High Speed Commercial Transport (HSCT)

Outlook

- HSCT study efforts are continuing under both government and industry auspices
- No prototype or production aircraft are forecast to be built in the next 10 years

Orientation

Description. Government- and industry-supported studies of a next-generation commercial supersonic passenger transport aircraft.

Sponsor. U.S. High Speed Commercial Transport (HSCT) research is sponsored by industry and the U.S. National Aeronautics and Space Administration (NASA). The European Supersonic Research Program (ESRP) is sponsored by French, British, and German industry. Japanese HSCT efforts are sponsored by industry and the Ministry of Economy, Trade and Industry.

Status. Technical feasibility studies are being performed in Western Europe, the U.S., and Japan.

Total Produced. Not applicable.

Application. Intercontinental-range, high-capacity (250-300 passengers) scheduled passenger transportation.

Price Range. Estimated cost of a 250-300 passenger HSCT is $250-$350 million in 2010 U.S. dollars. Estimated development cost is $15-$30 billion.

Technical Data

Design Features. Various large supersonic transport designs have been unveiled over the past several years. Most that are considered economically and technically viable have a double-delta wing, a single vertical tail, and four advanced engines in the 222.4-311.4 kN (50,000-70,000 lbst) class. Exact size and weights vary with each design. However, common specifications include a passenger capacity between 250 and 300, speed between Mach 2.0 and Mach 2.5, and a maximum range between 5,000 and 8,000 nautical miles.

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Concorde

Source: Air France

Variants/Upgrades

U.S. HSCT. Boeing evaluated several HSCT concepts over the years, as did McDonnell Douglas prior to its 1997 merger with Boeing. Boeing envisioned an aircraft that would cruise at Mach 2.0-2.5 and carry 250-300 passengers over 5,000 nautical miles at an altitude of 60,000 feet. The company considered the use of polymeric composites, such as thermoplastics, in the aircraft structure. McDonnell Douglas evaluated speeds up to and including Mach 5 and concluded, similar to Boeing, that Mach 2.2-2.5 was the optimum cruise speed within environmental and economic constraints. Estimated gross weights of the Boeing/ McDonnell Douglas supersonic transports (SST) were between 450,000 and 600,000 pounds.

An HSCT might be powered by four engines rated at approximately 50,000-70,000 lbst each. The U.S. National Aeronautics and Space Administration's technology concept airplane (TCA) featured 49,500-lbst mixed-flow turbofan engines. The mixed-flow turbofan reduces jet noise by mixing low-energy air with engine high-energy exhaust flows during takeoff. It has a secondary, slower-moving airstream that bypasses most of the engine's turbomachinery but rejoins the airflow before reaching the engine exhaust nozzle.

In September 1994, NASA awarded a $266 million contract to a team of GE Aircraft Engines and Pratt & Whitney for propulsion technology research for the HSCT. The contract definitized a June 1994 letter contract. Boeing and Allison supported the GE/Pratt team on the program.

Northrop Grumman has received a U.S. patent for a supersonic transport design. The company's design incorporates laminar flow control and a reverse delta wing. Two pairs of engines are arranged in a stacked configuration. Northrop Grumman has not pursued further research into the design.

ESRP. In April 1994, British Aerospace, Aerospatiale, and DASA signed a Memorandum of Understanding regarding a future supersonic transport project. The companies' individual conceptual studies were merged into a joint program called the European Supersonic Research Program (ESRP). Design goals include a speed of Mach 2.0, cabin space for 250 passengers in a three-class configuration, and a range of 5,500 nautical miles. (British Aerospace is now known as BAE Systems, while Aerospatiale and DASA have been absorbed into EADS.)

An earlier French effort was the Aerospatiale/ONERA/ Snecma Alliance future SST, which was a Concorde-type aircraft with a high-aspect-ratio double-delta wing. Alliance was envisioned as a 250-300 passenger, Mach 2.05 aircraft with a lift/drag ratio of 10.5, compared to 7.3 for the Concorde. Range was 11,000 kilometers (5,935 nm). Composite and light alloys would likely have been used widely in the aircraft, with titanium used in the central portion of the fuselage. As for engine candidates, European engine manufacturers Rolls-Royce, Snecma, MTU, and FiatAvio had teamed to study HSCT propulsion concepts. The team chose a mid-tandem fan (MTF) as the most promising system.

