A MARKET FOR THE ORIENT EXPRESS

Ben H. Lightfoot
Northwest Airlines

To set the stage, let's talk about what the 21st Century might be like. To do this, I will borrow from a paper delivered last fall by Geoffrey Lipman, Executive Director of the International Foundation of Airline Passenger Associations (IFAPA), at the first High-Speed Commercial Flight Symposium held by the Battelle Institute at its new Center for High-Speed Flight.

The 21st Century

Mr. Lipman predicted "...steady economic growth at 3 percent per annum, controlled inflation at single-digit levels, and affordable energy -- that is, no third oil shock. There will no large-scale politico-military upheaval even though events in the Middle East, Central America and Southern Africa could easily shatter this particular prediction. Let us also assume continued general technological progress with emphasis on computers, and telecommunications as well as leaps in areas that we cannot hope to conceive.

"World trade (will expand) under the impetus of a new GATT (General Agreement on Tariffs and Trade) round. The hopes for the developing world (will) rest on quantum jumps forward on the back of technological innovation and industrialized world aid.

"For aviation, we can anticipate: (a) continued liberalization -- at different paces in different regions -- with Europe and Asia following to some degree the U.S. patterns, but with a 10- to 15-year time lag; (b) a world of megacarriers, controlling hubs, feeding on their global computer reservation systems and corporate and individual brand loyalty schemes; and (c) perhaps four or five Eurosupercarriers built around British, German, French, Dutch and Swiss nuclei; Aeroflot and its agglomerates in Eastern Europe; one major African Consortium; three or four carriers in the Middle East and Indian subcontinent, including a Saudi-led Arab Consortium and the Air India/Indian Airlines carrier; one or two in Latin America, four or five in the Far East and Australia including the Airline of the People's Republic of China and Hong Kong; and five or six in the United States (Unless Lorenzo has combined them into one!). These 20 or so carriers are the potential hypersonic operators.

"The world (would have) perhaps two major civil aircraft manufacturers, each linked to smaller manufacturers in a network of component-supply arrangements and perhaps -- antitrust laws permitting -- even linked to each other for the massive development costs of a hypersonic aircraft. The passenger (would) use only a single credit card for all airline-related transactions -- ticket purchase, check-in, and boarding -- and select and book a flight on the 21st Century version of the home computer."

Northwest Airlines Interest in High-Speed Flight

Now let me borrow from another paper delivered by our Northwest Airlines President, John Horn, at that same Symposium.

"What is the reason for Northwest's keen interest in the HST, particularly since interest among other airlines is not apparent? Well, for one thing -- experience. Northwest has four decades of experience operating some of the longest flight segments in the world -- routes best suited for the HST.

"In the summer of 1986, Northwest operated 62 passenger flights and 12 cargo flights a week across the Pacific, with service to 12 Asian cities. Northwest, the largest U.S. transpacific airline, has nearly 27 percent of the U.S.-Japan market and 19 percent of the total transpacific passenger market, according to U.S. Department of Transportation statistics. In addition, we are a leading cargo carrier, including operations with all-cargo aircraft.

"Our 40 years of experience serving Asia tells us that a properly design HST will be a very valuable asset to our airline and our customers well into the 21st century. The HST could truly revolutionize U.S.-Asia air travel, providing fast, comfortable, and efficient customer service at prices reflecting the value received.

"While Europe is a logical market, Asia is the most attractive market for HST service. Routes to Asia are among the longest in the world, and Asia is home to many of the fastest developing economies in the world. For the United States today, Asia is becoming increasingly important.

"The best evidence of that is the shift in focus of U.S. trade from Western Europe to the Pacific Rim. In 1984, Pacific trade surpassed Atlantic trade for the first time.

"The leader in Asia has, of course, been Japan. It is a well-documented success story. Not only is Japan a leading producer and consumer of goods, it is fast becoming an important participant in the world's financial affairs. Furthermore, Japan has made major commitments to aerospace technology, SDI, and other technological ventures.

"Mike Mansfield, the U.S. Ambassador to Japan, has called the U.S. - Japan bilateral trade agreement the most important in the world, "bar none." He is correct. Trade between the United States and Japan has opened up new markets both to U.S. products and to Japanese products, and has spurred growth among other countries in Asia.

