

MINES PARISTECH

MAIN ISSUES OF SUPERSONIC FLIGHT

- Which problems occur when breaking the sound barrier? (vibrations of the aircraft, heat & aerodynamical issues)

The main problem is the introduction of wave drag, which significantly reduces L/D relative to a subsonic aircraft. Heat is not a big issue until about M1.8.

- What are the technical solutions for these problems Aerion is developing?

Aerion's straight, thin wing is the solution to the drag problem. Traditional swept-wing designs try to minimize wave drag. This necessarily causes the boundary layer on the wing to be turbulent, maximizing skin friction (viscous) drag. The Aerion wing achieves natural laminar flow over most of its surface, minimizing viscous drag. Keeping the wing thin minimizes the increase in wave drag, resulting in about a 20% drag reduction for the aircraft.

- Gulfstream is currently experimenting a telescopic nose; what changes in the shape of the aircraft are you working on? **None** Why did you choose this solution? **Variable geometry adds weight, complexity, and makes it more difficult to achieve civil certification.**

- Some manufacturers are experimenting new techniques to reduce the effect of the sonic boom on the ground, what about Aerion ?

While Aerion is staying informed of boom-shaping technology, we are not incorporating them in our current design (see answer below)

- What are the consequences of these solutions? How can they affect the passengers? Are they economically sustainable?

Boom minimization technology consists of changing the shape of the pressure wave from an "N-wave" to something more like a sine wave. This makes the pressure variations much less audible to people outdoors. This shaping is achieved by shaping the aircraft in certain ways. There are several problems:

- a "low boom" shape is never a "minimum drag" shape. Thus, "quiet" designs are necessarily larger & burn more fuel.
- The pressure wave can still rattle buildings
- The shaping of the boom only Works at the design cruise point. There is actually a louder « focused boom » that is created during acceleration.

That is why Aerion does not rely on boom shaping. Instead we use a phenomenon called « Mach cutoff » to fly up to Mach 1.15 in standard conditions without having the boom reach the ground. We would cruise at full M1.5 – 1.6 over the ocean and uninhabited areas. Also note that boom is a function of weight, and current supersonic bizjet designs are about ¼ the weight of Concorde, so our boom is naturally much less.

LEGISLATION

- What is your position concerning the actual legislation? [The Aerion aircraft can operate under the existing legislation.](#) Are you working along with the U.S. government (and other governments as well) to change the law, or are you trying to find a loophole in the law? [We are working with the FAA and ICAO as they develop standards. This process will take many years. There are no loopholes.](#)

- Do you think the law will evolve? In which way?

[Ultimately, any change in the law is a political decision. It is difficult to predict what will happen.](#)

- To what extent the current legislation (and all the possible evolutions) can influence your work/research?

[We chose to design the aircraft to work with the current law, rather than wait for the sonic boom issues to be solved and the law changed.](#)

MARKETING

- Is there a market for supersonic aircrafts? Can you give us an estimation of the size of that market?

[Several studies have found a market of approximately 300 aircraft over 10 years. We think that is conservative.](#)

- Considering the technologies used today, and the technologies you plan to develop, do you think there will be a market for “regular businessmen” (eg : the Concorde) ?

[Yes. The existence of “all business class” flights on current airliners prove that.](#)

- Is it possible / sustainable to release a supersonic aircraft these days?

[Yes. There is quite a lot of interest even now, and the investment situation will change in the 5 or so years it will take to develop & certify the airplane.](#)

- If it is not, considering the current situation (especially investments & research), when will it be possible?

[\(I am so sorry – I don’t have an answer from him. He must have inadvertently missed it. If you are looking for an entry into service date, it is currently slated for 2015/2016.\)](#)