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Folder Title:
[National Aero-Space Plane] [2 of 4] [1990]

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FOREIGN CAPABILITIES TO DEVELOP HIGH SPEED AIRCRAFT: TECHNOLOGY REQUIREMENTS VS. MACH NUMBER

OCTOBER 3, 1990

OVERVIEW

STUDY OBJECTIVE:

ASSESS FOREIGN COMPETITIVENESS FOR
HIGH SPEED COMMERCIAL TRANSPORT

- TECHNOLOGICAL COMPETITIVENESS
- ECONOMIC VIABILITY

TODAY'S MEETING:

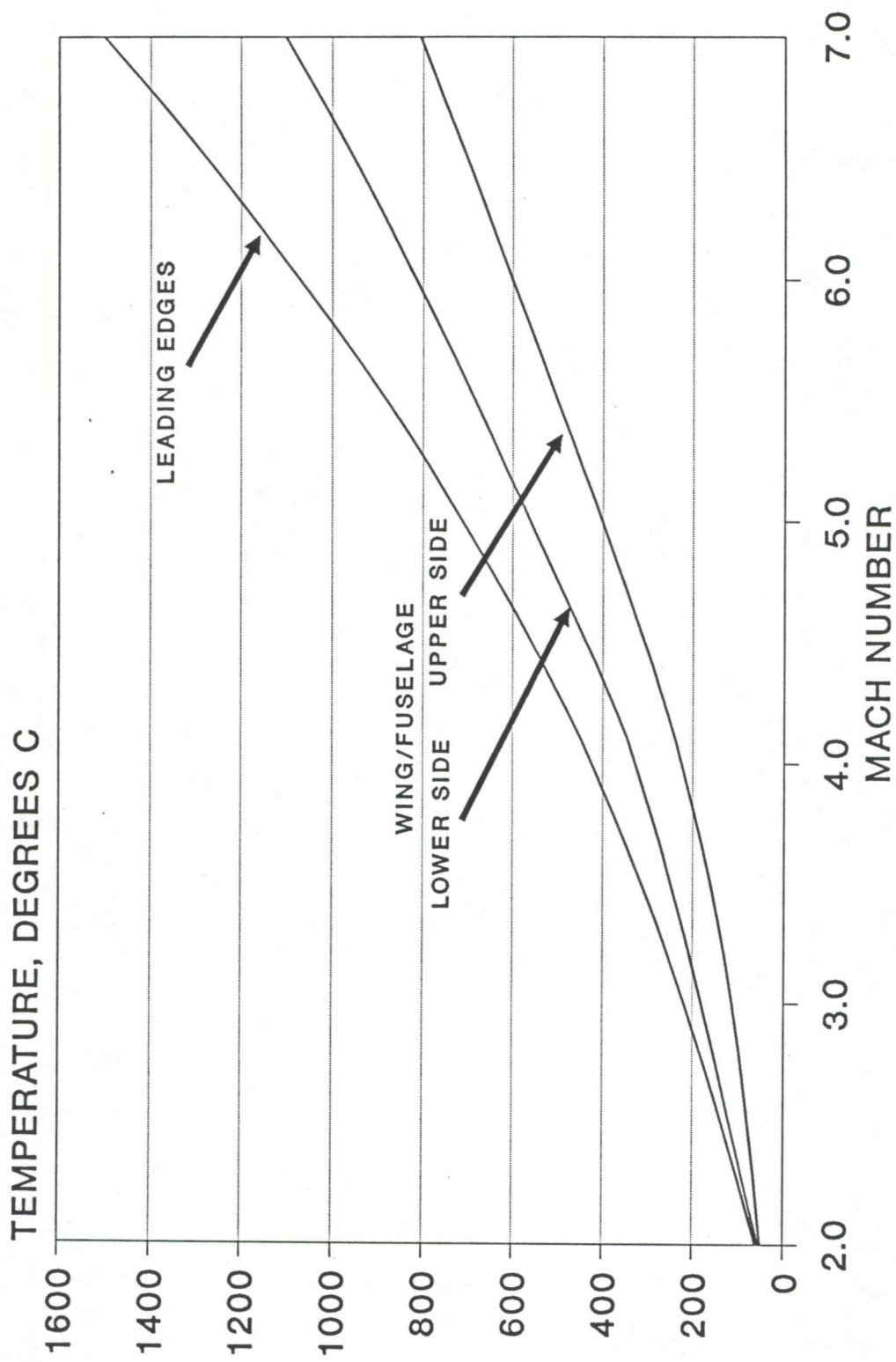
ASSESS TECHNOLOGY REQUIREMENTS FOR
DIFFERENT FLIGHT REGIMES
(MACH 2 - MACH 7)

- STRUCTURAL MATERIALS
- PROPULSION CYCLES, FUELS
- PROPULSION MATERIALS
- AERODYNAMICS
- TEST FACILITIES
- ENVIRONMENTAL ISSUES

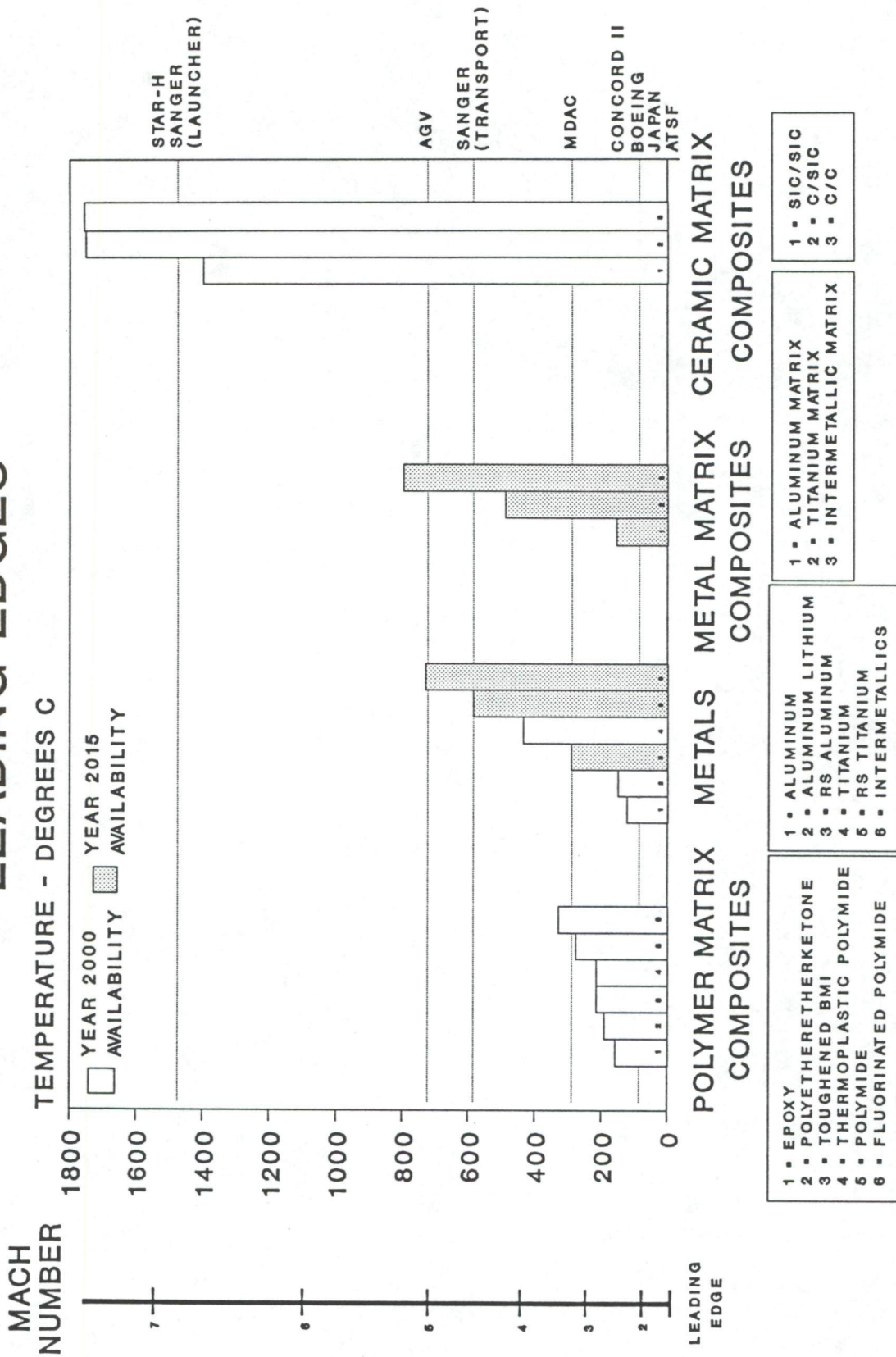
REPRESENTATIVE TECHNOLOGY ISSUES ABOVE MACH 7

- SRAMJET REQUIRED
- ACTIVE COOLING OF ENGINE
- TITANIUM ALUMINIDE TECHNOLOGY CRITICAL
- LEADING EDGES, POSSIBLY OTHER COMPONENTS REQUIRE COATINGS
- ADVANCED ATTITUDE CONTROL TECHNOLOGIES REQUIRED
- ENGINE TRANSITION BECOMES MAJOR CONCERN
- DIFFICULT TO IDENTIFY FLOW TRANSITION POINT
- REACTION-RATE CHEMISTRY ENCOUNTERED IN FLOW
- FLOW CAN NO LONGER BE CONSIDERED A PERFECT GAS
- NEW, HIGH TEMPERATURE SENSORS REQUIRED
- ADVANCED ACTUATION SYSTEMS NEEDED
- HIGH RELIABILITY, VERY FAST ON-BOARD PROCESSORS NEEDED
- TESTING FACILITIES FOR BOTH AERODYNAMICS AND PROPULSION SEVERELY LIMITED