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The British Advanced Supersonic Transport (AST) project was similar to Alliance but differed in at least two respects: the AST had a forward canard empennage and a lower wing aspect ratio. As a base for its SST studies, British Aerospace had concentrated on an aircraft seating 280 passengers in a three-class layout, meeting Stage 3/Chapter 3 noise regulations and having a range of 5,500 nautical miles. Features that distinguished it from the Concorde included the use of area ruling to reduce supersonic drag, a foreplane to improve pitch control and decrease trim drag, and high-lift devices to reduce fuel burn at low speed and to improve takeoff performance in an attempt to reduce noise. The engines were bypass derivatives of the Concorde's Olympus powerplant. However, the propulsion system for the actual AST would likely have been either the European MTF or one of the U.S. concepts examined by NASA.

Japanese HSCT. In 1989, Japan's Ministry of International Trade and Industry (MITI) awarded a $435,000 contract to the Society of Japanese Aerospace Companies (SJAC) for a preliminary survey of SST development. In August 1991, Japan Aircraft Development Corp (JADC) was commissioned to perform SST research. In February 1992, JADC displayed an SST model at the Asian Aerospace show in Singapore.

MITI launched a government-funded program in 1989 regarding development of a Super/Hyper-Sonic Transport Propulsion System. A new turbofan, called the HYPR90-T, has been studied by Kawasaki, Mitsubishi, and IHI with assistance from Rolls-Royce, United Technologies Corp, General Electric, and Snecma. The Japanese view the HYPR90-T as one part of a combined-cycle engine that could power an HSCT capable of sustained speeds as high as Mach 5.0.

MITI is now called the Ministry of Economy, Trade and Industry.

Tupolev Tu-244. A model of the Tupolev Tu-244 SST was displayed at the Paris Air Show in 1993. Specifications for the aircraft included a passenger capacity of 269, a maximum takeoff weight of 325,000 kilograms (716,500 lb), and a maximum range of 9,200 kilometers (4,965 nm). Tupolev worked on the Tu-244 program together with the Russian government and the TsAGI and GosNII research institutes.

Tupolev is currently working on a supersonic business jet called the Tu-444. Research results from the (apparently now shelved) Tu-244 project are being utilized in the Tu-444 program.

Program Review

Background. Renewed interest in a new-generation, supersonic-capable, commercial transport actually began with U.S. President Ronald Reagan's pledge in the mid-1980s to develop a hypersonic "Orient Express," a Mach 8-25 single-stage-to-orbit space vehicle with long-term commercial potential. Since that announcement, the quest for very-high-speed transports has diverged into two greatly different but related concepts: very high Mach number single-stage-to-orbit aircraft/launchers for space projects, and supersonic passenger aircraft.

Industry Agreements. At least eight major industry agreements concerning an HSCT have been reached since the late 1980s. In 1989, Rolls-Royce and Snecma agreed to jointly study propulsion systems for a next-generation SST. In May 1990, British Aerospace and Aerospatiale decided to work together to design a new Concorde follow-on, although these two firms eventually began to work independently on separate programs. Later in May, yet another multi-company agreement was reached. Boeing and McDonnell Douglas joined with British Aerospace, Aerospatiale, and DASA to conduct a study of all issues affecting the HSCT. This group, called the Supersonic Commercial Transport International Cooperative Study Group (SCTICSG), was later joined by Tupolev, Alenia, and Japan Aircraft Development Corp (JADC).

Also in 1990, GE and Pratt & Whitney joined forces to design and develop an advanced powerplant to power any future HSCT. They extended the pact in 1991.

A fifth agreement, involving Boeing and DASA, was inked in March 1991. Then, in April 1994, British Aerospace and Aerospatiale again joined forces on a next-generation SST program, this time with DASA as a partner. Also, Boeing and McDonnell Douglas teamed in 1994 to participate in Phase II of NASA's High-Speed Research program.

