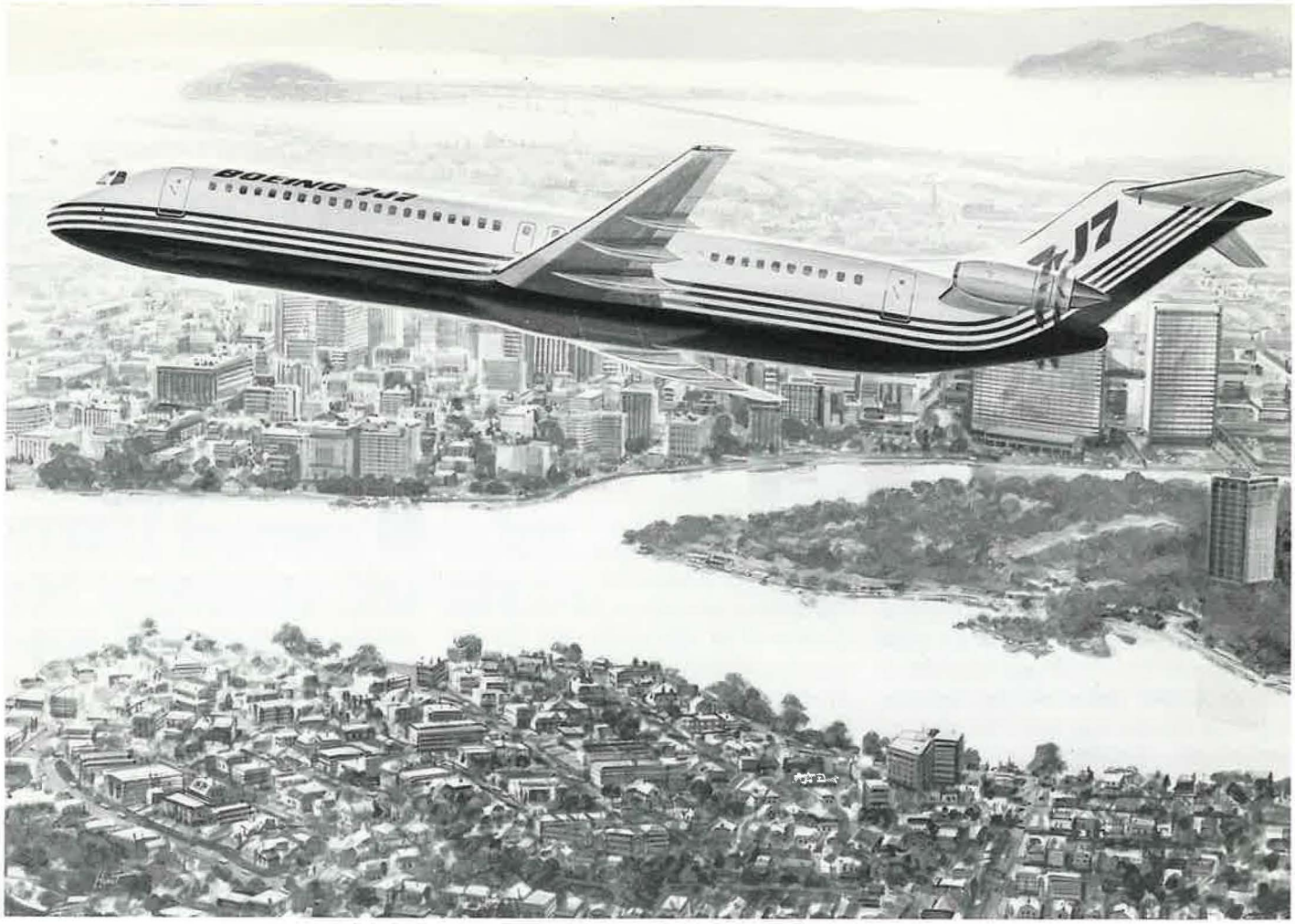


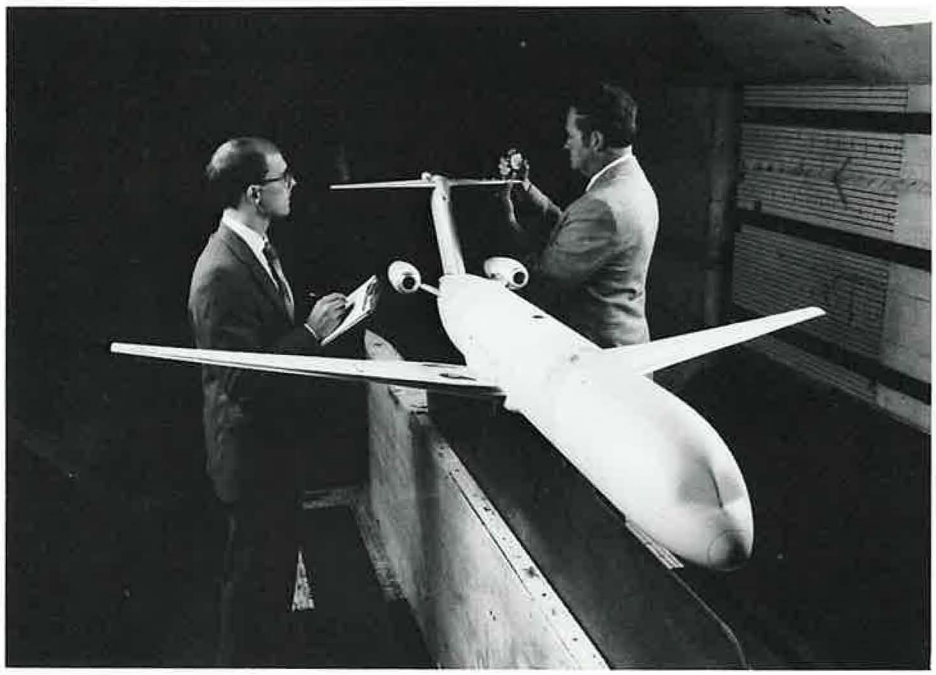
In 1992, Boeing plans to deliver the 7J7—a new 150-passenger airplane to replace the aging 727, DC9, and 737 fleets of the airlines and to support air travel growth. Incorporation of cost-effective new technologies will significantly improve fuel efficiencies and operating costs, providing airlines with improved airplane utilization and reliability, reduced maintenance costs, and increased cabin comfort and flexibility.

Air Transportation Research Needs

H. Carl Munson, Jr.

EDITOR'S NOTE: *H. Carl Munson, Jr., Vice President, The Boeing Commercial Airplane Company, and a member of the TRB Executive Committee, was one of the invited speakers at the 1986 International Roundtable held during TRB's 65th Annual Meeting. Following are his remarks on the research needs in air transportation from an international perspective.*

