

# Hypersonics

## A GAME-CHANGING TECHNOLOGY



### WHAT IS HYPERSONICS

Hypersonic flight refers to speeds that are generally defined as greater than Mach 5, or approximately 3,400 mph. Vehicles flying at this speed operate at extremely high temperature as the friction of air against the surface of the vehicle causes heating to occur.

Current interest in hypersonics is focused on so-called *lifting bodies*, slender shaped air vehicles that can slice through the air with minimal drag and use their bodies rather than wings to stay aloft and maneuver as they fly for sustained periods in the atmosphere. These high-lift hypersonic technologies could enable high-speed aircraft, but most immediately, will be used as high-speed maneuvering weapons for either tactical or strategic applications.

### APPLICATIONS/TECHNOLOGY

Hypersonic vehicles that operate for long periods in the atmosphere will generally fall into one of two distinct classes:

- 1) Boost/glide vehicles that are released at a high Mach number in the atmosphere after being rocket launched and which have the ability to glide and maneuver to a target.
- 2) Air-breathing vehicles that are propelled by their own engines in order to sustain hypersonic flight speeds and which have maneuvering capability during flight.



### THE THREAT

The United States has long been the clear global leader in hypersonic research, development, and testing. That lead has now diminished, if not been lost. While the United States was pursuing hypersonic technologies intermittently, starting and stopping programs and, in so doing, failing to achieve continual progress, other nations have steadily made investments that have enabled them to reach parity or even to surpass us, while largely building upon U.S. government-funded R&D work. This is consequential to our national security because hypersonic vehicles can be effective weapons that are difficult to defend against due to their speed and maneuverability. Hypersonic weapons can be launched from the land, air, and sea where they are used to rapidly attack targets hundreds to thousands of miles away in a matter of minutes. Hypersonic missiles will be difficult to engage and offer little time for an effective defensive response. Some reports indicate that our competitors, including China and Russia, have deployed operational hypersonic weapons. In response to these developments, the United States has initiated a number of programs to rapidly field hypersonic weapons and defensive systems.

### CONTINUING CHALLENGES

Beyond the ongoing activities, there are remaining challenges to hypersonic system development in the United States:

- › The current investment in systems to defend against hypersonic weapons is a small fraction of the resources expended on offense weapons development, putting at risk our ability to keep pace with the weapons that will be fielded by other nations.
- › While resources are being expended on rapid fielding of first-generation hypersonic weapons, support of fundamental S&T is needed to yield second-generation capabilities.
- › Hypersonic system work requires unique skills, and past university programs in these areas were dropped due to lack of national interest, reducing workforce entrants. Strengthening and rebuilding our workforce with expertise in all areas of hypersonic technology, from basic research to design and testing will fill these gaps.
- › Current U.S. hypersonic ground test facilities are few and decades old, with limited test capacity, workforce, and equipment maintenance challenges that can only be addressed through national investments.



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