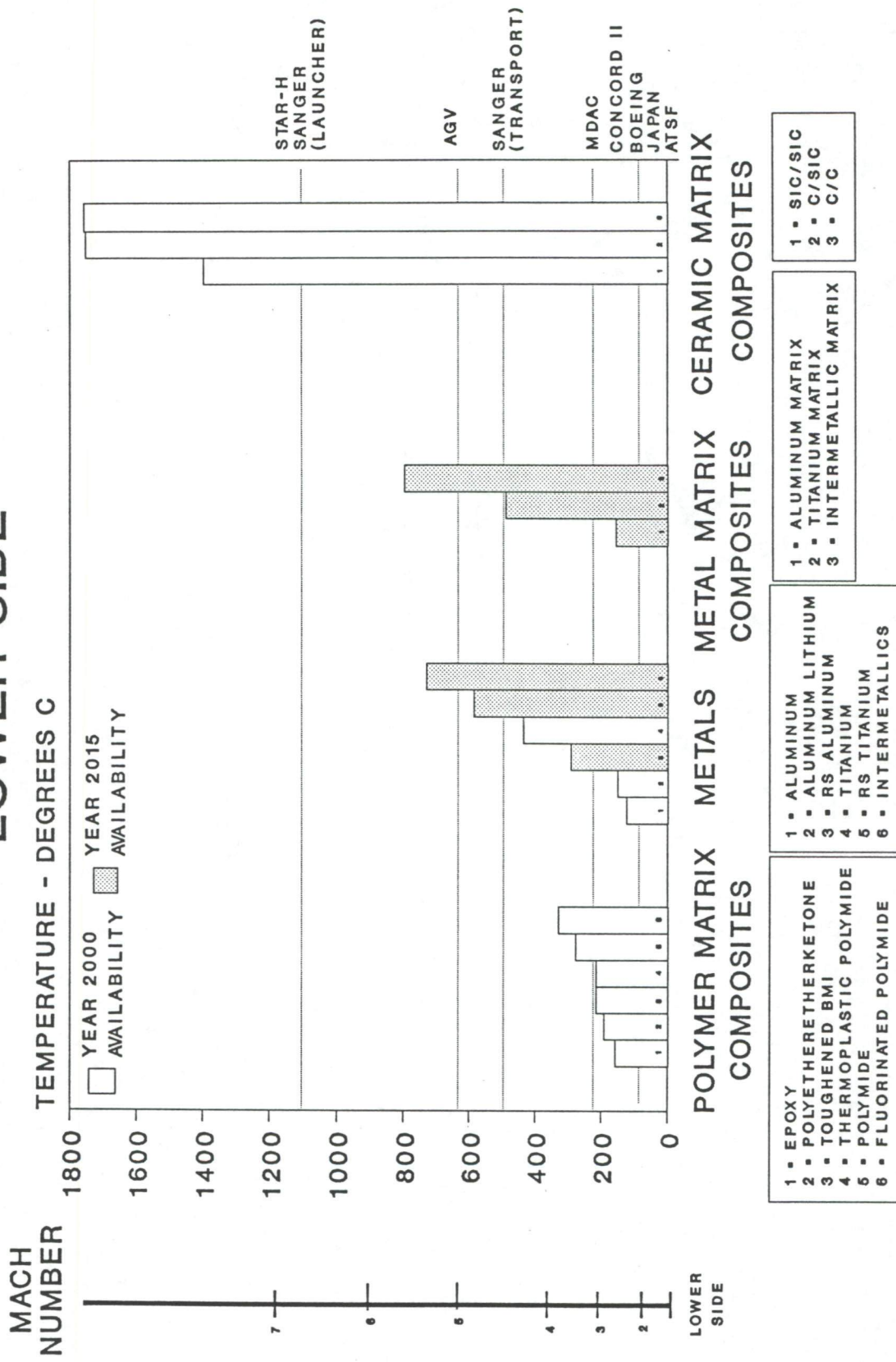
REPRESENTATIVE TEMPERATURE/ MACH NUMBER RELATIONSHIP



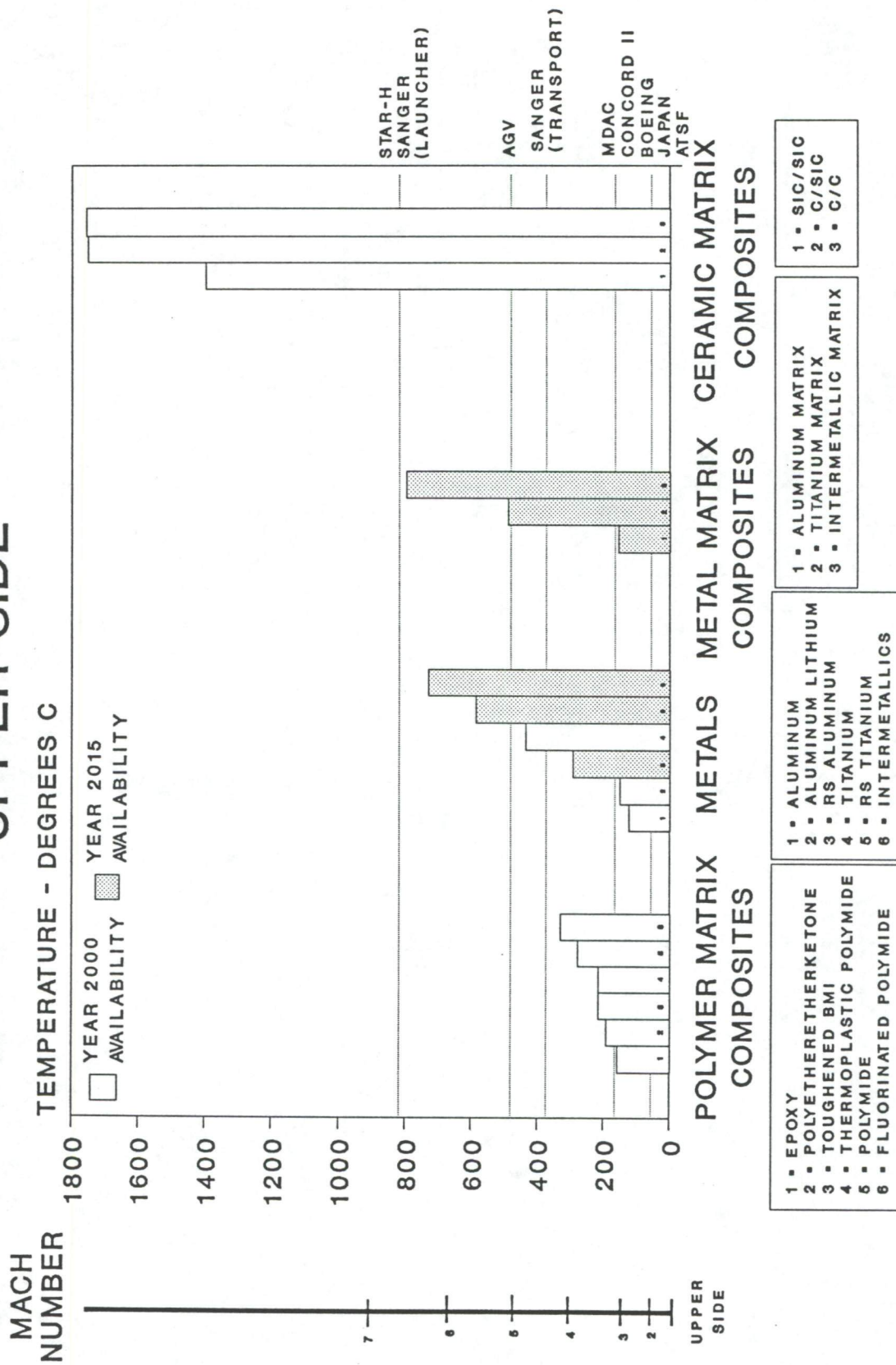
STRUCTURAL MATERIALS CANDIDATES: LEADING EDGES



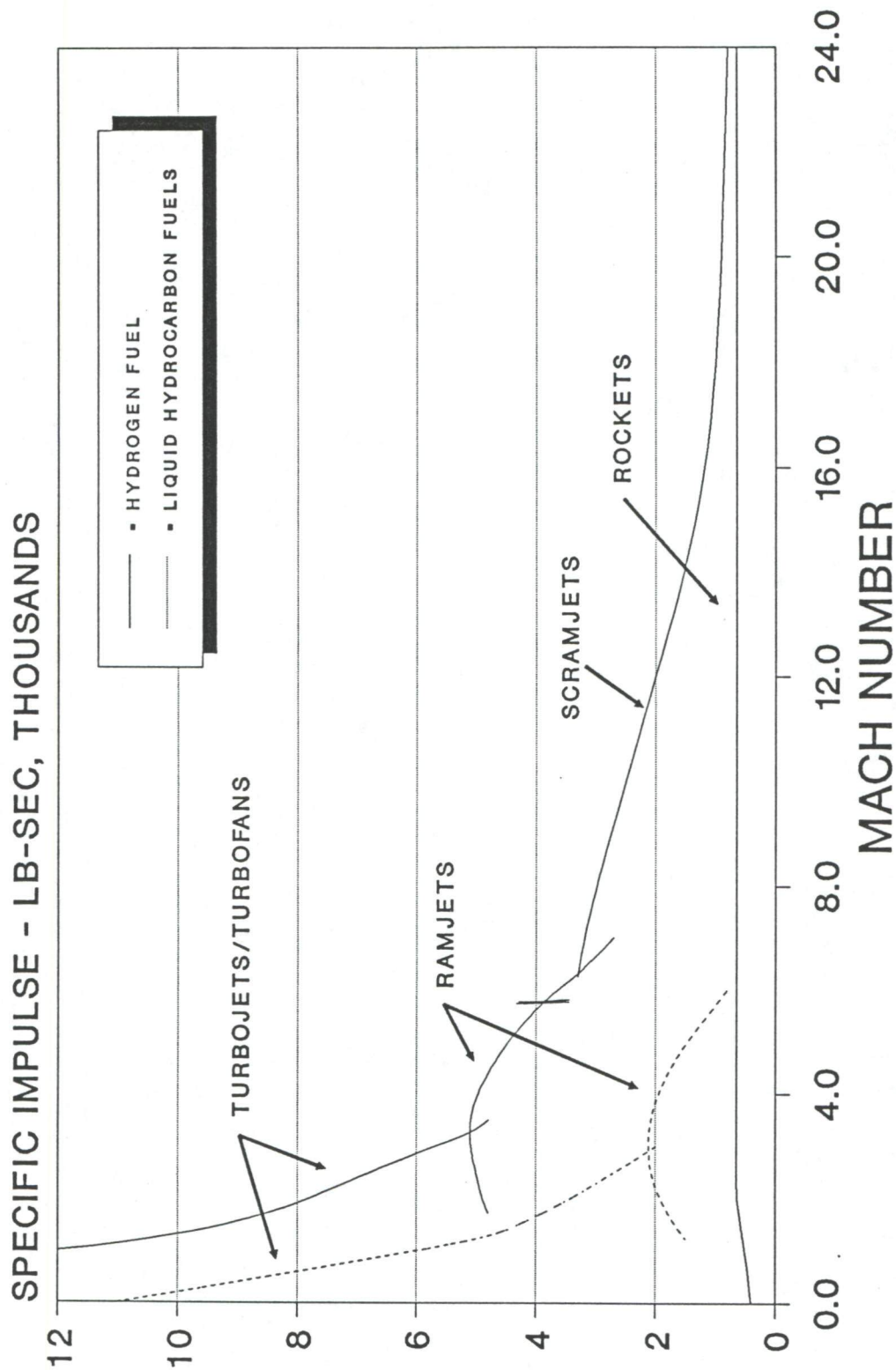
STRUCTURAL MATERIALS CANDIDATES: LOWER SIDE