While I was head of strategic planning for a commercial airplane manufacturer, our principal concerns were what kind of airplanes to build, when to build them, and what volume of production to anticipate for planning in the future. From that perspective and in preparation for this talk, I thought about the kind of research activity I would like to see conducted that is not being done today or planned for the future. Viewing the situation in that light, I found myself relatively comfortable with the technical activity that is going on. Yes, concerns exist in this country about NASA funding for aeronautical purposes with the budget constraints we are facing, but in general the fundamental research on structures, aerodynamics, and engines is reasonably well in place. My company

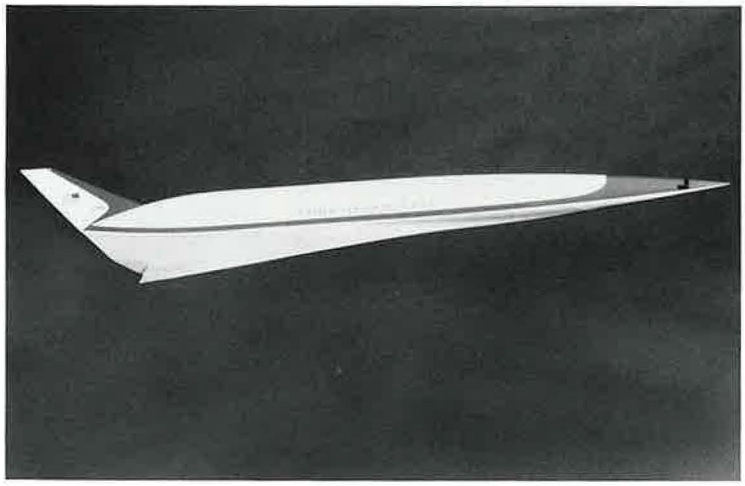


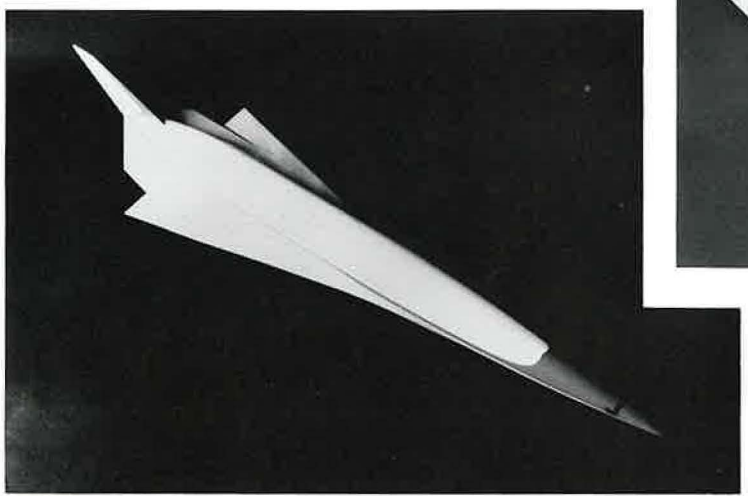
Wind-tunnel configuration development testing for the 7J7 airplane is under way at Boeing. Results from the wind-tunnel testing are being used with Boeing's extensive flight test data base to enhance and substantiate results obtained through computational fluid dynamics analysis.

