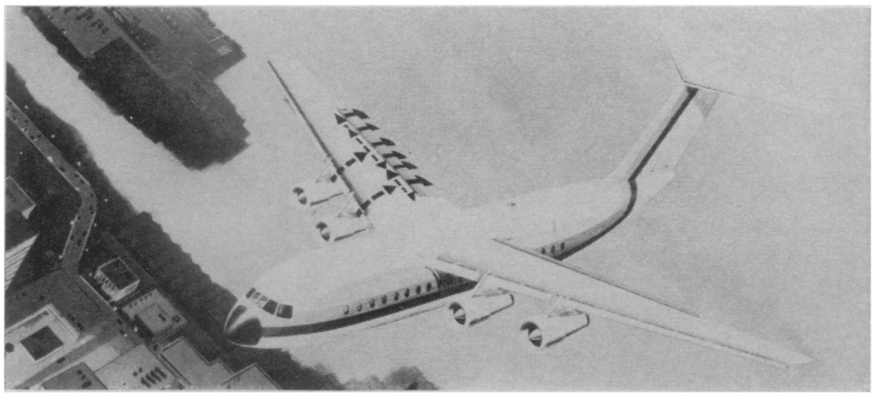
STOL aircraft for the late 1970's



NASA is requesting $15 million in the 1972 budget for research and development of two experimental short-haul transports

by Everly Driscoll

There is little argument that the nation's transportation systems resemble a labyrinthian jungle. The problem is overwhelming. It involves systems that developed independently of each other and that are seemingly unable to accommodate new technology without major upheavals in cost and service. Supplanting old systems with new ones appears to be equally difficult, involving long lead times and conflicts between local and national factions.

One of the greatest transportation needs is for an effective short-distance (up to 500 miles) travel service. Although the air transportation system has proven an ideal mode for long-distance travel, it has been costly, cumbersome and ineffective in meeting the daily needs of the millions of short-distant travelers. For this, says the Civil Aeronautics Board, after a two-year study of the present situation in the populated Northeast corridor, a properly implemented Short Take-Off and Landing (STOL) system is needed. Ten billion short-haul passenger miles were flown in the nation during 1970 alone. "We estimate," says Dr. George Low, Acting Administrator for the National Aeronautics and Space Administration, "that the market for short-haul transportation will approach 40 billion passenger miles by 1980 and may well be between 100 billion and 300 billion passenger miles by 1995."

In addition, increasing demands that large airports be built away from heavily populated areas necessitate an efficient city-to-airport air service. Pressures from the public to do something about door-to-door travel time are another factor.

The market seems wide open. In light of this, one might ask why private industry has not capitalized on the need. The reasons are legion. They include both operating problems such as air traffic control systems and the aircraft development itself. In recent Congressional testimony, Roy P. Jackson, Associate Administrator for Advanced Research and Technology at NASA, explained the lack of STOL progress as the result of a "cycle of inaction." Providing the aircraft itself—one that can take off and land in a small area, quietly, economically, and in all kinds of weather—is one element. The nature of the service, however, requires many small, convenient airports. "Aircraft manufacturers are reluctant to assume the risk of developing the special type of transport needed for short-haul use without air carrier orders and some assurance of Government certifications," says Jackson. And "air carriers are reluctant to place orders for aircraft without some assurance of routes, suitable airports and a suitable air traffic control system." And finally, "local communities are reluctant to provide new airports or allow the use of existing ones because of the anticipated noise and pollution or because the advantages of the service are not apparent," he concludes.

This particular cycle is relatively new. The increasingly divergent paths of military and civilian aircraft needs in recent years have left the aviation industry with much of the research and development work that used to be a spin-off from military aircraft development.

It is this void that has led some Congressmen to urge that NASA expand its aeronautical research into more direct applications. Thus NASA is proposing in its 1972 budget requests $15 million for initial steps in a joint Government-industry program for research and development of a STOL system (SN: 11/28/70, p. 413).

The system development is a joint NASA-Department of Transportation venture with NASA assuming the responsibility for the aircraft development. The DOT's over-all responsibility is to organize an air system that can accommodate such a craft. According to Congressional testimony, much of the necessary wind tunnel testing, quiet engine, pollution and noise abatement research has already been done at NASA research centers as a natural function of the agency's charter.

