationship of a technology program with policy related to implementation of a specific operating capability.

It is the DOT's view that a basic market demand for short takeoff and landing (STOL) transports must exist in order to support implementation of a system. Since economic viability of this generic transport design has not yet been established, a demand does not now exist within the private sector. On the other hand, ground congestion expected to develop over the next decade, in several locations, could lead to the development of a market, provided that the airlines are confident that an appropriate aircraft will be available to operate.

The DOT does not anticipate the introduction of STOL aircraft into the air transportation system before 1985-1990 and sees no immediate need to plan for such implementation. However, the DOT concurs with the timeliness and the pace of the NASA STOL technology program. It takes about 7 to 10 years, from the time a given technology is available, to achieve the operational introduction of its application. The scheduled readiness of NASA's STOL vehicle technology by the early 1980's is in consonance with DOT's position vis-a-vis a STOL system implementation.

A thorough understanding of the options and operational impacts is needed when it becomes appropriate to promulgate regulations and develop operational plans. It is our understanding today that STOL operations can be handled by the evolving air traffic control (ATC) system, and that regulations and certification can be supported by the results of research/development, airport development, and aircraft certification programs now being conducted within the FAA and NASA. There will be other benefits, such as reduction in hub airport ground congestion through use of satellite short-haul facilities (whether new or existing) which will also be achievable when it is possible to introduce quiet, efficient new transports. A comprehensive R&D program in the 1970's is important to the ability to make policy choices in the 1980's. An important contribution to the decision

process is expected from the DOD operational evaluation of the two prototype military transports. We have already benefitted, in a similar manner, from our observer participation in the Canadian STOL demonstration program.

The report suggests clarifying and unifying the positions of the various agencies on STOL. STOL is today only one transportation alternative being investigated to provide options for the longer range future. Agreement exists over the need for R&D. However, establishing agreement over the timing and extent of implementation is more difficult. The future is uncertain. A commitment now for or against a specific technology, which has not yet matured to marketability would be premature.

(See GAO note, p. 49.)

POSITION STATEMENT

Page ii, last paragraph: The paragraph implies that the current National Aviation System cannot accommodate STOL transport technology today. We do not agree with this implication, nor do we agree with the statement that STOL transport technology is ahead of other system components. In our experience, the technological base for a commercially viable STOL aircraft has yet to be established. The military STOL program and

APPENDIX IV

NASA's STOL technology should help establish this technological base. However, we are further ahead in accepting such an aircraft into the ATC system than the aircraft is in becoming a quiet, fuel-efficient, and economical transport.

(See GAO note, p. 49.)

Page iii, first paragraph and Chapter II (pages 8-13): The cited sections convey the theme that, "since 1974, each sector (i.e., FAA, NASA, et al) has pursued its own programs to improve short-haul transportation based on its own perception of present and future needs. ..". NASA and FAA are collaborating in many ways, including a contract study entitled "Alternative Future Scenarios for the National Aviation System" (Contract No. DOT-FA-74-WA-3510). This joint effort, which touches upon the nature of future short-haul aviation demand, is a contradictory example to the aforementioned GAO "theme." Also, military needs for the advanced medium STOL transport aircraft technology, NASA's pursuit of its STOL efforts, FAA's studies on certification criteria and ATC advances for the future such as MLS and area navigation, are all being pursued in parallel. What is lacking for development of a national STOL system is the "marketplace requirements" for the development of this type transport aircraft.

(See GAO note, p. 49.)

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On page 12, change the third paragraph to be consistent with the same paragraph on page ii. We recommend referring to the most recent statement of policy, September 1975.

(See GAO note.)

Hamilton Herman
Assistant Secretary
for Systems Development and Technology

GAO note: Portions of this letter have been deleted because they are no longer relevant to the matters discussed in this report.

