LINKÖPING UNIVERSITY

Concorde 2.0: Ongoing supersonic transportation projects

Alexander Brohmé, Martin Kammeby, Emma Stenberg and *Islam Abdullayev*
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1 Supersonic Airliners of Today

Since the retirement of the Concorde back in 2003 there has been no civilian supersonic airliners in operation. This is however about to change as several companies are working on new supersonic aircraft designs. There are four major projects in the works. These are Spike Aerospace, Aerion Supersonic in cooperation with Lockheed Martin, Boom Technology and NASA in cooperation with Lockheed Martin. [1] [4]

Each of these projects are facing some problems in the development of a new supersonic aircraft. At supersonic speeds the fuselage and the wings have to be narrower at the same time as these parts are under higher stresses and temperatures which causes difficulties in production. The fuselage also has to be stronger because of high pressure difference between cabin and atmosphere due to high altitudes. Another problem the supersonic aircrafts has to face are the international regulations, making flights at supersonic speeds above land prohibited. The regulations are in place because of the sonic boom that's created when an aircraft flies faster than the speed of sound.

2 Spike Aerospace

Spike Aerospace was founded in 2013 making it a relative young company and their primary focus is to reduce effect of sonic boom. Business idea of the company is to build a quiet supersonic airplane the Spike S-512 that will carry maximum 18 passengers and will be able to operate at Mach 1.6 over cities, producing a muted background noise at level less than 75 PLdb. This in comparison to the sonic boom of the Concorde at 105 PLdB.
Concept design has long small body with long nose, wings look to be a combination of back swept wing with tailless delta in the middle (wing structure is similar to B2's wing). Engines are placed at the tail instead of horizontal tail wings. To make fuselage structure simplier and strong enough engineers decided to get rid of windows for passengers and instead have 4K cameras outside of the cabin and thin screen along side walls inside the cabin. The preliminary design is shown in figure 1. The company's airplanes are intended to start fly in the beginning of 2021 and start deliveries in 2023. [7]

Fig. 1 . Preliminary design of the Spike Aerospace supersonic aircraft.

3 Aerion Supersonic

Aerion is an American company founded in 2003 when an investor group led by Robert M. Bass bought the company ASSET group (Affordable Supersonic Executive Transport). The reason why ASSET was purchased was that the company had since the early 1990s performed research on supersonic natural laminar flow, a phenomenon making it possible to reduce drag and operation cost at velocities above the speed of sound, and acquired enough information about it to become one of the world leading companies at the subject.

Aerion's current design of a supersonic aircraft is the AS2 and is shown in figure 2. It was announced in 2014 and is an executive jet aircraft able to carry up to 11 passengers, with the goal to reach cruise speeds of Mach 1.4 over water and Mach 0.95 over land. The company is however working with authorities in the US and Europe to certify the aircraft for speeds up to 1.2 Mach over land, since in right weather conditions it is possible to fly at such speeds without creating a disruptive shock wave. In its current state the aircraft has three turbo fan engines, one situated under the vertical stabilizer and one under each wing. It has short

wings in order to reduce parasite drag and slightly resembles Lockheed Martin's F-104 Starfighter.

During May of 2017 the company started a collaboration with GE Aviation with the goal to design a new supersonic engine for the AS2, and in December of the same year Aerion invited Lockheed Martin to join forces on the AS2 project. The aircraft is scheduled to make its first flight in 2023 and entering full service by 2025. [1]

Fig. 2 . Preliminary design of the Aerion and Lockheed Martin supersonic aircraft.

4 Boom Technology

Boom Technology is an American start up company founded in Denver 2014. Since early 2016, Boom Technology has participated in the top ranked start up incubator program by Y-combinator and has secured investments from Japan Airlines, Virgin Group and several venture funds. What Boom Technology is trying to achieve is a way of flying at 2.2 Mach with as many as 55 passengers and reducing traveling time by half during flights over sea, for example between New York and London. This will be done by combining materials and technologies proven on other passenger aircraft's into a revolutionary design. The aerodynamics of the aircraft have been refined through extensive wind tunnel testing with the aim of generating more lift for less drag to improve fuel efficiency and allowing supersonic travel at lower fares. The propulsion system is a setup of three medium-bypass turbojet engines with no after burning possibilities. [2]

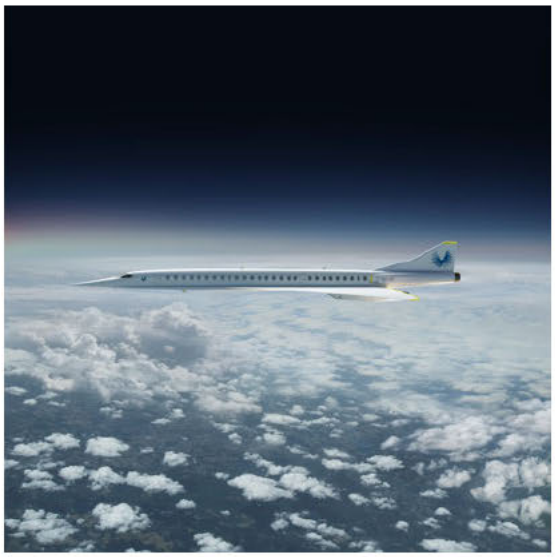

Fig. 3 . Preliminary design of the Boom Technology supersonic aircraft.

5 Lockheed Martin and NASA

Since the year of 2016 NASA has worked with defense giant Lockheed Martin on a supersonic aircraft, called X-59 Que-SST. The aircraft's design is shown in figure 4. One of their biggest obstacles is the sonic boom, mentioned in section 1. Their goal is to reduce the sonic boom to a sonic thump. The idea is to design the airplane so that the shock waves are aliened in such a way that the pressure gradually builds up, producing a thumb at only 75 PLdB. [6] [3]

NASA is aiming for the maiden flight in 2021. Since flying supersonic over land isn't allowed due to the regulations mentioned in section 1, NASA plans to make community overflights and gather response data from the communities. The hope is that the data will make supersonic flights legal over land and thus creating a whole new market. [5]

Fig. 4 . Preliminary design of the NASA and Lockheed Martin supersonic aircraft.

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