The new program, however, proposes to go one step further: NASA will go to industry with the requirements for the vehicle and award the contracts for building of two research craft. When NASA announces the opportunity for contract competition, says one NASA official, "there will be open the opportunity for cost-sharing by the contract industry itself." If the aerospace industry is not willing to assume some of the cost, NASA will pay for it

all—a tab estimated to be $100 million over four years.

The two planes would not be prototypes—models of aircraft to be reproduced on the assembly line—but rather experimental aircraft to study flight dynamics and other technological problems.

A few months ago the STOL program looked quite different. At that time NASA was going to seek funds to develop and test fly an experimental craft at its own Flight Research Center at Edwards, Calif. This plan was dropped in favor of a second approach, which was to go to industry with a proposal for cost-sharing. This second plan would have involved a joint venture by the aerospace industries: Industry would pool its funds; NASA would add its funds to the effort. Any company could participate; after the test flights, the resulting research and development data would then be made available to all aircraft industries. But as a result of a meeting of aerospace industry representatives that ended April 2, this approach was canceled. Industry was not interested in the joint venture. But the companies did express interest in contract competition. The companies awarded contracts would help share the costs.

The plane that NASA envisions would be "a comfortable plane," says Gerald G. Kayten, acting director of the STOL technology office at NASA. It would be about the size of a DC-9, carrying about 100 passengers or more. But that is where any similarity to conventional air transports ends.

The plane could take off and land at a much steeper angle than conventional craft—7.5 degrees, compared with the 3-degree landing approach of conventional craft. Since the plane would fly higher over most communities, much of the landing and take-off noise would be reduced. Its engine would be equipped with acoustical devices, fans and techniques now being tested by NASA's Lewis Research Center at Cleveland. The goal is to reduce the ground noise level of a craft at 500 feet altitude from the current sideline noise of a Boeing 727 of 119 decibels to 92 or 95 decibels. Another noise abatement method is to follow a curved ground track like a river, a method now not widely used because of the restrictions of the instrument landing systems (ILS).

In addition to being quieter, the turbofan engine would be designed to be less polluting. It would operate on a leaner mixture (more air) of fuel, which results in a more efficient combustion rate.

The STOL could land in one-fourth the space required by conventional transports (2,000 feet compared with 7,000 or 8,000 feet). This would allow it to land at 90 percent of the nation's airports. (Current transports, says Kayten, can use only about 10 percent of the same airports. Of course the economics of service to small out-of-the-way airports would still be a limiting factor.) This shorter runway area would also reduce the area affected by noise from 10,000 acres for the 727 to 180 acres for the STOL.

The plane's high lift would permit it to pop in and out of airports, eliminating costly delays on the runways. The propulsion system and wing structure account for most of the STOL's uniqueness. Wind tunnel tests on several types of wing systems narrow the contenders to two—the air augmentor wing and the externally blown jet flap.

With the externally blown jet flap, the flow of jet exhaust is deflected downward by the flap, producing lift. Increased air flow over the flapped sections adds lift also. In an internally blown system, high pressure air from the jet engine is ducted into a plenum, or enclosed space, inside the wing. The air from the plenum is also directed over the flap, but unlike the first system, the flow is ducted along the entire trailing edge of the wing. The augmentor wing is an internally blown system in which the jet flow is further improved by an induced secondary flow of air drawn from the upper surface of the wing. An air augmentor wing is currently being fitted on a C-8A Buffalo at NASA's Ames Research Center at Moffett Field, Calif. Flight tests will begin next spring.