APPENDIX V

National Aeronautics and
Space Administration

Washington, D.C.
20546

W

2 JUL 1976

Mr. R. W. Gutmann
Director, Procurement and
Systems Acquisition Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Gutmann:

Thank you for the opportunity to review your proposed report to the Congress on "Federal STOL Programs-Status and Needs", which was forwarded with your letter of April 28, 1976. NASA's detailed comments, keyed to the related page and paragraph of draft report, are enclosed.

At a meeting held on June 14, 1976, to discuss the draft report with members of your staff, we were asked to provide an update of previously supplied cumulative obligations expended on the NASA STOL programs. The requested information is as follows:

The estimated cumulative obligation expended for the NASA STOL program from FY1971 through April 30, 1976, is:

	($K)
Research and Development (R&D)	$109,572
Research and [Program Management]	36,737
	$146,309

If we can be of further assistance please let me know.

Sincerely,

William N. Shavely
Assistant Administrator for
DOD and Interagency Affairs

Enclosure

COMMENTS RELATED TO THE
GAO DRAFT REPORT

TITLED

FEDERAL STOL PROGRAMS - STATUS AND NEEDS

DEPARTMENT OF TRANSPORTATION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DEPARTMENT OF DEFENSE

Beginning in July 1975, NASA, at the request of the GAO, provided historical information and detailed program data on its short takeoff and landing (STOL) technology effort in support of this GAO study. The draft report presents this information, as it relates to NASA, in a generally accurate and reasonably complete manner in Chapter II, Chapter III and Appendix I. We believe the report should present in similar detail the related activities of the other Federal agencies surveyed (DOD, DOT and FAA) and the programmed total investments of private industry in the AMST prototype program. We also believe that the draft report emphasizes the scale and pace of NASA's program in relation to the other Federal and private programs and does not adequately present the total Federal/industry involvement in this area.

The draft report addresses only the U.S. military and U.S. domestic civil needs for jet STOL aircraft and does not recognize the significant and substantial foreign sales potential of the AMST and its civil cargo and/or passenger derivatives, estimated to be $8 to 12 billion including approximately 600 to 750 military transports for foreign countries. It should be noted, in this regard, that FAA certification would be required for an AMST civil derivative developed for the export market. Consequently, the pacing requirement for the information on STOL airworthiness certification criteria being developed in the collaborative NASA/FAA program effort may be foreign sales of AMST civil derivatives. In addition to the direct balance-of-payments benefits to the nation, these export sales would reduce the cost of the production AMST's purchased by the U.S. military and would maintain the high technology U.S. leadership image in these foreign countries.

APPENDIX V

NASA basically agrees with the intent of the recommendation in the draft report calling for a reassessment of the Federal agencies' research, development and demonstration activities related to STOL systems and short-haul transportation. However, we strongly believe that such a reassessment should not be made solely by considering potential future domestic passenger transportation, but must also consider the relationship, impact and timeliness of NASA's research program to the AMST development; to sales of AMST civil cargo and/or passenger derivaties to foreign countries; and to quiet U.S. civil cargo operations. The GAO draft report does not recognize this broader context of the applicability of NASA's technology effort, nor does it recognize the lead time needed to bring technology to a sufficient level for the development and implementation of an operational, economically viable, vehicle system. Currently, the DOT does not foresee the introduction of a STOL passenger aircraft into the U.S. air transportation system before the 1985-1990 time period and, accordingly, sees no immediate need to plan for such implementation. This position is totally consistent with the schedule of NASA's research program. Our program, which is aimed at technology readiness by the early 1980's, recognizes that it will take about 7 to 10 years from technology availability to the time when operational implementation can be achieved. It is important to note that quiet STOL aircraft and operating technology is the most time-critical element for potential domestic cargo and/or passenger operations and that, on this basis, the schedule of NASA's program is in consonance with DOT's position.