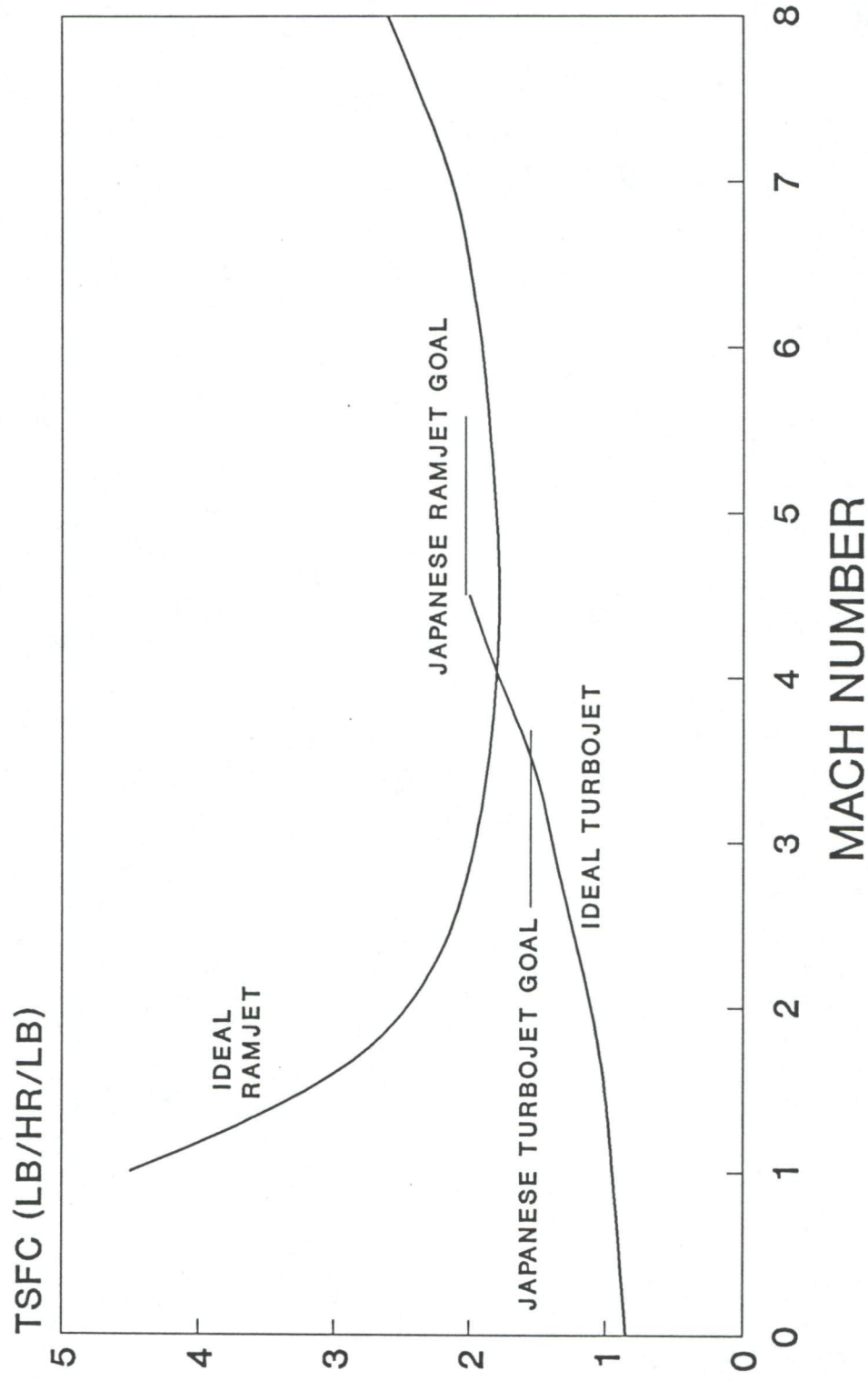
STRUCTURAL MATERIALS CANDIDATES: UPPER SIDE



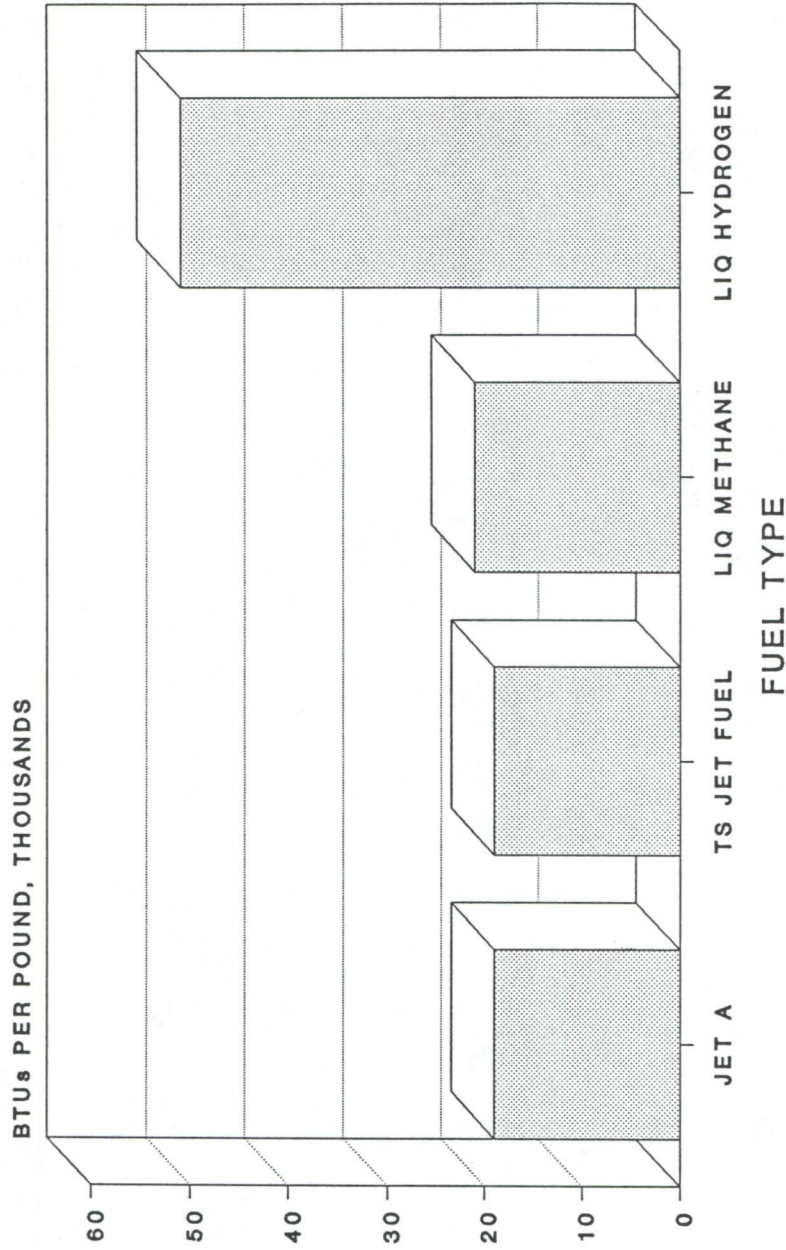
PROPULSION OPTIONS



COMPARISON OF RAMJET AND TURBOJET OPERATING REGIMES



CANDIDATE FUELS



RELATIVE ENERGY
PER UNIT VOLUME

1.00