is currently hard at work, in conjunction with the engine manufacturers, on a new engine, which will fly in a test bed in 1986 and could revolutionize fuel consumption efficiencies for turbine engines. If successful in the prototype form, it could be ordered to production by the engine companies in 1987 and followed by a commitment for an airplane in 1988, delivering a certificated airplane to the air carrier industry at the end of 1992. The lead time in this business is about 5 years for engines and about 4 years for airplanes. Thus from the standpoint of technology, today is essentially 1992, and a planner must view the industry accordingly.

One area in which I think more work needs to be done is supersonics. Commercial aviation has always sold speed. Speed does sell, but the issue is at what price. The work being performed at this time on the fundamentals of supersonic flight would, I believe, allow us to build an airplane that would fly higher, faster, and further than any supersonic plane available today; however, I have reservations about the economics of such a vehicle. There is still time for planning because that airplane will not go into commercial service during this century. How soon after the turn of the century it will be available remains to be seen.

An issue that needs to be addressed in future research programs is building an airplane at a price the customer can afford. Obviously, what the customer





General concept of future aerospace plane, which would be capable of taking off horizontally from and landing on conventional runways, accelerating to orbit, and cruising hypersonically in the atmosphere between earth destinations.

Airport landside capacity is a major concern as air travel continues to increase.

can afford depends on the interest rates at the time and the other items in the capital-cost equation. However, we cannot build airplanes continuing to do things the same way we do them today, increase the sophistication, and expect to have a product that can be delivered at a price that represents what it is worth to the airlines. One thing we have learned is that the airlines will pay what an airplane is worth to them, not necessarily what it costs to build it. That can be a painful lesson.

Another issue that needs to be examined and better understood is the projection for the retirement of current equipment. In estimating the level of production during the next 5 or 10 years, it is less difficult to project the level of traffic growth, the disposable income of the traveling public, and their propensity to travel than it is to project how many of the airplanes that are flying today will be retired and for what reason.

Many airplanes flying today will be structurally sound 10 or 15 or even 20 years down the road if properly maintained. It is doubtful that many of these airplanes will be squeezed out of the system because of environmental considerations. The major factor in the retirement of an airplane will be its operating economics in comparison with that of the new planes being delivered. There are too many variables to make a credible analysis of how long airplanes will last in the system as used vehicles: Where is the cost of fuel headed? What is going to happen to labor costs of the airlines? What will be the cost of money in the future? What level of earnings will the airlines require and therefore what kind of fares will be necessary? The only thing that is predictable is that they will be in service a lot longer than they have been in the past.

A third issue in which research is needed is related to the vehicle: Does the air carrier industry need, and should the manufacturers provide, what might be termed a 707 or DC8 replacement—a small, long-range airplane for use by the airlines on the so-called "long, thin traffic routes of the world." The problem is that we really don't know what the requirement is. This issue cannot be resolved at this time because the data are unavailable and the requirements are currently unknown.

With all the data that exist on air transportation and all the individuals involved in collecting the information, those not involved with the industry might assume that more data exist than can be evaluated. But in reality, ICAO and IATA, which are clearinghouses for airline traffic data, do not retain the data in a manner that allows for tracking an international traveler from point of origination to point of destination. A passenger's route can be traced by using his ticket; but, for example, if he wanted to fly from this country to Africa, he would first fly to Europe, to London or Paris or Frankfurt, and then change planes, taking another flight from one of these three European locations to Africa. The way the information is currently maintained in the international data bank would result in that passenger being identified as a passenger from the United States to Europe and as a pas-

Airside congestion is a growing problem at many airports.

senger from Europe to Africa. An analyst would have no way of knowing how many United States to Africa trips were actually occurring, and whether the passenger traveled to Europe first because he chose to go that way or because it was necessary to be routed that way. Thus the reasons that passengers choose routes are largely unknown, and unless that information becomes available, the manufacturer who commits to build the so-called "long, thin-route airplane" must do so based on faith in the customer who says he needs them. The problem is that these customers may change their minds at any time.

