Flyer for X-30 NASP program ca. 1988. From Ken Stetson. Scanned SPS 10/2009.

National Aero-Space Plane: In Orbit

National Aeronautics and Space Administration

National Aero-Space Plane (NASP)

NASP is blazing a trail for a new era in the history of human flight. The goal of the NASP program is to create the technology for next-generation spacecraft that would operate much more like airplanes than today's rocket boosters. The payoff is not limited to space; technology from the NASP program also greatly benefits the nation's economy here on Earth.

National Team

The major partners in the NASP program form a true national team. NASA and the Department of Defense manage the effort through a Joint Program Office at Wright-Patterson AFB, Ohio. Five of the nation's largest aerospace companies have combined their technical expertise and their best ideas as members of a "National Contractor Team." General Dynamics, McDonnell Douglas and Rockwell International are developing the X-30's airframe. Pratt & Whitney and Rocketdyne are responsible for NASP engine technology. Government research laboratories are major contributors of the emerging technologies.

NASP: A Step-by-Step Program

From 1984 to 1985, NASA, the Defense Department and industry studied several NASP-like concepts that would use powerful hydrogen fuel, could take off and land on runways and would fly into Earth orbit using airbreathing engines. The current phase of the NASP program, which began in 1986, is developing advanced technologies in propulsion, computer modeling, materials and structures. This work will support a decision to build and fly the X-30, a flight research vehicle essential to all the key aspects of these technologies.

That decision is expected to lead to the X-30's first flight around the year 2000. As the test program progresses, the X-30 will reach ever-higher speeds and altitudes in a series of "envelope expansion" flights that will climax with a mission to orbit.

Technology Challenges

To meet its goals, the X-30 NASP program is making breakthroughs in several key technologies:

- **Propulsion:** The X-30's supersonic combustion ramjet (scramjet) engines will burn a mix of onboard hydrogen fuel and oxygen scooped up from the atmosphere. Researchers are testing advanced engine components and studying the chemistry of air-fuel mixtures across an unprecedented range of speeds and altitudes. The NASP program has also pioneered the use of "slush" hydrogen fuel—a mixture of liquid and solid hydrogen—that is denser and more efficient than traditional liquid hydrogen.
- **Materials and Structures:** Much of the X-30 will be made of new titanium-based alloys that are strong, tough and heat-resistant. The NASP program also has developed special coatings to protect the alloys from reacting with the aero-space plane's hydrogen fuel. Other innovative coatings will guard against oxidation of the special carbon-carbon panels that will protect some of the hottest areas on the X-30's airframe.
- **Aerodynamics:** The X-30's "lifting body" shape will create lift as it flies through the air. The front part of the fuselage will compress and feed air to the scramjets; the afterbody will work as an exhaust nozzle to increase thrust. To model these very complex airflows at speeds up to 17,500 mph, the NASP program has pushed back the frontiers of computer-based study techniques called computational fluid dynamics (CFD), producing benefits to aerospace engineering and design methods.

Why the X-30?

The NASP program has enormous benefits for the nation. Even now, the advances coming out of the effort are helping the U.S. maintain competitiveness in world aerospace and related markets. Ultimately, NASP will lead to a vast improvement in space-launch capabilities through flexible, routine and efficient access to orbit.

Just as important, the NASP program is part of our national vision of the future—an invigorating challenge to our pioneering spirit and exactly the type of high-payoff effort needed to maintain our international leadership in high technology.