The eighth agreement was signed in June 2005 between the Society of Japanese Aerospace Companies (SJAC) and the French aerospace industry association GIFAS. The accord covered a three-year, $5.5 million joint research effort into supersonic aircraft structures and engines. In July 2008, the cooperative effort was extended for an additional three-year period. Among the areas covered by the program are engine noise reduction and development of structural composite materials.

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Japanese participants in the joint program include JADC, Fuji, IHI, Kawasaki, Mitsubishi, and the Japan Aerospace Exploration Agency (JAXA). French participants are EADS and Safran.

United States High Speed Commercial Transport. In 1986, NASA launched an initial set of studies with Boeing and McDonnell Douglas to determine the feasibility of a next-generation supersonic transport. The $9.0 million High Speed Civil Transport study program culminated in two 1988 reports by the contractors. Boeing narrowed the focus, as did McDonnell Douglas, to a Mach 2.0-3.0 aircraft from a previous target of Mach 5. Technical issues, including high-temperature materials, active and passive cooling of aircraft structures, propulsion, and fuel systems, led to the speed limitation. A Mach 5 aircraft was determined not to be economically feasible.

Boeing and McDonnell Douglas reviewed several aircraft concepts in terms of block times, utilization rates, range, seating, and airline networks. An aircraft was indeed technologically possible, but environmental considerations were a significant issue. The new SST would have difficulty meeting Stage 3/Chapter 3 noise regulations. More critical, however, was the engine emission issue, particularly that of nitrogen oxide (NOx), which is considered harmful to the Earth's ozone layer. U.S. engine companies have been researching the reduction of NOx to an acceptable level through use of advanced combustion systems.

NASA High-Speed Research Program. In early 1999, NASA decided to terminate its supersonic transport research effort, which was called the High-Speed Research (HSR) program. Previous decisions by Boeing and other companies to scale back their own investments in HSCT research led to NASA's decision to terminate the HSR program.

The HSR program had been intended to be a 13-year effort with two overlapping phases. Phase I began in FY90 and lasted seven years. Under this phase, NASA investigated barrier technologies – those that prevent the introduction of an environmentally acceptable, economically viable aircraft. The second phase was envisioned as a nine-year effort running from FY94 to FY02. This phase was the technical validation portion of the program. NASA had proposed spending $1.5 billion during the second phase. In July 1994, NASA awarded a $440 million contract, covering the second phase, to a team of Boeing and McDonnell Douglas. Lockheed Martin, Northrop Grumman, and Rockwell acted as subcontractors.

NASA had proposed a Phase IIA that would have started in FY99. This phase had been intended to mitigate risk in the areas of propulsion and airframe materials and structures.

The HSR program might also have included a third phase, which would have involved a subscale device.

In mid-1993, NASA awarded contracts to Boeing, McDonnell Douglas, and Lockheed (now Lockheed Martin) to develop materials and material fabrication technology for a high-speed civil transport. Under the contracts, work focused on development and testing of promising high-temperature materials and fabrication techniques, and investigation of the long-term durability of structural components. Boeing received $25.4 million, McDonnell Douglas received $23.9 million, and Lockheed was awarded $27.3 million. These amounts included funds for optional material development efforts.

Much of the HSR program's work was environmental, with a major objective being the resolution of the issues of noise and emissions of NOx. Other major NASA HSCT efforts involved reducing the manufacturing cost of composite materials, development of supersonic laminar flow technology, and the use of synthetic vision to eliminate the aircraft's droop nose.

In September 1998, NASA decided that the HSR program should focus more on basic supersonic research rather than manufacturing technology that would lead to a prototype.

Boeing Scales Back Research

In the fall of 1998, stymied by problems with technology and costs, Boeing decided to scale back its HSCT research efforts. Plans called for its staff of 300 engineers working on the program at that time to be reduced to approximately 50 personnel within a year.

Boeing and its partners, General Electric and Pratt & Whitney, found that they could not overcome a number of obstacles, including increasingly stringent governmental engine noise regulations and a requirement for improved airframe technology.

Recent financial difficulties at Boeing were also a factor in the decision, but not the primary one. Boeing also considered disbanding the SCTICSG.