"Although not as advanced as Japan today, other nations of the Pacific are experiencing dramatic growth in their economies, which is resulting in growth in international trade.

"The 1984 list of the world's 20 leading exporting nations included six countries -- five of them from Asia -- that did not appear on the list in 1973. The newcomers from that region were Hong Kong, Singapore, South Korea, Taiwan and The People's Republic of China.

"The growth of exports from these countries to the rest of the world has been rapid and steady. For example, from 1973-1984 South Korea experienced average annual export-volume increases of 15 percent. Hong Kong, Singapore, and Taiwan had export-volume growth greater than 10 percent, while Japan recorded 9 percent annual growth. By contrast, the United States in that time averaged about 2 percent export growth a year.

"Imports are getting stronger as well. Among the 20 leading importing nations in 1984 were the same five Asian countries that emerged as export leaders, and again, none of them was among the import leaders in 1973.

"With continued growth in Asia expected, Ambassador Mansfield confidently predicts that the 21st Century will be the Century of the Pacific Rim. We believe he will be proven correct.

"It is fair to say that aviation has been a key element in shaping the rapid growth rate in transpacific trade and travel. As aircraft have improved with new technology, resulting in shorter travel times, increased capacity and improved customer comfort, the demand for transpacific air service has increased. As a result, we believe that the aircraft does indeed make a strong contribution to increasing the market."

How Speed Develops Markets

Mr. Horn continued: "Fifty-seven years ago an infinitesimal number of people flew coast-to-coast by commercial aircraft -- the majority moved by train, auto or bus. The growth rate of our economy and U.S. business was constrained by the time it took to travel. In 1929 coast-to-coast by rail took 3 1/2 days. Through a combination of air and rail, the brave and sturdy traveled to Los Angeles in 48 hours and 26 minutes. The trip included 10 enroute stops, with the traveler flying by day and going by rail at night. In late 1930, TWA started the first single airplane through-service from New York to Los Angles. This trip took 35 hours and 9 minutes with stops for fuel. The most popular commercial aircraft at that time was the Ford Trimotor, carrying 14 passengers at 110 mph.

"Early long-range jet aircraft were developed in the late 1950s primarily for service to Europe, the most popular transoceanic market at that time.

"In 1960, Northwest introduced jet service to the North Pacific. The DC-8 opened the door to growth and expansion in U.S.-Asia air travel and trade. In 1965, just a few years after the introduction of the narrow-body jet, airlines carried 3.6 million transatlantic passengers and 358,000 transpacific passengers. The relative weakness in the transpacific market can be partly attributed to long flying times and the economic climate in Asia at that time.

"By the early 1970s, introduction of the Boeing 747 wide-body had increased the range, comfort level, and capacity of long-distance air travel. In 1976, airlines carried 3.3 million transpacific passengers, or about 30 percent of the total transatlantic passengers that year.

"The number of passengers across the Pacific continued to increase as more 747s were introduced, longer-range models became available, and airlines offered service to more cities. In 1985, the number of transpacific passengers reached 7 million, 37 percent of the total number of transatlantic passengers. The gap between transpacific and transatlantic traffic is projected to continue to narrow.

"From 1975 to 1984, traffic to and from Asia increased an average of 11 percent a year, and those markets now account for 41 percent of worldwide air traffic on flight segments over 5,000 miles.

"An increase in cargo shipments accompanied the growth in passenger traffic. Annual air cargo traffic between the United States and Japan rose from 3.5 million pounds in 1962 to 586 million pounds in 1984. Between 1978 and 1984, air cargo shipments between the United States and 10 leading Asian nations more than doubled, from 732 million pounds to 1.5 billion pounds. I can't imagine what the above figures would look like if we had had hypersonic or even supersonic intercontinental service for the past five years.

"Yet, projected demands for passenger and cargo services continue to call for faster, more productive aircraft.

"According to projections by one airframe manufacturer, year-to-year growth in passenger traffic will be in double digits though the end of the 20th Century. In the year 2000, 36 million passengers are expected to fly across the Pacific, and further increases are projected for the first two decades of the 21st Century.

