PATHFINDER
AIR POWER DEVELOPMENT CENTRE BULLETIN

Issue 49, July 2006

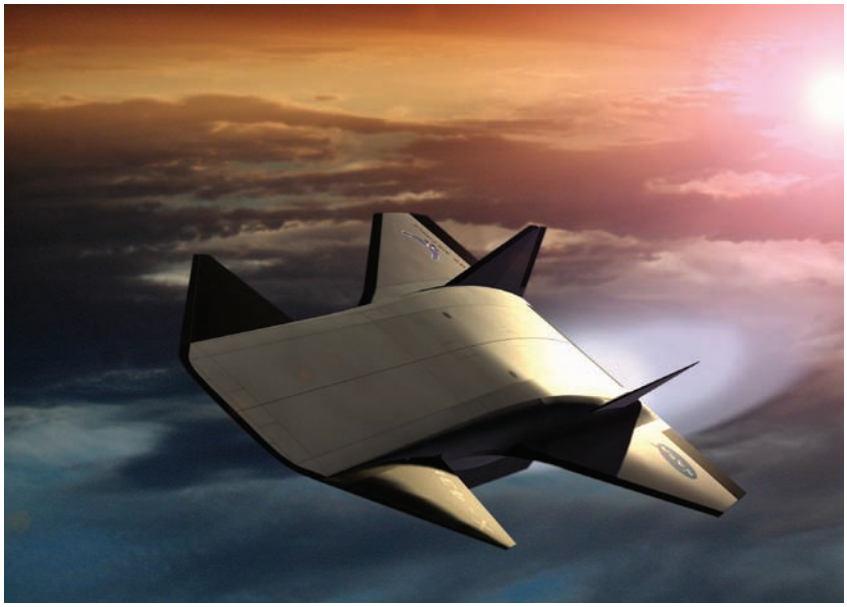
THE NEED FOR SPEED – FUTURE HYPERSONIC MILITARY SYSTEMS

Speed, as an inherent characteristic of air power, has arguably fired the imagination of more people—both in the military and public domains—than any other single aspect of military flight. However, since the early 1980s speed has experienced a hiatus as one of the core drivers of air power projection, overtaken instead by other enhancements such as stealth, agility, improved weapons, greater endurance and network-centricity. But speed may be on the verge of a significant resurgence. Imagine being able to launch a military strike anywhere on the surface of the earth in less than two hours. Unrealistic? If the ongoing development of hypersonic platforms, capable of operating at speeds of up to Mach 10—over 12,000 kilometres per hour—continues at its current pace then this might not be an unrealistic expectation for very long.

The hypersonic flight regime begins at Mach 5, and until recently remained the practical realm of solid- and liquid-fuelled rocket engines, such as the ones that propel modern day astronauts, satellites and other materiel into space. However, as the development of supersonic air-breathing jet engines (SCRAMJETs)—which create thrust by igniting fuel in a supersonic airflow—has matured in the US, Europe and Australia, there has been a renewed interest in creating practical and economical hypersonic military systems. Research into other hypersonic challenges related to high-temperature material design, fuel selection and aerodynamics is also beginning to yield results, all of which suggests that we might expect hypersonic platforms and weapons systems in the very near future—some of them as early as next decade.

Hypersonic systems are likely to be divided into two distinct divisions: weapons and vehicles. Hypersonic weapons will be the first deliverable military systems to operate in excess of Mach 5. Developmental work in the US into hypersonic cruise missiles launched from traditional airborne and surface-based platforms is well advanced. India, in conjunction with Russia, has recently delivered to service the BrahMos cruise missile capable of speeds over Mach 3, and continue to work on next-step hypersonic technology. Russia is now renowned for its SCRAMJET development work and delivery to service of operational hypersonic cruise missiles seems to be very close—potentially by 2012–2015.