International Efforts. While NASA and U.S. aircraft companies were performing their initial HSCT work, Battelle Columbus' Center for High Speed Commercial Flight was attempting to launch a true international consortium to develop the next-generation SST. Its three-year effort generated no U.S. aerospace industry interest but secured the participation of 42 companies in six nations. Most of these firms, however, had U.S. participation as a precondition to continuing. Boeing and McDonnell Douglas opted not to join the Battelle effort because of concerns about sharing of research.

In April 1989, Battelle invited the world's aerospace and airline companies to participate in a second-phase HSCT effort. Only 15 responded favorably: nine manufacturers (four Japanese, five European) and six airlines (two European, three U.S., and Japan Airlines).

The Battelle effort was completed in early 1990.

Oblique Wing. One aircraft concept that was considered for the NASA HSCT was the oblique wing. NASA conducted a research demonstration program to evaluate the concept of adjustable wings on subsonic and supersonic aircraft. The program was terminated in 1988 before the agency could embark upon its plan to fit a U.S. Navy F-8 Crusader with an oblique wing to study supersonic performance.

Under this initiative, NASA would have modified a Crusader fuselage and tail section to accept a single-piece wing pivoting on the aircraft centerline. For takeoff and landing, the wing would be in the normal 90-degree position relative to the fuselage. For transonic and supersonic flight, the wing would be gradually transitioned to about 120 degrees, with one half of the wing swept forward, the other half swept aft.

NASA and the U.S. Navy would then have performed extensive flight testing for potential applications on Navy fighters of the future. These evaluations were to be a follow-on to an earlier NASA test of the oblique wing concept on the Ames Industrial Corp/NASA-Dryden-1 (AD-1) research aircraft. In those evaluations, however, flight tests were confined to the low-speed regime and neither transonic nor supersonic conditions were studied in flight.

Expected advantages of this configuration included a 12-15 percent weight savings compared to a variable-geometry layout in which long loiter time and supersonic dash speeds are prime design goals. The oblique wing aircraft would also require 12-14 percent less carrier deck space, as the airfoil would be pivoted until almost fully aligned with the fuselage.

NASA issued a Request for Proposals (RFP) for the preliminary design of the airfoil in 1984. While NASA had hoped that two or three contractors would submit preliminary design proposals, only the North American Aircraft Operations Division of Rockwell International responded, and a contract was awarded to that firm in November 1985. At that time, the program timetable called for fabrication of the wings during FY87-FY88, with first flight in December 1989. A one-year, 40-flight-test program was anticipated. However, the Navy subsequently failed to provide its share of funding, and the program was terminated in 1988.

Since FY88, there has been little if any military interest in reviving the program. However, NASA interest once again surfaced. This time, the end-use was the HSCT. In 1992, the agency completed a preliminary design study of an oblique all-wing SST able to carry 300-500 passengers over 10,000-12,000 kilometers (5,500-6,500 nm) at speeds from Mach 1.6 to Mach 1.8. In 1993, Boeing and McDonnell Douglas each received a $100,000 contract from NASA to assist in the design of an oblique wing SST.

In past decades, several studies of oblique wing SSTs had been conducted. Each speculated on the enormous performance and weight advantages of such an SST. There were, of course, disadvantages, the most important being wing attachment.

NASA and U.S. Industry Progress. In January 1992, NASA issued a five-year, $88.7 million contract to a team of GE and Pratt & Whitney to study advanced combustor and exhaust nozzle materials. A four-year, $88.9 million option was included in the contract. The goals of the GE/Pratt program were a low-NOx, ceramic-matrix combustor that produces five grams NOx per kilogram of fuel burned, and a nozzle capable of withstanding temperatures of 2,400°F.

In 1995, NASA began flight testing a specially configured F-16XL. A large titanium panel, called a glove, was attached to the upper surface of the F-16's left wing. The panel was perforated with over 10 million laser-cut holes, while below the panel was a suction system linked to a compressor.

The goal of the project was to achieve laminar air flow over the surface of the aircraft's wing while flying supersonic. Laminar flow conditions can reduce aerodynamic drag and contribute to reduced operating costs by improving fuel consumption and lowering aircraft weight. A method of maintaining laminar flow control could be incorporated into the design of an HSCT.