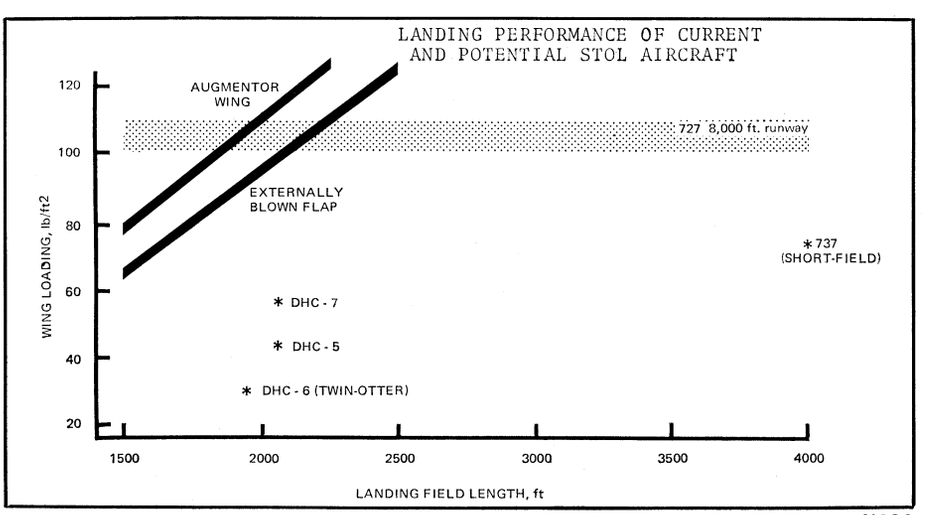
Although the craft is a pivotal element, says George W. Cherry of NASA, "problems arise from the relationship of the basic flight vehicle and its systems to the operating environment—to the airport, to other aircraft, to the airways, to the traveler, to the pilot, and to the nontraveling public. . . ." For this reason, flight testing by NASA of the craft is regarded as a prerequisite to shaping the entire system. The DOT and the Federal Aviation Administration would set regulation requirements and certification criteria and establish flight control, navigation and air traffic control ground stations for STOL. Only then would it be expedient for the aircraft manufacturers themselves to commit to mass production a craft to serve short-haul needs.

Other research by NASA, the FAA and DOT would apply to the entire air system. A microwave scanning beam system would be developed for landing in place of the current ILS. The microwave system covers a broader angle both vertically and horizontally, and therefore allows a wider approach path and angle, such as the curved, decelerating path the STOL would fly. NASA research on an aircraft braking system and runway grooving (SN: 2/27/71, p. 149) would if implemented lessen the time a plane occupies the runway.

New avionics and flight control systems involving autopilots, computers and displays would be needed.

NASA engineers emphasize that the STOL craft alone cannot solve the short-haul needs of the country. "Care must be taken," says Cherry, "so that the promise of STOL air transportation is not compromised by applying obsolete concepts in the design of the ATC [air traffic control], avionics and ground system facilities." The system itself is important. "The creative use of STOL aircraft implies that there will be terminals other than conventional terminals in order to make STOL ports as convenient as possible to the user," he says. In addition, short-distance flying implies low altitude operation via the most direct route. And the craft's electronic system must be compatible with the air traffic control system.

The major problems in applying technological expertise to solving the transportation woes of the average worker are not "state of the art"



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hangups, but rather social attitudes and problems of acceptance.

Although the money would be for aeronautical research on two experimental planes, much like the building and flight testing of the X-15, and not subsidization of industry, the STOL would still be a new plane. And coming so soon after the great Congressional debates on cost overruns of the C-5A, the cost duplications in the F-14 and F-111, and the Government involvement in and defeat of the SST, it might be reasonable to expect some opposition to STOL. The first such signs appeared this month when a letter to Dr. Low from Sen. William Proxmire (D-Wis.) was released to the press. Although an aide of the Senator said Proxmire was only "inquiring" and "requesting information, not criticizing," the STOL initiative, the release of the letter by the Senator's office was interpreted by the press in negative terms.

"As far as this Senator is concerned," Proxmire said, "Congress must not again become involved with some vague open-ended, potentially very costly 'joint undertaking' with the aircraft industry. If we are going to assist development of a STOL aircraft," he added, "we should know precisely what we are getting into . . . and the limits on our involvement. From this it seems clear the proposed NASA program is not likely to go unscrutinized.

Industry has made some recent moves of its own in the STOL effort. American Airlines this month announced the selection of McDonnell Douglas, Grumman Aerospace, Canadair and de Havilland of Canada to continue studies and negotiations for an interim propeller-driven STOL. The proposals submitted to American from the companies varied, but all the proposed planes would be capable of using a 2,000-foot runway. The Grumman craft is a 487C transport that would carry 90 passengers; the McDonnell Douglas, a 188F, carrying 60 to 67; the Canadair, a CL-246, carrying 70; and the de Havilland, a DHC-7, carrying 48.

The Canadair and de Havilland craft figure heavily in the STOL system that Canada would like to develop, depending in part on the participation of American industry. Supposedly the DHC-7 would be ready for initial deliveries in 1974 about the same time as the NASA research and flight testing would be completed.

The NASA STOL proposal, on the other hand, is for research to meet aviation needs during the latter part of the decade, as opposed to the lower-speed interim STOL. Thus the outlook for the NASA proposal appears good. But much still depends on the enthusiasm of both industry and Congress. □