NASA disagrees with the statements and implications in the draft report that each agency is going its separate way, and believes it is extremely misleading to imply that the FAA's Quiet Short-Haul Air Transportation System (QSATS) Office was the only mechanism for Federal program coordination. In fact, excellent coordination by the Federal agencies involved in STOL programs existed well before the establishment of the QSATS office and has continued since its dissolution. The research, technology and development efforts are coordinated and reviewed through a wide range of mechanisms, including the DOD/NASA Aeronautics and Astronautics Coordination Board (AACB) and the NASA/FAA Coordinating Committee. A specific example of NASA's continuing assessment and coordination of its research and technology programs is the activity related to current

APPENDIX V

budget planning. In-house teams have been established to identify and develop candidate programs required to support major new technology thrusts addressing significant national needs. The Short Haul - R/STOL team has considered and reviewed current Federal programs, agency positions and national policies in the process of establishing additional technology needs to be addressed in the future. The rationale, basic underlying approach, technology application scenario and candidate new programs were recently reviewed and endorsed by a Research and Technology Advisory Council Subpanel with representatives from the DOT, FAA, DOD and the airframe, engine and airline industries.

In summary, NASA believes that its STOL technology program is properly scaled, paced and in consonance with DOT/FAA and DOD positions and programs. The rationale for the NASA program considers more factors than are addressed in the GAO draft report and NASA's effort is well coordinated with other Federal agencies. It is recommended that the GAO reassess the theme and detailed content of its draft report in light of these facts.

Detailed comments on the draft report, keyed to page number and paragraph, are as follows:

(See GAO note, p. 55.)

Page ii, Last Paragraph: NASA does not agree that the development of jet STOL transport technology, particulary for quiet and efficient operations, is ahead of other system components. We do believe that the technological base for the development of an environmentally acceptable, commercially viable STOL aircraft is the most time-critical element for possible STOL operational implementation, and we agree with the DOT that the technology for accepting a STOL aircraft into the ATC system is further ahead than the technology for the development of the aircraft.

Page iii, First Paragraph: The statement that "each of several agencies is pursuing its own programs based on

its own perception of present and future needs" is misleading and a misrepresentation of what, in fact, are well-coordinated activities. Actually, each agency is pursuing its program as part of a family of related activities in the context of its chartered responsibilities, and is continuing its liaison and coordination with other agencies.

The list of survey participants in our recently published Outlook for Aeronautics 1980-2000 Study illustrates the extent to which NASA solicits the views of industry, university and government leaders in formulating an overall perception of the future.

(See GAO note, p. 55.)

Page 7, Last Paragraph: The statement on "a divergence of opinion about short-haul transportation" is erroneous and does not reflect current views. For example, Transportation Secretary William T. Coleman, Jr., in his April 7, 1976 testimony before the Senate Aviation Subcommittee of the Senate Committee on Commerce said, "Every figure I have ever seen indicates the most efficient way to move people by public transportation between cities where the distance exceeds 300 miles is by air."

(See GAO note, p. 55.)

Chapter VI, Conclusions and Recommendations: Our previous general comments and specific detailed comments on the draft report's Digest also apply to this chapter.

Dr. Alan Lovelace
Associate Administrator for
Aeronautics and space Technology

8 JUL 1976
Date

GAO note: Portions of this letter have been deleted because they are no longer relevant to the matters discussed in this report.

APPENDIX VI

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

JUN 14 1976

Mr. Victor L. Lowe
Director, General Government Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Lowe:

The Director has asked me to respond to your letter of April 29, 1976, requesting OMB's review and comment on the GAO proposed report to Congress on "Federal STOL Programs - Status and Needs."

OMB does not agree with the report's position (Chapter III) that NASA, USAF, FAA and DOT are each pursuing their own short-haul transportation programs with little regard to the activities of other agencies. We note, however, that these agencies are also being given the opportunity to comment on the report and we will therefore not provide a lengthy discussion of the many mechanisms, both past and current, which seek to ensure effective coordination of transportation programs.