In 1996, NASA completed flight testing of a synthetic-vision landing system planned for use on the HSCT. The agency demonstrated that a pilot using such a system could safely land a Boeing 737, as well as see other aircraft flying in the vicinity and obstacles on the ground. A high-speed transport would require a windowless landing system in order to avoid fitting the aircraft with a drooped nose as found on the Concorde, and save thousands of pounds of weight.

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Besides a 737, a BAC 1-11 was also used in the testing. The 737 was equipped with a Rockwell Collins WXR-700 X-band radar system plus video and infrared sensors from FLIR Systems Inc. The 1-11 had a Westinghouse X-band radar and FLIR and a CCD video camera. Both aircraft were used in taxi and flight tests, while the 737 was also used for piloted synthetic-vision approaches.

NASA also created an HSCT planform called the technology concept airplane (TCA). The TCA's general design goals were a Mach 2.4 cruise speed, a range of 5,000 nautical miles, a maximum takeoff weight of less than 340,200 kilograms (750,000 lb), and capacity for 300 passengers in a three-class configuration. The planform featured a low double-delta wing, a horizontal and vertical tail, and four underwing-mounted engines.

In the spring of 2003, the U.S. Federal Aviation Administration (FAA) issued a Request for Information concerning research and development of sonic boom mitigation. This was an initial step by the FAA toward the establishment of noise standards for overland operation of commercial supersonic aircraft. The issue of quiet supersonic flight had also been discussed by the Committee on Aviation Environmental Protection of the International Civil Aviation Organization (ICAO).

The Supersonic Cruise Industry Alliance, an alliance of 10 U.S. companies, was formed in 2004. The goal of the alliance is to enable supersonic flight over land within 10 years. The group approached NASA with a proposal for a flight demonstration program, but the agency could not afford the $1.0 billion price tag for the effort. NASA asked the alliance to re-scope the program. The group then put together a more modest proposal for a subscale low-boom demonstrator. NASA subsequently funded four studies into the feasibility of, and concepts for, such a demonstrator.

The four studies were conducted by Boeing Phantom Works, Raytheon Aircraft, a team of Lockheed Martin and Cessna, and a team of Northrop Grumman and Gulfstream. Each received a contract worth approximately $1.0 million in July 2005 for the study efforts from American Technology Alliances (AmTech). NASA awarded a grant to AmTech to fund the studies. The same grant also funded GE, Pratt & Whitney, and Rolls-Royce North American Technologies for engine-related data.

The 10 companies in the Supersonic Cruise Industry Alliance are Boeing, Cessna, General Electric, Gulfstream, Lockheed Martin, NetJets, Northrop Grumman, Pratt & Whitney, Raytheon, and Rolls-Royce North American Technologies.

European HSCT Programs. British Aerospace and Aerospatiale, joint venture manufacturers of the Concorde, produced 20 Concorde aircraft, including four prototypes. Sixteen production aircraft were delivered, including two used for spare parts. Fourteen entered airline service, seven each with British Airways and Air France.

In May 1990, British Aerospace and Aerospatiale signed an agreement to carry out a joint preliminary study on a second-generation Concorde, assessing technical feasibility, commercial viability, market potential, aircraft and engine configurations, and environmental issues. A few months prior to this joint announcement, Rolls-Royce and Snecma, producers of the original Concorde propulsion system (Olympus), signed an agreement to conduct a two-year program to produce a market survey and define the necessary engine type and cycle and the key technologies required to develop such an engine.

British Aerospace and Aerospatiale said that they would explore wider international cooperation on the Concorde follow-on. This led to an announcement in May 1990 of an informal alliance of U.S. and European companies, including Boeing, McDonnell Douglas, DASA, Aerospatiale, and British Aerospace. This transatlantic consortium is the Supersonic Commercial Transport International Cooperative Study Group (SCTICSG) mentioned above. Alenia and Japan Aircraft Development Corp joined in early 1991. This program was extended in June 1991 at the Paris Air Show, and Tupolev entered the study group shortly thereafter. FiatAvio and MTU joined the Rolls-Royce/ Snecma joint engine studies in late 1991.

The SCTICSG team has studied environmental issues, certification procedures, and market potential, and has also investigated international cooperation benefits and international business compatibility. The SCTICSG studies have been conducted separately from those performed by individual members.