0.99

0.80

0.25

MACH RANGE

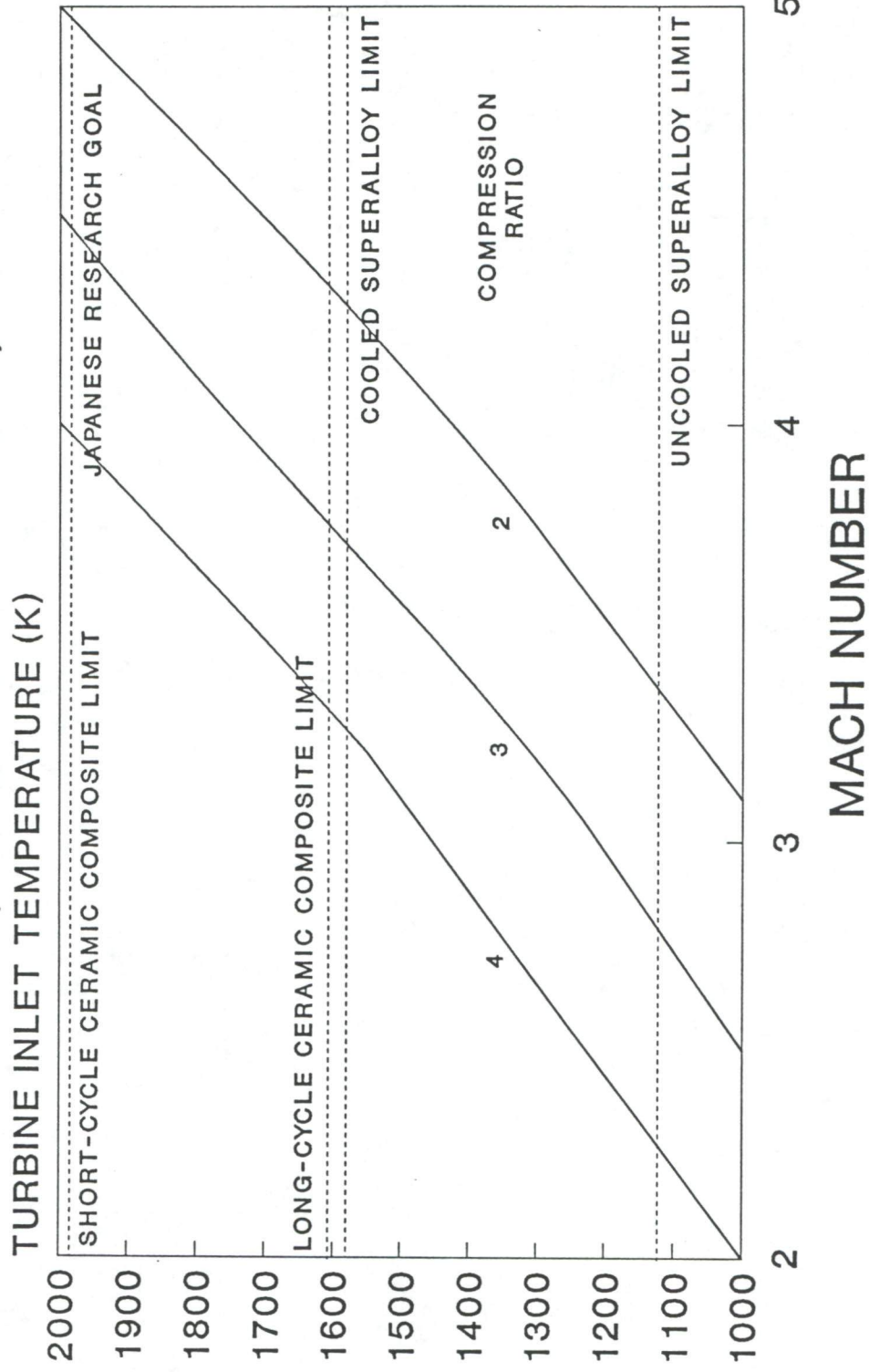
0.0 TO 2.5

2.0 TO 4.0

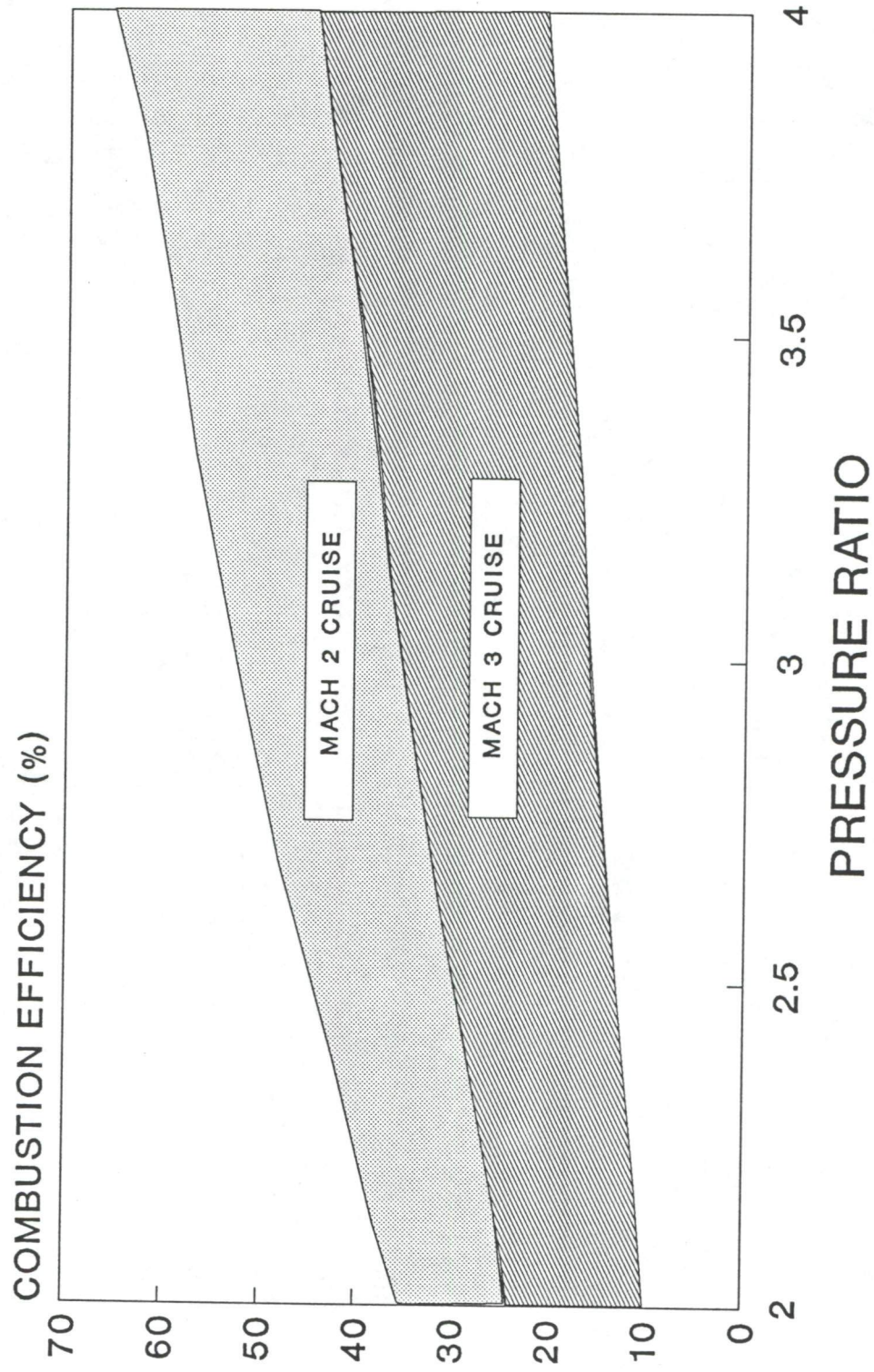
3.0 TO 6.0

4.0 TO 20.0

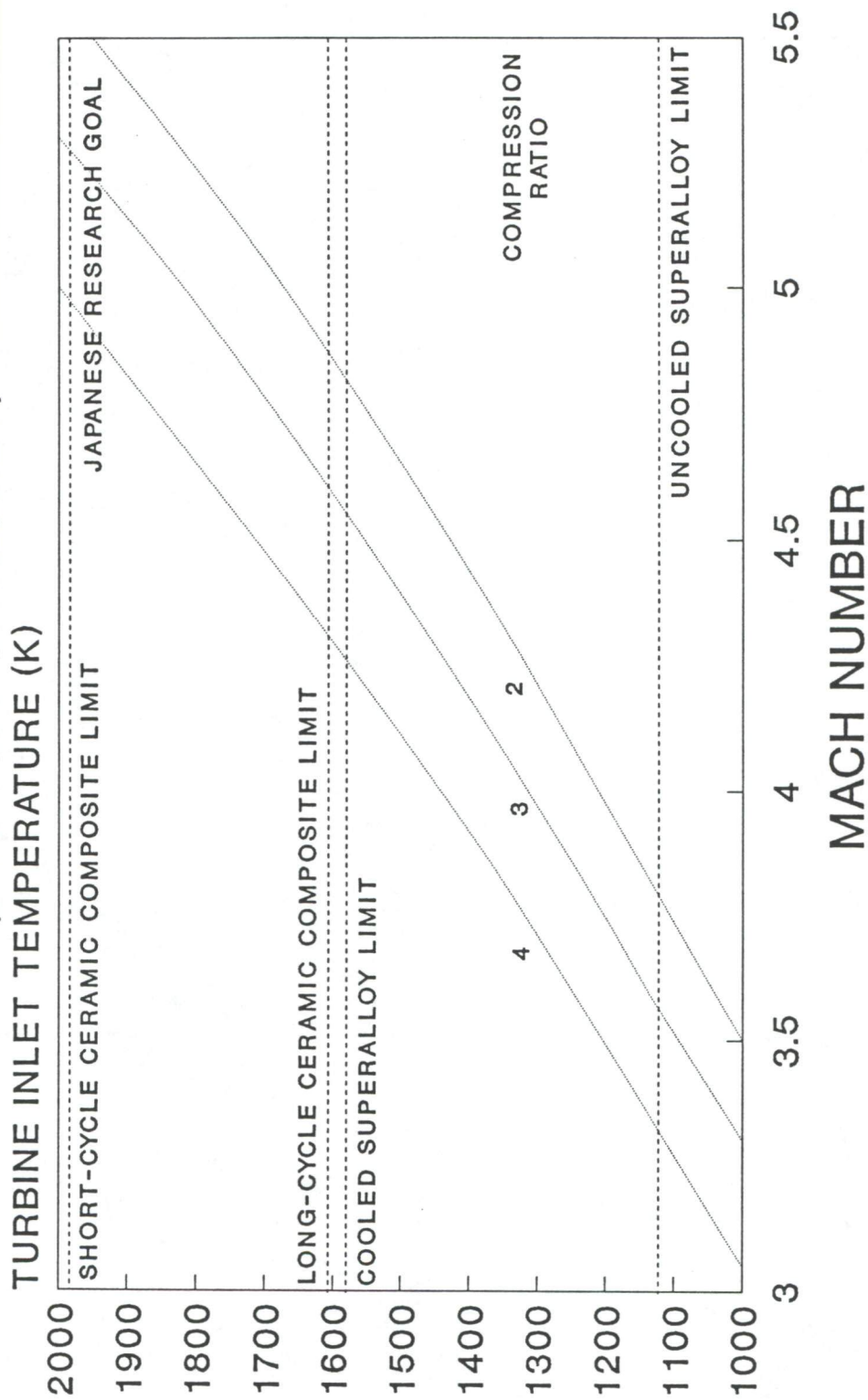
TURBINE MATERIAL TEMPERATURE VS. MACH NUMBER (TURBOJET/TURBOFAN)