Another problem that I don't think we understand very well and for which analysis is needed is the solution and integration of long-haul and short-haul air transportation. This is important to me as an equipment manufacturer because I am interested not only in supersonic airplanes, but also in how big they should be; how far they should fly; and what kind of characteristics they should have. Today we have a real smorgasbord of airport long-haul, short-haul characteristics, and it may be impossible to find an optimum solution.

The real question is: Which way is the right way to go? We are finding that an airport serves all transport communities until it begins to get congested. Then a variety of things can happen: small carriers may be moved to a so-called domestic regional airport, or some other accommodation is made. At many airports throughout the world, the airport authority—either as the government or as the airport—legislates the amount of capacity that will be offered to each of the different segments of air transportation, thereby taking on a regulatory responsibility on a de facto basis.

By building new types of airplanes that incorporate short takeoff and landing characteristics, airplanes could operate from so-called ancillary runways, closer to the terminal and within the geographic constraints of the airport; in this way, congestion could be alleviated. When this kind of operation was evaluated in the United States about 10 or 15 years ago, an example of the classic "chicken and egg" problem became evident. The FAA established a quiet, short-haul (QSH) office to look at developing airplanes that could fly into airports in downtown regions. It was found that nobody wanted to build such an airplane until a system existed in which to operate it, and nobody wanted to build the system until an airplane was available to use in the system.

The latest version of the Boeing 767-300 airplane with General Electric CF6-80A2 engines on its maiden flight during a test program of the Delta Airlines ordered model. The medium-range, fuel-efficient, longer aircraft burns 12 percent less fuel per seat than the 767-200 and about 34 percent less than the DC-10.

Manufacturers who have designed cost-operating penalties into their airplane to provide some of the short-haul, short-runway characteristics have suffered as a result of this decision because there has been no system to fully exploit it. Research is needed to provide more answers on these characteristics and on where we should be headed.

Finally, I would like to briefly address one aspect of deregulation of the air transportation industry that I think is critically important and that requires some additional thinking, if not analysis. This has to do with the traffic flow at congested airports. It is an inevitable consequence of deregulation that air-traffic density will be stimulated and increased: more carriers and more demand for service by the public means higher frequency of flying. Thus not only are there more carriers, but the trend is for the incumbent carriers to buy smaller airplanes. The result is acceleration of the congestion problem.

Once the airport starts to become congested, the issue becomes who gets in and who doesn't. Nobody has yet come forward with a satisfactory solution to that problem. Why do I as an equipment manufacturer care? Again, it is because this is the only way I will be able to try to plan how big an airplane to build and how many of them to build. Should we plan to design new smaller airplanes because that is what the airlines want, recognizing that it won't be long before congestion is going to force them to turn about and go the other way? And when congestion hits, who is going to be in and who is going to be out? Will the short-haul carrier be discarded to accommodate the mainline trunk operators? Will a mix be legislated? The issue is not a parochial one.

At this Roundtable today, there were discussions concerning future international deregulation. The answer to this question, obviously, is that deregula-

The Boeing 747-400 is the first production commercial airliner to feature winglets as part of the aerodynamic improvements. The airplane uses the same fuselage and basic wing of the 747-300, but has a 6-ft (1.8-m) wing-tip extension in addition to the 6-ft-high winglets.

tion has moved toward becoming international; it is just a matter of degree. Some areas of the world will never have it; some areas of the world already do have it. In the United States, however, unless we resolve this issue on how to accommodate all comers in a system that has limited capacity, we will be back to some form of regulation whether or not we call it that.

The airlines' position is that because Congress saw fit to deregulate them, it is the responsibility of Congress to provide them with a system in which deregulated systems can compete. To the airlines, this means capacity for all comers. Some of us don't think we can afford to provide that, and even if we were to try to provide it, it would take a long time because the lead time on ground capacity in the airport system is very long—a decade or more.

Briefly, I have attempted here to make suggestions relating to a wide panorama of research that I think necessary at some time in the future—research studies that range from how much people will pay for the time savings that will come from supersonic travel to how we can control the access to airports in a deregulated environment. The air carrier business is maturing, and some have suggested that we have almost exhausted the technological stimulus to air transportation. For those of us who are in the industry, it is gratifying to note that a recent Presidential Commission Report suggested that the advances in commercial air travel during the next 25 years show every indication of being capable of exceeding those of the previous 25 years (25 years just about takes us back to the piston airplane).

I would say that supersonic transport will not be available within that 25-year horizon, but there is still much we can do to improve the vehicle—and perhaps it is also time to expend more effort on the system in which the vehicle operates.