Outside of the SCTICSG studies, Aerospatiale, British Aerospace, and DASA teamed in early 1994 to pursue a next-generation SST effort called the European Supersonic Research Program. Design goals included a speed of Mach 2, cabin space for 250 passengers in a three-class configuration, and a range of 5,500 nautical miles.

Japanese HSCT Efforts. Japan's Ministry of Economy, Trade and Industry has been conducting a number of studies regarding a high-speed commercial transport. Industrial participants include Mitsubishi, Kawasaki, IHI, Fuji, Nissan, All Nippon Airways, and

Japan Airlines. In February 1991, the ministry announced that an agreement had been reached with United Technologies Corp, General Electric, Rolls-Royce, and Snecma regarding participation in research and development of the propulsion system for the Japanese SST.

Mitsubishi is currently working with Toray Industries and Mitsui Toatsu Chemicals to develop materials capable of withstanding the temperatures in supersonic flight.

In mid-2004, a five-year, $120 million study sponsored by Japan's New Energy and Industrial Technology Development Organization (NEDO) was completed that involved research and development into an environmentally compatible propulsion system for a next-generation supersonic transport. The study was led by IHI. Also taking part in the project were Kawasaki, Mitsubishi, JAXA, General Electric, Pratt & Whitney, and Rolls-Royce. According to IHI, the program met its noise and emissions reduction objectives.

In October 2005, JAXA successfully completed a test flight of an unmanned, one-tenth scale model of a supersonic transport. The model was launched piggy-backed on a rocket booster, from which it separated at around 62,300 feet. At its peak, the model glided at Mach 2.

JAXA envisions development of a Mach 2 class airliner by 2015 and a Mach 5 class hypersonic demonstrator by 2025.

Funding

NASA's HSR program was canceled in 1999. NASA later revamped its aeronautics programs, and now conducts research into civil (and military) supersonic flight under the Supersonics Project of the agency's Fundamental Aeronautics Program. NASA requested $40.6 million for FY10 for the Supersonics Project.

Private industry in the U.S. also funds HSCT research.

Non-U.S. HSCT funding data are not available.

Timetable

Month	Year	Major Development
	1969	First flight of Anglo-French Concorde
	1971	Congress terminates the U.S. Supersonic Transport program
	1976	Concorde commercial flights inaugurated
	1986	NASA issues contracts to Boeing and McDonnell Douglas to study new SST
	1989	Rolls-Royce and Snecma begin new SST engine studies
	1989	NASA begins High-Speed Research program
May	1990	BAE and Aerospatiale sign agreement to jointly study Concorde follow-on
May	1990	Boeing, McDonnell Douglas, DASA, BAE, and Aerospatiale form SCTICSG
Feb	1991	MITI announces agreement on SST propulsion R&D with Rolls-Royce, Snecma, GE, and Pratt & Whitney
	1991	Alenia, Tupolev, and Japan Aircraft Development Corp join SCTICSG
	1991	FiatAvio and MTU join Rolls-Royce and Snecma on joint engine studies
Feb	1992	Japan unveils SST-X001 at Asian Aerospace
Apr	1994	Aerospatiale, BAE, and DASA sign MoU on next-generation SST joint program
Feb	1999	NASA cancels HSR program
Jun	2005	GIFAS and SJAC sign agreement for three-year HSCT research effort
Jul	2008	GIFAS/SJAC cooperative effort extended for further three years

Worldwide Distribution/Inventories

Both Air France and British Airways withdrew their Concorde fleets from active service in 2003.

Forecast Rationale

NASA intends to award a contract of undisclosed value to Lockheed Martin to study concepts for a commercial supersonic transport that could enter service beyond the year 2018. The study will be conducted under the auspices of the Supersonics Project of NASA's Fundamental Aeronautics Program.

Meanwhile, NASA plans to soon decide whether to embark on an effort that could lead to the manufacture of a low-sonic-boom flight demonstrator. In mid-2009, Boeing completed a study on the possibility of extensively modifying a cranked-arrow-wing F-16XL to serve as such a demonstrator. NASA plans to examine other options as well before deciding on how to proceed.