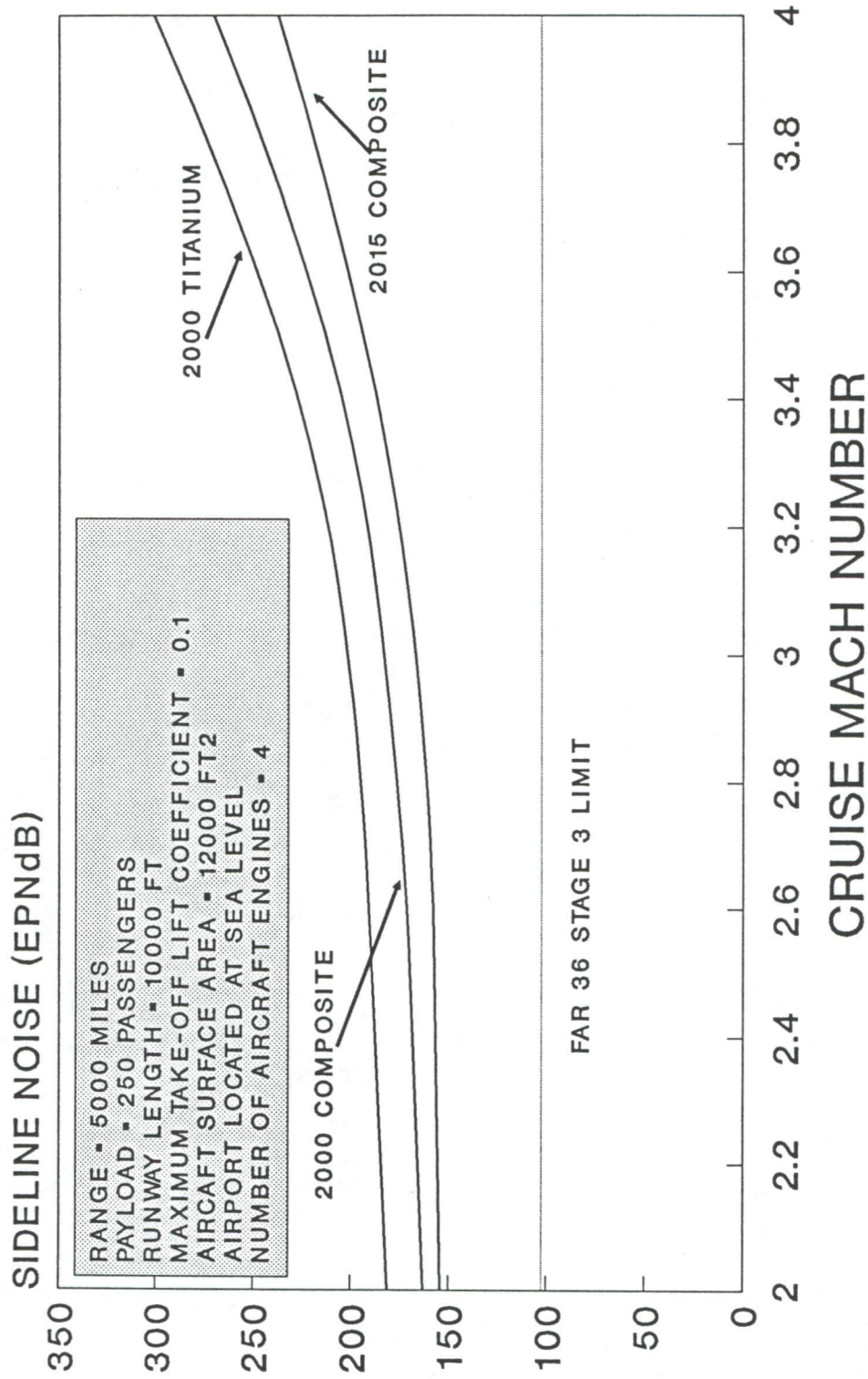
PRESSURE RATIO EFFECT ON COMBUSTOR EFFICIENCY



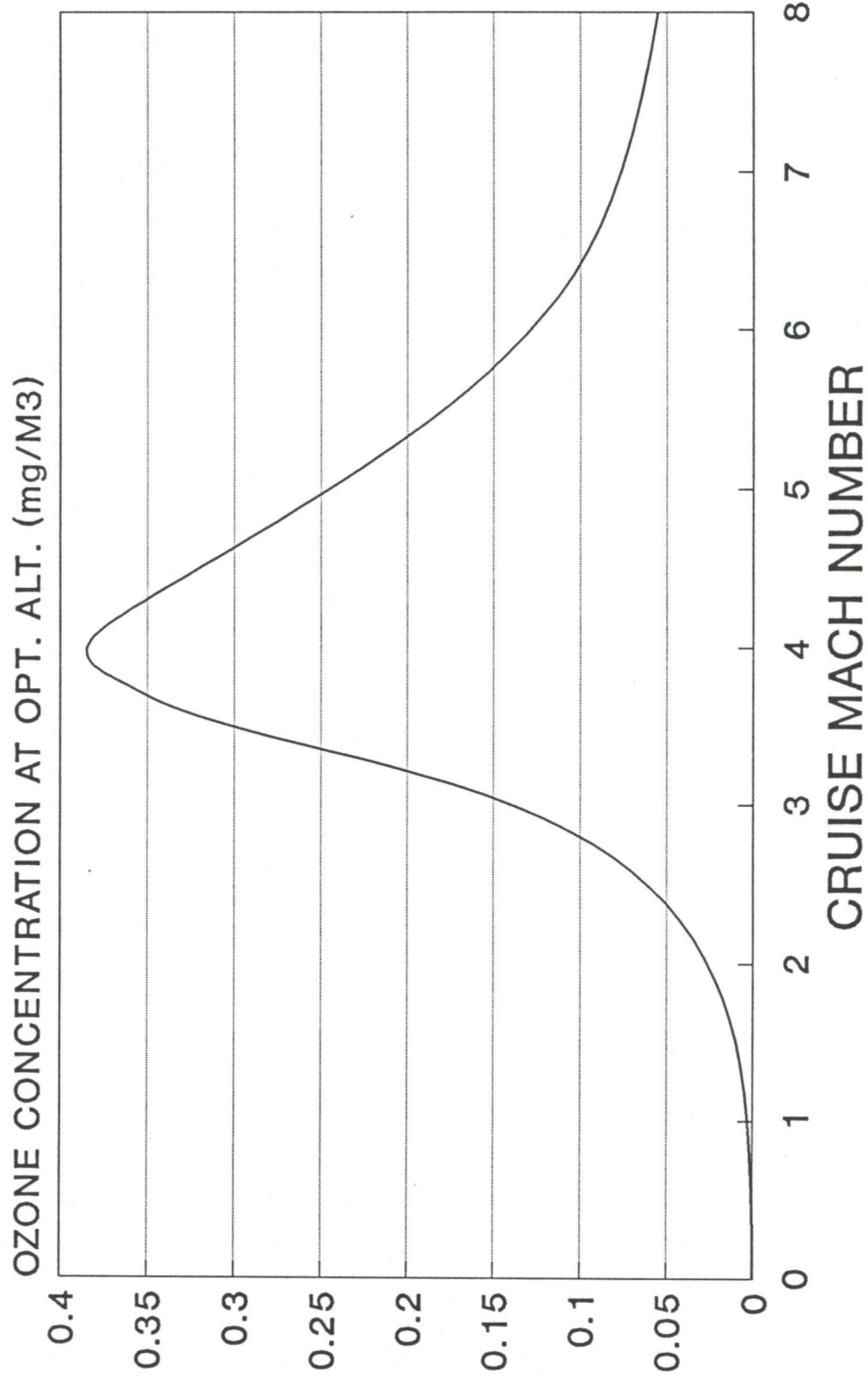
TURBINE MATERIAL TEMPERATURE VS. MACH NUMBER (AIR/TURBO/ROCKET)