"Although the next generation of transpacific aircraft, the 747-400, will increase nonstop range and payload and offer greater operating efficiencies, it will not significantly reduce flying times.

"The next technological jump is to the HST, also referred to as the Orient Express. We need that aircraft."

The Case for a Mach-5 HST

Let's look at some city pairs and today's scheduled block times via 747:

City Pair	Flying Times	Annual Passengers
New York (JFK) - Tokyo (NRT)	13 h 55 m	488,803
Chicago (ORD) - Seoul (SEL)	14 h 35 m	19,229
Seattle (SEA) - Tokyo (NRT)	10 h	429,302
Los Angeles (LAX) - Tokyo (NRT)	11 h 30 m	767,284
Boston (BOS) - Frankfurt (FRA)	6 h 55 m	122,473
Boston (BOS) - London (LGW)	6 h 5 m	528,816

How many of you have taken a 13-hour trip from JFK to Tokyo? No matter how hard we try to make our passengers comfortable, 13 hours of sitting, eating two meals, watching two movies, and trying desperately to catch some sleep leaves anyone in pretty sad shape when they arrive.

A Mach-5 HST will reduce that 13 hour trip to 2 1/2 hours!

Why Mach 5? Four reasons:

1. Fast enough -- but not too fast.
2. Compatibility with existing airports, facilities, and ground equipment.
3. Environmental considerations.
4. Economic considerations.

Let's look at each of these:

Speed. Let's go for a speed that will allow the aircraft to provide significant savings in present day flying times but still be "slow" enough to be useful in long domestic markets. Consider these flying times for a Mach 5 HST:

Segment	Distance (N.M)	Time
New York (JFK) - Tokyo (NRT)	6000	2 h 25 m
Chicago (ORD) - Seoul (SEL)	6200	2 h 29 m
Seattle (SEA) - Tokyo (NRT)	4240	1 h 53 m
Los Angeles (LAX) - Tokyo (NRT)	4775	2 h 03 m
New York (JFK) - Frankfurt (FRA)	3390	1 h 28 m
New York (JFK) - London (LGW)	2040	1 h 22 m
Tokyo (NRT) - Hong Kong (HKG)	1680	57 m
Los Angeles (LAX) - Frankfurt (FRA)	5080	1 h 59 m
Washington (WAS)* - Seattle (SEA)	2038	59 m

But while we are considering speed, we must also consider local curfews, arrival and departure times, and traffic fed into and out of the airlines' system hubs. For example, at NRT no aircraft can depart or arrive after 11 p.m. and before 6 a.m. For any new slot awarded at NRT, the evening curfew begins at 9 p.m.

A large percentage of travelers on long-haul routes are connecting at major hubs and going on to other destinations. For example, in 1986 30 percent of Northwest's passengers from NRT to ORD and WAS went on to other cities in the United States. Therefore, arrivals and departures into and out of hubs must provide good connections. Northwest has conducted routing exercises using a small fleet of three Mach-5 HSTs and successfully routed these aircraft to provide attractive arrival and departure times at major U.S. and Orient cities, while honoring all curfews and meshing these flights with other connecting flights at hub cities. Daily utilization for this example fleet was just under 7 1/2 hours per day. We feel that higher utilizations might be realized for such a fleet.

To rather dramatically demonstrate the maximum utilization and productivity for a single Mach-5 Orient Express on a given day, we routed it thus:

Departs NRT	0900 Monday
Arrives LAX	1803 Sunday
Departs LAX	2000 Sunday
Arrives NRT	1503 Monday
Departs NRT	1800 Monday
Arrives JFK	0625 Monday
Departs JFK	0820 Monday
Arrives LGW	1542 Monday
Departs LGW	1740 Monday
Arrives JFK	1302 Monday
Departs JFK	1445 Monday
Arrives NRT	0710 Tuesday

* WAS is a general designation for airports in the metropolitan area of Washington, D.C.

This aircraft would cover 32,000 miles in a total elapsed time of about 22 hours, allowing for 1 3/4 to 2 hour turnarounds at each city served.

My point is this: Mach 5 seems to be a good speed to satisfy all constraints.