Our broader concerns center around the specific conclusions and recommendations contained in Chapter VI of the report. We recognize and agree with the GAO concern that NASA's research and development programs on STOL require a careful assessment of the technology's potential implementation in the national transportation system. At the same time, we do not believe that the development of advanced technology should drive a premature Federal commitment to develop and implement the total ground and air STOL system before sufficient information is available to assess the potential of such technology. Clearly it is important to seek an appropriate balancing between these somewhat conflicting objectives. At this time the environmental impact uncertainties and technological risks of the STOL program are significant. While all involved agencies are hopeful that significant technological advances will result from the NASA and Air Force STOL programs, it would be unwise to make a premature Federal commitment to develop a total STOL transportation system.

APPENDIX VI

It is generally recognized by the aircraft manufacturers and the airlines that the economic risks of implementing a short-haul air transportation system with new aircraft are substantial. Certainly the Federal Government should take note of the fact that prudent businessmen have serious doubts as to the economic viability of a new short-haul STOL aircraft incorporating current technology. It would appear to be quite useful to more fully explore the characteristics of these economic risks in this report.

We believe that the national long-term transportation objectives should be clearly stated and coordinated among appropriate agencies. However, we would also support the viewpoint that these objectives must be responsive to the dynamics of the market place.

The Office of Management and Budget will continue to reassess each agency's research, development, and demonstration activities for improving short-haul transportation. Furthermore, OMB will continue to encourage interagency coordination of transportation programs to ensure that such programs are productive and that limited resources are wisely allocated.

Thank you for the opportunity to review and comment on this report.

Sincerely,

Daniel P. Kearney
Associate Director for
Economics and Government

APPENDIX VII

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D C. 20301

7 JUL 1976

Mr. R. W. Gutmann
Director, Procurement and
Systems Acquisition Division
U.S. General Accounting Office
441 G Street N. W. - Room 6915
Washington, D. C. 20548

Dear Mr. Gutmann:

The draft report dated April 28, 1976, 'Federal STOL Programs - Status and Needs' (OSD Case #4348) has been reviewed and the following comments are forwarded.

The report makes three recommendations which are repeated for reference in Enclosure of this letter. I have no disagreement with the recommendations of the draft report insofar as they pertain to the Department of Defense.

The Department of Defense must look at STOL usage from a military requirements point of view. The DoD STOL program, the Advanced Medium STOL Transport (AMST), is a prototype program initiated by the Air Force and designed to:

(1) demonstrate by flight test the application of new technology which, with minimal additional engineering development, could provide a medium sized turbo fan STOL transport.

(2) provide a low cost development option for modernizing the tactical airlift force with an aircraft of improved utility and productivity.

(3) obtain visibility on costs and operational factors associated with short field airlift performance.

APPENDIX VII

(4) define STOL operational rules, safety rules, and related design criteria.

(5) define engine and airframe characteristics which could substantially reduce maintenance requirements.

The Air Force established a close working relationship with the National Aeronautics and Space Administration (NASA) early in the AMST program. A NASA representative was assigned to the Prototype Program Office and NASA data requirements have continually been incorporated in the Air Force flight test program. NASA personnel are deeply involved with current YC-15 vehicle testing at Edwards AFB and additional testing will be accomplished on the YC-14 as that aircraft proceeds into flight testing later this year.

The Air Force AMST program will assist in identifying airframe costs associated with STOL operations. Although the AMST is designed to meet military requirements the aircraft design could be converted for civil use if a commercial need arises for an aircraft of its characteristics.

To date, no commitment has been made within the DoD to continue the AMST program beyond prototype demonstration of the flight test vehicle. A decision to proceed with further development will be based upon a thorough analysis of flight test results evaluated in conjunction with a positive military requirement.

Sincerely,

Malcolm R. Currie

Enclosure

ENCLOSURE

(1) DOT should clarify its position concerning the possible long range need for a STOL (short takeoff and landing) system in accordance with its emerging policy position regarding long term transportation needs, constraints and investments.

