Research Accelerates the Design of Scramjets

Project Purpose: *This research studies the physics of a flow path during high speed flight utilizing scramjets as the mode of propulsion in air-breathing vehicles.*

The Need for Speed

Hypersonic flight, between Mach 5.0 and 10.0 (or 3,820 and 7,640 miles per hour), offers many challenges. Understanding the complex physics of high speed flight could result in use of sustained hypersonic speeds as a mode of propulsion. The goal of this DoD Challenge project is to analyze the unknown physics in high speed propulsion, including inlet distortion, fuel-air mixing, ignition, and thrust generation. HPC research, in conjunction with modeling and simulation, as well as flight and ground tests, reduces the expenditure of resources. Thus, many other projects have been greatly impacted such as: JAWS, HIFIRE, X-51, and FACET.

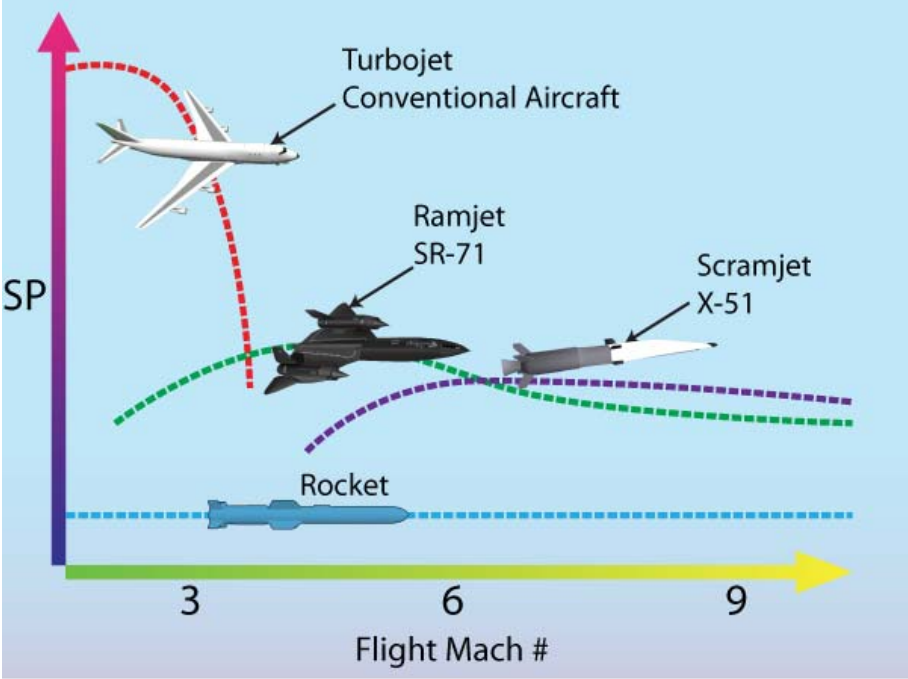
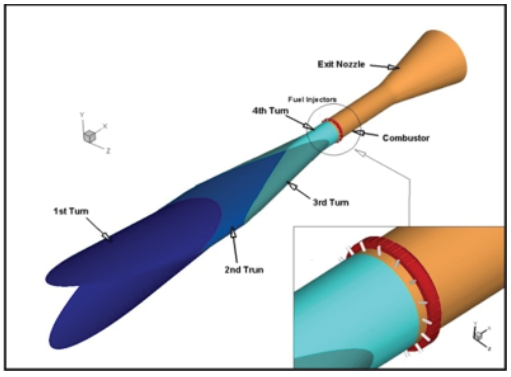


Illustration shows the relationship of Mach and Specific impulse (SP), used in jet engines. The higher the SP, the less propellant is needed to gain a given amount of momentum.



Visual analysis of a circular combustor during design studies exploring optimal inlet configuration, fuel and air mix.

IMPACTS:

- ***Offers new defensive and offensive options for on-demand delivery of air vehicles to penetrate hostile territory and to deliver munitions directly at subterranean targets***
- ***Provides rapid deployment of multi-missions and reduces the cost of delivery of space payloads***
- ***Provides high-fidelity studies to multiple agencies***

Dr. Datta V. Gaitonde, AFRL Computer Sciences Branch Air Vehicles Directorate, AFRL Wright-Patterson AFB, OH, is the investigator of this Challenge project. This project has performed many successful runs using HPC codes: FDL3DI, AVUS, GPACT (CHSSI), GASP, UFS, and CFD++.

AFRL DSRC System Utilization: SGI Altix 4700 (HAWK) 1,600,000 hours and HP XC Cluster (FALCON) with 1,100,000 hours.

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