Consider the Concorde service across the Atlantic. Westbound trips from Paris to JFK are enjoying load factors 20 points higher than eastbound trips between those cities. Why? Going west, one can leave Paris at 11:00 AM and arrive in New York at 8:45 AM ready for a full day's work. Going east there are no combinations of both good arrival times and good departure times for businessmen.

Compatibility with Existing Airports. Let's look at our second reason for favoring the Mach-5 HST: compatibility with existing airports, facilities, and ground equipment.

A methane-powered Mach-5 HST will result in some special fueling equipment and facilities and will require special handling procedures because of residual skin temperatures after arrival. However, the manufacturers tells us that a 300-passenger Mach-5 HST will work with existing jetways and operate off existing runways. One configuration proposed is no larger than a DC-10, weighing 530,000 lbs. with a wing span of 106 feet and an overall length of 252 feet.

If we think in terms of a higher-speed HST -- Mach 6 and up -- we must think in terms of hydrogen fuel. We believe that hydrogen fuel would present substantially more problems for ground handling. Further, because of the low density of hydrogen, the airplane must be much larger than a methane-powered Mach-5 vehicle designed for the same payload-range. Such an aircraft would not be compatible with existing terminal facilities and ramps.

Environmental Compatibility. Our third argument for Mach 5 is the case for the environment. Its poor economics was not really what killed the U.S. Mach-2.8 SST in March, 1971. The environmentalists did; and maybe they were right to do so. Any design we propose today that creates too much noise to fly overland or operate from existing airports or that destroys ozone is going to have a rough time getting enough public and congressional support to be successful. And the environmental considerations impact the economics of the vehicle. We must have an aircraft that can fly overland at design cruise speeds and can operate from existing airports.

We understand that a Mach-5 methane-powered HST can be built to meet such requirements. We may have to get the FAA to bend a little on airport noise, but less than 1 psf overpressure with the aircraft cruising at 100,000 feet should be acceptable for overland operation. The economic viability of an advanced SST or HST will be greatly enhanced by the aircraft's ability to operate at design Mach number overland.

Economics. This brings us to our final -- and most important concern -- economics. The economics must work for the manufacturers, the airlines, and the passengers.

Our company's position is that any high-speed commercial transport must be capable of supporting fares competitive with subsonic jets operating in the

same time frame. Obviously passengers will pay some premium for greatly reduced flying times, but Concorde has shown that when the fares are too far above competing fares, the passenger demand is very limited. We want to be able to provide three classes of Mach-5 service at reasonable fares.

At Northwest, we have worked with projected operating costs for such an aircraft. We estimate that costs per hour will be substantially higher for fuel and maintenance, but equal to or somewhat lower per hour for flight and cabin crews.

We estimate that operating costs per trip, exclusive of ownership costs, will be substantially lower than those for a same-era 747.

Unfortunately, we do not have all of the picture. Development costs will be very high for an advanced SST or HST. The manufacturers have ways of making new technology extremely expensive. Some of it is justified. We are presently working in-house to try to estimate what we could afford to pay for a Mach-5 HST to enable it to be economically viable.

You asked me to talk about the market for an advanced SST or HST. I have strayed from that and given you a sales pitch for Mach-5. While our very limited work points to a Mach-5 aircraft, we are anxious to see what the parametric studies now underway at Douglas and Boeing will show. I understand that they are fixing certain requirements and allowing Mach number to vary.

Conclusion

There are almost 40 long overwater city pairs in the world today, now served by someone with nonstop service. The flying times between these city pairs vary from 10 hours to 14 hours.

There are an additional 400 city pairs of medium length served by commercial carriers with flying times ranging from 6 hours to 10 hours.

In addition, transcontinental U.S. flights today require 4 1/2 to 5 hours flying time. In 1985 almost 46 million passengers flew on international trips.

A Mach-5 HST will do the longest non-stop trips in 2 1/2 to 3 hours, the medium length trips in 1 to 2 hours, and the transcontinental trips in less than 1 hour.

Will a large percentage of the passengers flying these routes pay more to reduce their flying times to one-quarter or one-third of subsonic times? You bet they will!

The demand is here today, and the technology is within reach. What are we waiting for?