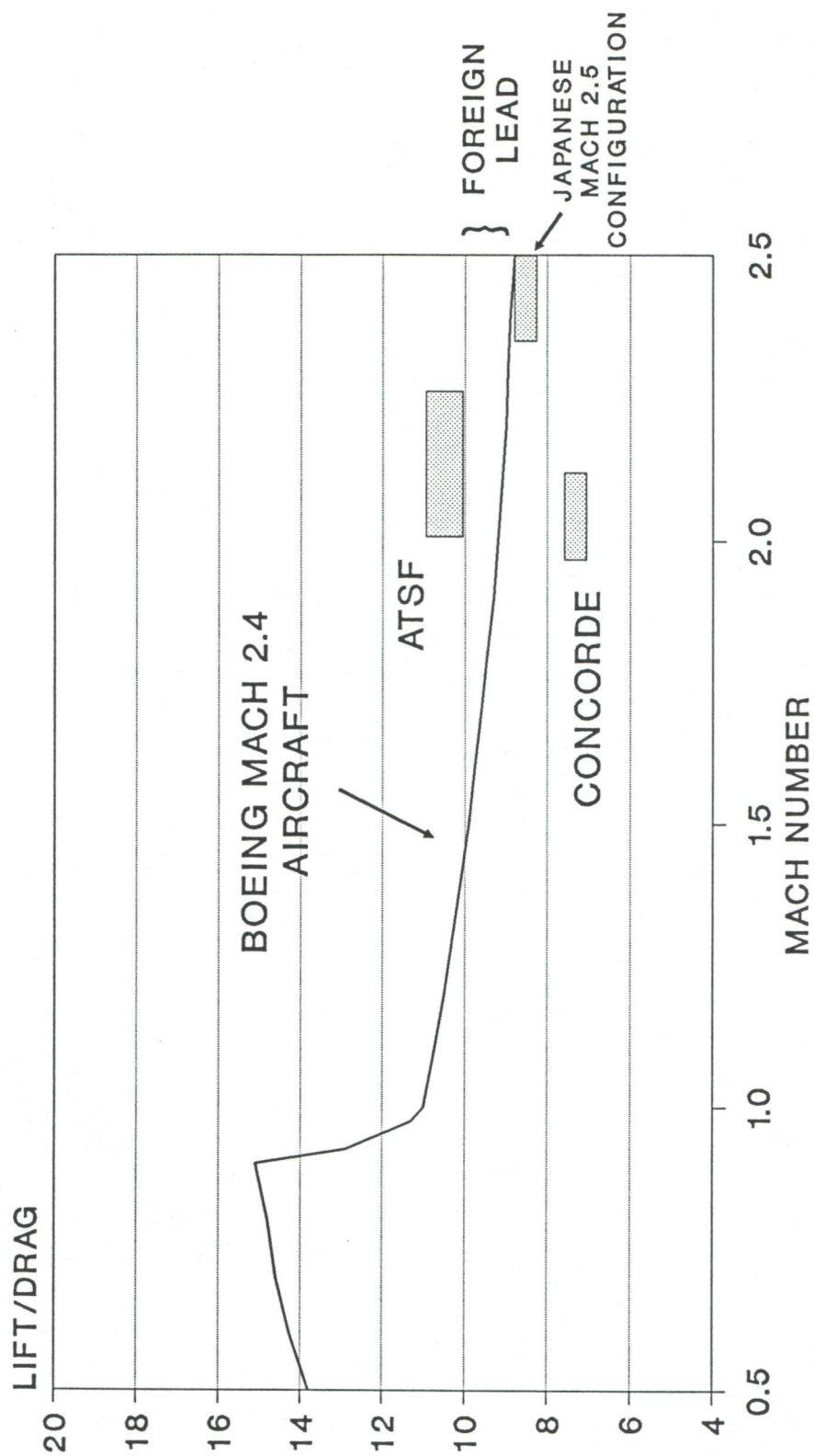
COMMUNITY NOISE LEVEL VS. CRUISE MACH NUMBER



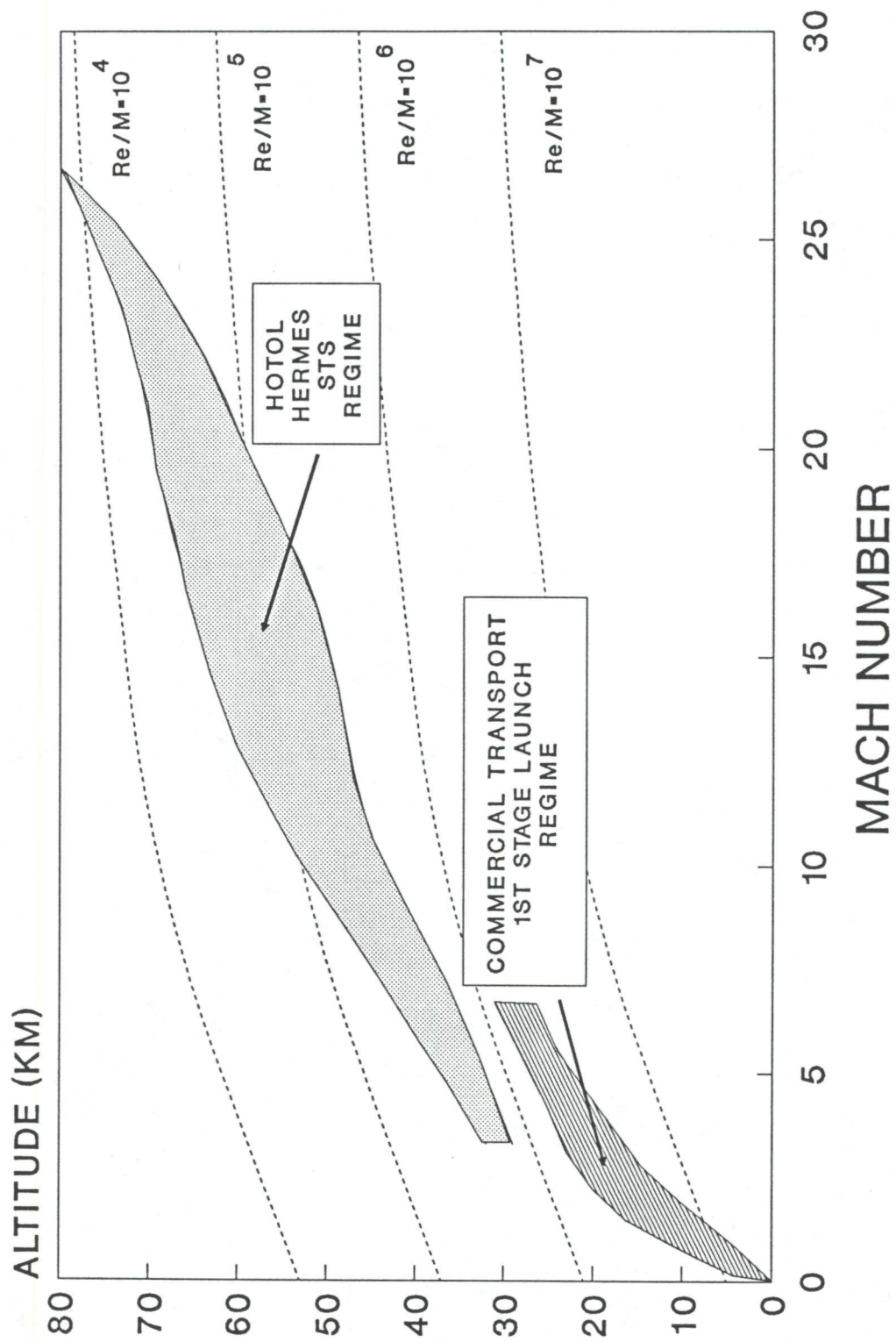
OZONE CONCENTRATION VS. CRUISE MACH NUMBER



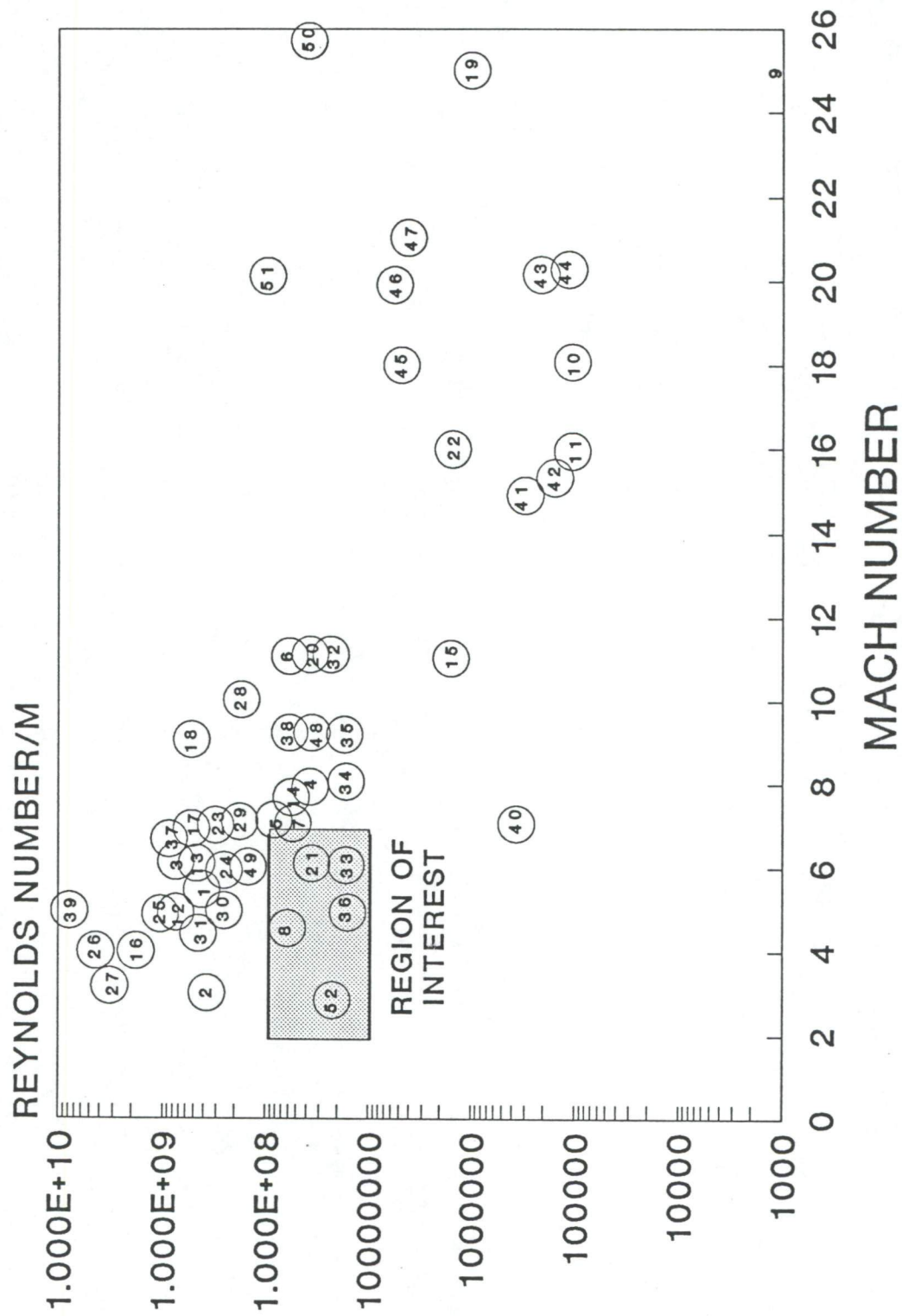
AERODYNAMIC PERFORMANCE



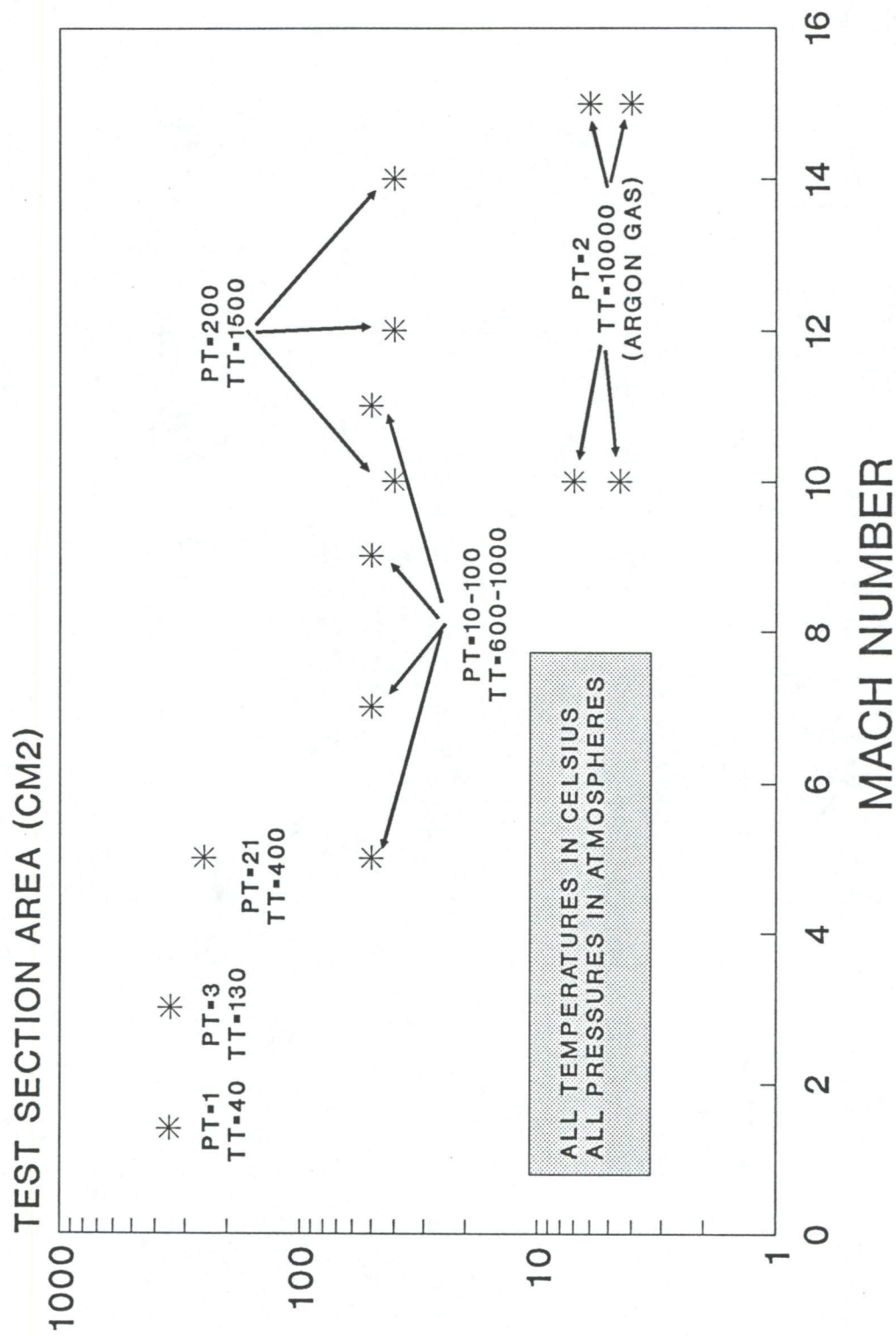
COMPARATIVE FLOW REGIMES



EUROPEAN WIND TUNNELS



JAPANESE WIND TUNNELS



OVERVIEW OF FOREIGN PROGRAMS (1 OF 2)

COMMERCIAL TRANSPORT				
MACH 2.0 TO 3.5				MACH 5.0
HST* (JAPAN)	ATSF/AST	BOEING	MDAC	AGV
PAYLOAD-300 PASSENGERS MACH #-2.5 (CRUISE) RANGE-5500 NM # ABREAST SEATS-5 LENGTH-326.4 FT WINGSPAN-140.7 FT WING AREA-12372 FT2 DRY WEIGHT-265000 LB TOGW-740000 LB MAX. THRUST-80000 LB CRUISE L/D-8.80 CRUISE TSFC-1.34 * ONE OF SEVERAL CONFIGURATIONS UNDER STUDY	VEHICLE LENGTH: ATSF-76M WING SPAN: ATSF-37 M AST-30 M CRUISE SPEED- M 2.0 ENGINES: AIRBREATHING VARIABLE CYCLE (TURBOJET/TURBOFAN) # X THRUST: 4 X 15000 LB MAX. TEMP. RANGE: 300 DEG C RANGE: ATSF-6500 