(2) NASA should reassess the scale and pace of its research directly supporting the development of a STOL system with the purpose of bringing it more in line with the emerging DOT position.

(3) The Office of Management and Budget and the appropriate committees of the Congress should reassess the Federal Agencies' research, development and demonstration activities for improving short haul transportation. Consideration should be given to:

-- The long term potential of proposed plans to improve intercity rapid rail passenger service on airport congestion and short haul air transportation requirements;

-- The relative cost and benefits of developing short-haul intercity air services using existing airports and aircraft technology as an alternate to a STOL system;

-- The investments needed to assure that FAA's proposed increases in air traffic capacities will be balanced by increases in ground capacities;

-- The possible timing and amounts of Federal resources that would be needed to develop and implement a STOL system, which in addition to aircraft technology, air traffic control systems and airport development, may include Federal participation in the development of production aircraft, market demonstrations and ground feeder systems;

-- The pacing of NASA's development of jet STOL transport technology as compared with development of other system components, airports, routes, air traffic control and ground feeder systems;

-- The extent to which NASA's present and future STOL activities could be deferred, redirected or paced to coincide better with the Department of Transportation concepts of long-term transportation objectives.

PRINCIPAL OFFICIALS

RESPONSIBLE FOR ADMINISTERING ACTIVITIES

DISCUSSED IN THIS REPORT

	Tenure of Office	
	From	To
DEPARTMENT OF TRANSPORTATION		
SECRETARY OF TRANSPORTATION:		
William T. Coleman, Jr.	Mar. 1975	Present
John T. Barnum (acting)	Feb. 1975	Mar. 1975
Claude S. Brinegar	Feb. 1973	Feb. 1975
John A. Volpe	Jan. 1969	Feb. 1973
FEDERAL AVIATION ADMINISTRATION		
ADMINISTRATOR:		
John L. McLucas	Nov. 1975	Present
James E. Dow (acting)	Apr. 1975	Nov. 1975
Alexander P. Butterfield	Mar. 1973	Mar. 1975
John H. Shaffer	Mar. 1969	Mar. 1973
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
Donald H. Rumsfeld	Nov. 1975	Present
James R. Schleshinger	July 1973	Nov. 1975
Vacant	May 1973	June 1973
Elliott L. Richardson	Jan. 1973	May 1973
Melvin R. Laird	Jan. 1969	Jan. 1973
DIRECTOR, DEFENSE RESEARCH AND ENGINEERING:		
Dr. Malcolm R. Currie	June 1973	Present
Dr. John S. Foster, Jr.	Oct. 1965	June 1973
DEPARTMENT OF THE AIR FORCE		
SECRETARY OF THE AIR FORCE:		
Thomas C. Reed	Jan. 1976	Present
Vacant	Nov. 1975	Dec. 1975
Dr. John L. McLucas	July 1973	Nov. 1975
Dr. Robert C. Seamans, Jr.	Feb. 1969	May 1973

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

	Tenure of Office From	To
ADMINISTRATOR:		
James C. Fletcher	Apr. 1971	Present
George M. Low (acting)	Sept. 1970	Apr. 1971
Thomas O. Paine	Oct. 1968	Sept. 1970
ASSOCIATE ADMINISTRATOR FOR AERONAUTICS AND SPACE TECHNOLOGY:		
Robert E. Smylie (acting)	July 1976	Present
Alan M. Lovelace	Sept. 1974	June 1976
Bruce K. Holloway (acting)	Mar. 1974	Aug. 1974
Edwin C. Kilgore (acting)	Nov. 1973	Mar. 1974
Roy P. Jackson	Jan. 1972	Oct. 1973
ASSOCIATE ADMINISTRATOR FOR ADVANCED RESEARCH AND TECHNOLOGY (note a):		
Roy P. Jackson	Nov. 1970	Jan. 1972

a/Office of Aeronautics and Space Technology superseded Office of Advanced Research and Technology effective Jan. 14, 1972.