

# X-43D CONCEPTUAL DESIGN AND FEASIBILITY STUDY

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NASA's Next Generation Launch Technology (NGLT) Program, in conjunction with the office of the Director of Defense Research and Engineering (DDR&E), developed an integrated hypersonic technology demonstration roadmap. This roadmap is an integral part of the National Aerospace Initiative (NAI), a multi-year, multi-agency cooperative effort to invest in and develop, among other things, hypersonic technologies. This roadmap contains key ground and flight demonstrations required along the path to developing a reusable hypersonic space access system. One of the key flight demonstrations required for systems that will operate in the high Mach number regime is the X-43D. As currently conceived, the X-43D is a Mach 15 flight test vehicle that incorporates a hydrogen-fueled scramjet engine. The purpose of the X-43D is to gather high Mach number flight environment and engine operability information which is difficult, if not impossible, to gather on the ground. During 2003, the NGLT Future Hypersonic Flight Demonstration Office initiated a feasibility study on the X-43D. The objective of the study was to develop a baseline conceptual design, assess its performance, and identify the key technical issues. The study also produced a baseline program plan, schedule, and cost, along with a list of key programmatic risks.

## Nomenclature

<i>AETB</i>	= Alumina Enhanced Thermal Barrier
<i>AML</i>	= Adaptive Modeling Language
<i>GITU</i>	= GPS Integrated Tracking Unit
<i>GPS</i>	= Global Positioning System
<i>L.E.</i>	= leading edge
<i>psf</i>	= pounds per square foot (dynamic pressure)
<i>SLV</i>	= United States Air force, Reentry Systems Launch Program, Space Launch Vehicle
<i>TPS</i>	= thermal protection system
<i>T/M</i>	= telemetry

## I. Introduction

Research into air-breathing hypersonic and related technologies has been conducted by NASA and other agencies for over 50 years which included engine and airframe materials, propulsion physics, aerodynamics and aerothermodynamics, propulsion airframe integration (PAI), vehicle design and systems analysis. In the past 15 years alone, NASA and the Department of Defense (DOD) spent over \$3 billion to advance hypersonic technologies<sup>1</sup>. During the late 80's and early 90's, NASA focused on the National Aerospace Plane (NASP), as envisioned by President Reagan. NASP was to be the culmination of years of research in a prototype hypersonic vehicle. However, technology development and manufacturing issues increased program cost, and while significant research and advancements were made during NASP, no system was developed.

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