Dynamics, Lockheed, and Rockwell) have been given $35 million each to come up with a broad design for the airframe. By 1985, having spent a total $5,000 million, the NASP technologies will have been validated.

A simple ramjet would do the job for the Orient Express, though the Aerospaceplane would need something more sophisticated. So there is a divergence of needs, possibly, between the two types. The trouble with ramjets is the familiar one of dead weight: until the aircraft is travelling fast the ramjet will not work at all, and it will not work efficiently until approaching Mach 2. So to get to Mach 5 conventional engines would have to be used in the early acceleration phase and then shut down, becoming dead weight. Airturboramjets have not yet been developed which show signs of hope for efficiency in the future. But at least, by staying below Mach 7, a ramjet avoids the need for extensive internal and external variable geometry.

The fuel would be liquid methane, according to Schaufele, who explains that conventional hydrocarbons are effective fuels only up to Mach 3.5. Liquid methane (natural gas) takes a smaller storage volume than liquid hydrogen, the former being effective up to Mach 6, and the latter beyond that speed. So there is a second possible fundamental difference between the Orient Express as seen by Douglas and the Aerospaceplane.

Schaufele pinpoints other key technology development areas required by both the civil supersonic machine and the Aerospaceplane as being primarily in materials required, which he describes as high-strength, high-temperature, low-weight. Among other materials development areas in which McDonnell Douglas is currently working is rapid solidification rate (RSR) powder metallurgy processes for producing high-temperature-resistant titanium alloy with boron reinforcement. Test results at the McDonnell Douglas Research Laboratory so far indicate that RST (rapid solidification technology) titanium alloy can have the same strength at 1,400°F as current titanium alloys have at room temperature.

The whole programme would still be in the realm of fantasy were it not for the advent of supercomputers, which can extrapolate fluid dynamics data to calculate optimum powerplant and airframe configurations.

Thermal management of the vehicle would still be necessary. Just as Aérospatiale and British Aerospace found a nest of problems under each innocent-looking stone turned over during Concorde research, so will these American pioneers. The point here is that research for NASP and the Orient Express will be phenomenally expensive, so unless most of the research bill is picked up by the Department of Defence and NASA it will never be a viable commercial proposition. Even when the research costs are written off, it is impossible to predict at this stage whether or not the cost per copy of producing the machine would leave it in the affordable range for large but financially realistic airlines.

It would be easy to look at this formidable task, and the size of the costs involved, and write-off the civil hypersonic craft. But before doing so, a look at what it could achieve might cause a double-take.

All of the parameters for the aircraft so far mentioned—Mach 5, 100,000ft cruising altitude, methane fuel—have not been drawn out of a hat. They were chosen as being the parameters which would sell a supersonic airliner by providing long range (Concorde’s fundamental failure was its poor range) at very high speed, yet would keep the aircraft within the realms of commercial viability by not trying to chase the goals set for NASP. The Orient Express goals, according to Schaufele, should be: range, 6,500 n.m. (Los Angeles-Sydney); speed, Mach 5; and passenger capacity 305 mixed-class.

McDonnell Douglas reckons that early next century there will be a market of 60 million passengers a year in the sectors which would be served by the Orient Express, yet only 205 out of the type would need to be produced to service this market, assuming a 65 per cent load factor. Mach 5 means Los Angeles-Sydney in 2hr 20 min. It also means that the aircraft could carry out at least two complete round trips a day even on that route, and that crews never need stay in a hotel again, except when the aircraft goes unserviceable. They can be home every night, wherever in the world they may be.

If the market assessment is correct there is good news and bad news. The good news is that an airline would need only one or two Orient Express types to cover the world. The bad news is that, since the manufacturer would need to make only small numbers of them, the cost, already high anyway because of the nature of the machine, will be even higher.

The hypersonic airliner will come. But for all the American confidence as expressed by Schaufele in his comment about NASP, it will be surprising—nay, amazing—if the Orient Express turns out to be all-American.

**Upgraded airliners**

The launch of McDonnell Douglas’ “advanced wide cabin trijet”, the MD-11, will take place as soon as the company notches up a minimum 20 sales divided among customers at home and abroad. It looked, during the run-up to Farnborough, as though it was on its way toward that figure, but Douglas would not then give names or numbers. The plan is to have the MD-11 in service by 1989.

Late in June, Douglas announced that 700hr windtunnel testing had proven its predictions for the modifications to the DC-10 which result in the MD-11. Fuel burn will be reduced by 7 per cent compared with the smaller, earlier machine.

Technology being applied to achieve the improvement consists of aerodynamic modification and the fitting of the latest big turbosfans—CF6-80C2 or PW4000. The most visible change will be new winglets, but the tailplane will be smaller, lighter, and will contain fuel to give extra range and computerised e.g. control. Weight saving is achieved where practicable by the use of “advanced metalics”, the introduction of composites, and the use of carbon brakes.

The flightdeck goes all-digital and has a two-man crew.

So there is nothing pioneering about the MD-11. Like the Boeing 747-400 it uses state-of-the-art modifications to a proven airframe to produce high-value efficiency.

Boeing’s first 747-400s enter service in 1989. The company originally hoped to be able to use aluminium-lithium (Al Li) extensively in the type to reduce weight, but instead is using the alloy which it has used in its 757s and 767s. The latter advanced aluminium alloy has never been used in 747s before. It is a little lighter and stronger than the original material, but does not bring the advances hoped for.