NM AST-6500 NM ALTITUDE-60000-60000 FT TAKE-OFF THRUST: 60000 LB PAYLOAD: ATSF-200 PASSENGERS AST-300 PASSENGERS CRUISE L/D-10+ TOGW: ATSF-483920 LBS AST-650475 LBS NOTE: ATSF IS AEROSPATIALE'S CONCORDE 2 CONFIGURATION AST IS BRITISH AERO. CONCORDE 2 CONFIGURATION	CRUISE SPEED-M 2.4 RANGE-6000 NM TOGW-745000 LB WING AREA-7466 FT2 VEHICLE LENGTH-76 M WINGSPAN-45 M PAYLOAD: 250 TO 300 PASSENGERS FUEL TYPE: CONVENTIONAL	CRUISE SPEED-M 3.2 RANGE-6500 NM TOGW-770000 LB TURNAROUND TIME- 2 HR LIFETIME-10 YRS FUEL TYPE-TS/JF PAYLOAD-300 PASSENGERS MAX. TEMP. RANGE: 360 DEG C VEHICLE LENGTH-96 M WINGSPAN-44 M MAX. ABREAST SEATS-6	VEHICLE LENGTH-69 M WINGSPAN-30M CRUISE SPEED-M 5.0 ENGINES: AIRBREATHING TURBO-RAMJETS # X THRUST: 4 X 32000 KG MAX. TEMP. RANGE: 400 TO 1100 DEG C RANGE-12000 KM ALTITUDE-30 KM MAX. THRUST-130000 KG PAYLOAD-150 PASSENGERS TOGW-3000000 KG PROP. WEIGHT-135000 KG WING AREA-600 M2

OVERVIEW OF FOREIGN PROGRAMS (2 OF 2)