Hypersonic vehicles, which will be reusable and used for traditional air power roles, such as strike and perhaps transport, are likely to take more time to mature. The challenges to be overcome are greater than for a weapon system. One of the hurdles faced is the fact that a SCRAMJET propulsion system will not operate at low-supersonic or subsonic speeds, requiring a different form of propulsion to bring the vehicle to a high enough speed for the SCRAMJET to be engaged. Another challenge, one not faced by a fire-and-forget cruise missile, is that the aerodynamics best suited to hypersonic flight are not ideal for take-off and landing, both of which are vital to a reusable vehicle. These challenges are not insurmountable, and programs like the US Force Application and Launch from the Continental United States (FALCON) are planned to deliver both manned and unmanned operationalised platforms around 2030–2035.



An artist's impression of the USAF X43-B hypersonic vehicle in flight (courtesy NASA)

Furthermore, an integral consideration in the ongoing development of hypersonic systems is the requirement for a capability to deliver a payload to space using a combination of rocket and SCRAMJET propulsion. This will not only significantly reduce the cost of lifting communication nodes and other payloads to space, but will allow for the responsive placement in orbit of military systems in significantly shorter timeframes than is currently possible.

Once in service, both hypersonic weapon systems and reusable vehicles will make a significant impact on all power projection capabilities of a nation. The speed that this technology will afford will fundamentally reshape our understanding of air power's reach, responsiveness, penetration and survivability. Perhaps the most immediate effect will be seen in the area of strike, where long-range hypersonic systems will be able to reach anywhere on the globe in less than two hours. Once within reach of a target, a hypersonic weapon system is unlikely to be stopped by traditional ground-based air defence (GBAD), which will not be able to detect the weapon in time or engage it. As an example, a sea-skimming hypersonic missile travelling at Mach 5 will break a ship's radar horizon in a little over three seconds before impact.

Other hypersonic capabilities may follow, but perhaps in a more extended timeframe. Hypersonic airlift, for example, given the high cost involved may not become a viable proposition at all unless a pressing need is identified to move troops or equipment significantly faster than is currently possible.

From an Australian perspective, there are two imperatives related to the introduction of hypersonic aerospace technologies. Firstly, we need to determine what level of offensive capability the nation requires. Almost certainly, large-scale hypersonic vehicles are going to be prohibitively expensive and would be unlikely to fit within Australia's resource constraints without a significant strategic imperative. Hypersonic cruise missiles, which would perhaps be suitable for use with the Joint Strike Fighter (JSF) or future Uninhabited Combat Air Vehicles (UCAV), might be a much more viable option. Such a capability would offer considerable penetration, reach and lethality advantages over current stand-off weapons, and may be one that Australia could easily integrate into legacy and next-generation systems for enhanced effect.

Secondly, it must be determined how to build a capability to defend against hypersonic systems. There will be a need to protect the joint force either on land or at sea from the threat posed by hypersonic weapons. Neither JSF in its current planned configuration nor the new Air Warfare Destroyer (AWD) will be able to destroy a hypersonic cruise missile in flight. Only a zero-time-of-flight system such as a Directed Energy (DE) weapon will offer any substantial guarantee of success, and even then only if backed up by a comprehensive suite of sensor and other targeting support.

Hypersonic aerospace technology will not necessarily become an integral part of the day to day fabric of military operations in the same way that we envision network-enabled warfare systems. However, one can say with a degree of certainty that hypersonic military systems will almost certainly begin to appear in the middle of the next decade, and will have a significant impact on how we use air power. These systems can be expected to mature over the period to 2035 into a radically new capability—one that will add a completely new dimension to the reach, speed, penetration and survivability of airpower. Speed, it appears, is making a very big comeback.

- ✓ Hypersonic military systems will begin to appear from around 2015.
- ✓ Hypersonic platforms and weapons will enhance speed, penetration, reach, survivability and responsiveness.
- ✓ Defences against hypersonic systems will be problematic.

First of all, you need speed. Manoeuvrability is good, but speed is the most important thing. Next, acceleration, which is important… A good mix of these, and a stable platform for your weapons.

– Adolf Galland

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