Under a separate effort, NASA is conducting research into concepts and technologies for a range of future civil transports, including both supersonic and subsonic aircraft, that could potentially enter service in the 2030-2035 timeframe. This effort is known as the N+3 project. Targets for an N+3 100-200 seat supersonic airliner include efficient cruise at Mach 2 when supersonic flight is unrestricted, and a low-boom cruise at Mach 1.6 over land.

In October 2008, six industry teams each received an 18-month research contract, worth about $2.0 million, from NASA for N+3 concept studies. Two of the six contracts involve supersonic concepts. One went to a team led by Boeing Phantom Works, and the other was awarded to a team led by Lockheed Martin. The Boeing Phantom Works-led group includes General Electric, Georgia Tech, M4 Engineering, Pratt & Whitney, Rolls-Royce, and Wyle Laboratories. The Lockheed Martin-led group includes General Electric, Purdue University, and Wyle. Following completion of the six studies, NASA intends to select two or three of the concepts for further evaluation.

Japanese Silent Supersonic Project

The Japan Aerospace Exploration Agency (JAXA) has launched a project called the Silent Supersonic Technology Demonstrator (S3TD) program. The aim of the program is to develop technologies to produce a sonic boom half that of the Concorde. NASA is participating in the effort.

The S3TD project involves the manufacture and testing of an unmanned, single-engine flight vehicle that is to be 13.2 meters (43.3 ft) long and weigh approximately 4,000 kilograms (8,818 lb). Initial flight is planned to occur by 2014 at the earliest.

The JAXA research is currently concentrating on studies into a concept for a twin-engine, 30-50 seat airliner. Eventually, the research is expected to move on to 100-seat and 200-300 seat aircraft concepts.

European Programs

The Long-Term Advanced Propulsion Concepts and Technologies (LAPCAT) program is conducted under the auspices of the European Space Agency (ESA) and is partly funded by the European Union (EU). It involves research into a possible hypersonic civil transport that would be capable of flying from Brussels to Sydney in two to four hours.

The initial phase of the LAPCAT program ended in April 2008, after three years of work. A EUR10 million ($14.9 million) second phase, dubbed LAPCAT II, began in October 2008 and is scheduled to last for four years. LAPCAT II involves further study into concepts for hydrogen-fueled Mach 5 and Mach 8 transports that had evolved in the first phase of the program.

Participants in the LAPCAT effort include EADS, Snecma, the British firm Reaction Engines, and a number of research institutes and universities. As part of the project, Reaction Engines has proposed a concept for a 300-passenger, Mach 5 transport.

Bizjet First?

As used throughout this report, the term High Speed Commercial Transport denotes a supersonic large commercial transport aircraft intended for future use in scheduled airline service. Such an aircraft would in essence be a successor to the no-longer-in-service Concorde.

Though interest in, and research activity regarding, an HSCT has picked up considerably in the past couple of years, there is still a long way to go before such an aircraft actually enters airline service. A number of obstacles need to be overcome, especially the sonic boom issue. Due to sonic booms, the Concorde was not permitted to fly supersonically over land. If a future HSCT is also banned from engaging in supersonic flight over land, the market for it will be quite limited. Other issues that could pose obstacles to HSCT operation include airport noise and high-altitude emissions.

In any event, at the present time, airlines generally do not place much of a priority on high speed when it comes to selecting aircraft for their fleets. Boeing found this out a few years ago when it floated its ill-fated concept for the Sonic Cruiser, a high-subsonic-speed airliner. At least for now, the potential HSCT market may not be large enough to justify the substantial investment that would be required to develop and produce such an aircraft, even should overland supersonic flight eventually be allowed.

It is quite possible that a supersonic business jet (SSBJ) could enter service ahead of a new 100+ seat supersonic airliner. A number of companies have proposed various designs for an SSBJ, while others are conducting research into such an aircraft.

Indeed, development of an SSBJ might serve as a stepping stone to development of an HSCT. The European High-Speed Aircraft (HISAC) research program has been studying concepts for a small (8-20 passengers) supersonic business/civil transport. HISAC participants include organizations such as Alenia, Dassault, Rolls-Royce, Snecma, and Sukhoi. A number of HISAC researchers believe that a future small supersonic jet could pave the way to a larger supersonic airliner.

Ten-Year Outlook

No HSCT prototype or production aircraft are forecast to be built during the next 10 years.

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