SPACE LAUNCH				
HYBRID			ROCKET BOOSTED (NO AUTONOMOUS ASCENT PROPULSION)	
SAENGER	STAR-H	HOTOL	HERMES	HOPE
VEHICLE LENGTH-84.6M WING SPAN-41.5M SPEED-M 4.4 (CRUISE) M 6.6 (MAX) ENGINES: AIRBREATHING TURBO-RAMJET # X THRUST: 6 x 41625 LBS MAX. TEMP. RANGE: 470 TO 1340 DEG C RANGE- 10,600 KM ALTITUDE-26Km (CRUISE) LIFETIME-16 YEARS (20,000 FLIGHTS) TAKE-OFF THRUST- 47260 LBS MAX. THRUST-67600 LBS PAYLOAD-230 PASSENGERS L/D (M4.4)-5.2 L/D(SUBSONIC)-10.5 TOGW-244000 KG H2 PROP. WT.-96000 KG NOMINAL MISSION: 2-STAGE-TO-ORBIT/ 1ST STAGE COMMERCIAL TRANSPORT	TOGW - 400000 KG (1ST STAGE - 280000 KG) (2ND STAGE - 120000 KG) PAYLOAD: 2000 KG TO LEO MAX. SPEED: 1ST STAGE MACH 6 2ND STAGE ORBITAL MAX. ALTITUDE: 1ST STAGE 100000 FT 2ND STAGE LEO PROPULSION: AIRBREATHING STAGE 1 ROCKET STAGE 2 (HM-60 CRYO. ENGINE) NOMINAL MISSION: 2-STAGE LAUNCH VEHICLE	TOGW-260000 KG MASS AT MECO-50000 KG PAYLOAD-7000 KG VEHICLE LENGTH-62M MAX. DIAMETER-7M WINGSPAN-28M ENGINES: AIRBREATHING TO M 5.0 ROCKET TO ORBIT MAX. TEMP. RANGE: 400 TO 1200 DEG C (REENTRY) LANDING MASS-42000 KG RUNWAY LENGTH-3000M TAKE-OFF ACC.-.56 G TAKE-OFF SPEED-334 MPH LANDING SPEED-196 MPH SUBSONIC L/D-6.5 SUPERSONIC L/D-4.5 ALTITUDE: 26 KM AT MACH 6 300 KM ORBITAL PAYLOAD MASS FRACTION: 3% NOMINAL MISSION: SINGLE-STAGE- TO-ORBIT LAUNCH VEHICLE/ POSSIBLE HYPERSONIC TRANSPORT CONFIGURATION	LENGTH: SPACEPLANE 13M RESOURCE MODULE 6M PROP. MODULE 1M WINGSPAN-9 M MAX. WEIGHT (TRANSFER ORBIT): SPACEPLANE 15000 KG RES. MOD. 8000 KG MAXIMUM WEIGHT (LANDING): 15000 KG CREW-3 PERSONS MAXIMUM PAYLOAD: SPACEPLANE 1500 KG RES. MOD. 1500 KG MAXIMUM PAYLOAD (LANDING): 1500 KG PRESSURIZED VOLUME: SPACEPLANE 33 M3 RES. MOD. 28 M3 MAX. TEMP. RANGE: LATERAL RANGE (REENTRY): 2000 KM LAUNCH VEHICLE: ARIANE 6 MISSION DURATION: 240 HOURS LIFETIME-16 YEARS NOMINAL MISSION: PERSONNEL TRANSPORT TO-AND-FROM LOW EARTH ORBIT	LENGTH-11.6M WINGSPAN-8.66M CREW, UNMANNED LANDING DISTANCE-3000M LATERAL RANGE (REENTRY): 1600 KM FLIGHT DURATION-96 HRS PAYLOAD (ORBIT)-1700 KG PAYLOAD (LAND)-1200 KG PROP. WT.-2000 KG WING AREA-90 M2 DRY WEIGHT-6300 KG GROSS LO WT.-10000 KG GROSS LAND. WT-7600 KG MAX. TEMP. RANGE: 1700 DEG C (REENTRY) LAUNCH VEHICLE, H-II NOMINAL MISSION: REUSABLE SPACE CARGO CARRIER TO-AND-FROM LOW EARTH ORBIT

CURRENT INTERNATIONAL PROGRAM FUNDING LEVELS

NATION	PROGRAM FUNDING	DETAILS
UNITED KINGDOM	\$13.5 MILLION	\$3.4 M GOVERNMENT CONTRIBUTION \$10.1 M BAe AND ROLLS ROYCE HOTOL CONCEPT STUDIES \$10M IN PRIVATE FUNDING TO UNDERTAKE A THREE YEAR STUDY OF CONCORD FOLLOW-ON (BAe AND AEROSPATIALE) \$2.4 M TO COORDINATE RESEARCH EFFORTS \$26 M TO FUND HYPERSPACE CONSORTIUM
FRANCE	\$28.4 MILLION	
GERMANY	\$232.2 MILLION	\$23.2 M INDUSTRY CONTRIBUTION \$209.0 M GOVERNMENT 5-YEAR SAENGER PHASE I STUDY
JAPAN	\$195.5 MILLION	FUNDING OF INTERNATIONAL CONSORTIA TO DEVELOP ADVANCED ENGINES UP TO MACH 5 (ALL FUNDS PROVIDED BY MITI)

JAPANESE HCST PROGRAM

- MITI POSITION ON HCST PRESENTED TO INTERNATIONAL INDUSTRY IN OCTOBER 1989
- NEW ENERGY AND INDUSTRIAL TECHNOLOGY DEVELOPMENT OFFICE HAS LEAD IN MITI
- PROPULSION RESEARCH CURRENTLY FUNDED AT \$194M OVER SEVEN YEARS
- RESEARCH GOALS INCLUDE:
 - LIGHTWEIGHT TURBOJET FOR UP TO MACH 3
 - INLET TEMPERATURE ABOUT 1700 C
 - TSFC OF 1.4 /HR AT MACH 3
 - METHANE-FUELED RAMJET FOR MACH 2.5 TO 5
 - COMBUSTION TEMPERATURE OF 1900 C
 - TSFC OF 2.0 /HR AT MACH 5
 - COMBINED CYCLE TURBO-RAMJET FOR MACH 5 TRANSPORT
 - PLANNING GROUND TESTS OF DEMONSTRATOR FOR 6000 LBS THRUST WITH CONVENTIONAL FUEL

JAPANESE SPACE PLANE WORK

- NATIONAL AEROSPACE LABORATORY LEADING EFFORT
- FUNDING INCLUDES MITSUBISHI, KAWASAKI, AND FUJITSU PRIVATE FUNDS PLUS \$35M FROM GOVERNMENT SOURCES
 - PROGRAM HOPES TO ACQUIRE \$67M IN '91 AND \$133M IN '92
- CURRENT THRUSTS:
 - SCRAMJET DEVELOPMENT
 - WIND TUNNEL TESTS
 - CFD WORK ON FUJITSU VP 400 COMPUTER
- PLANNING CONSTRUCTION OF FOLLOWING MAJOR FACILITIES:
 - STRUCTURAL FACILITIES LAB - TESTING OF THERMAL PROPERTIES OF MATERIALS - COMPLETION BY 1991
 - SCRAMJET TEST FACILITY - MODIFYING LE-5 TEST STAND BY '92 FOR SCRAMJET TESTS BETWEEN MACH 4 AND 8
 - UPGRADING SHOCK TUNNEL TO MACH 20
 - SEEKING \$2M TO EXPAND SMALL HYPERSONIC TUNNEL - EXPANDING TEST SECTION FROM 50 CM TO 1.2M
- ALREADY USING MACH 11 TUNNEL, TRANSONIC TUNNELS AND RAMJET TEST FACILITIES
- TSUKUBA (NASDA) AND KAWASAKI DEVELOPING ADVANCED C-C
 - TWO TIMES THE FLEXURAL AND TENSILE STRENGTH OF COMMERCIALLY AVAILABLE C-C
 - SIX TIMES STRONGER THAN C-C USED ON SHUTTLE

SUKHOI/GULFSTREAM

- MEMORANDUM OR UNDERSTANDING WAS SIGNED IN 1989
- NOMINAL CONFIGURATION:
 - MACH 2 CRUISE
 - 12 - 15 PASSENGERS
 - 4,600 MILE RANGE
 - 100,000 LB TOGW
 - 51,000 TO 65,000 FT CRUISE ALTITUDE
 - 2 X 20,000 LB THRUST ENGINES (VARIABLE NOZZLE)
 - ALUMINUM ALLOY, COMPOSITE AIRFRAME
 - \$50M ACQUISITION COST
- LYULKA DESIGN BUREAU, ROLLS-ROYCE STUDYING ENGINE DESIGN
- TEST VEHICLE AROUND 1994

→ Rick

"CORRESPONDENCE TRACKING"

TYPE: Information

DOCUMENT NUMBER: 9024260

FROM: Reis, Victor: DARPA

TO: Bromley

DATE OF
CORRESPONDENCE: 11/26/90

SUBJECT: Memo to Under Secretary for Defense re: hypersonic
vehicles

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
Michelle Van Cleave

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 12/06/90

FILE: NATIONAL SECURITY



OFFICE OF
THE DIRECTOR

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

1400 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22209

NOV 26 1990

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE
(ACQUISITION)

SUBJECT: NASP Steering Committee

As Chairman of the NASP Steering Committee,
you might be interested in a talk that one of your
new members gave on the subject a few years ago.

Vic
Victor H. Reis
Director

Attachment

cc: → Hon. Allan Bromley (OSTP)
Hon. Charles Herzfeld (DDRE)
Hon. J.R. Thompson (DD/NASA)
Hon. Jack Welch (ASAF/A)

Victor H. Reis
Science Applications International Corp
McLean, Virginia

Hypersonic Vehicles

Presented to
1988 AIAA Strategic Systems Conference
Naval Post Graduate School
Monterey, California
3 February 1988

Many of you, I'm sure, came here to hear Ron Kerber, a Deputy Under Secretary of Defense talk authoritatively on hypersonic vehicles.

I am not Ron Kerber and am not in the government, and so the good news is that I'm free to express a perspective on hypersonic vehicles without worrying much about official positions. The bad news is that I'm not in the government so anything I say is completely non-authoritative. But I did sponsor an interagency look at aeronautical R&D when I was in the Office of Science and Technology Policy at the White House, and was more recently involved in reviewing the National Aerospace Plane for both DARPA and the Defense Science Board. So if I'm not authoritative, at least I'm reasonably well informed.

Hypersonics is a relatively old technology, dating back to the birth of the long range ballistic missile. Ballistic missile reentry vehicles are dependent on hypersonic technology, and as long as ballistic missiles remain part of our strategic force posture, we shall have to maintain and exercise a hypersonic technology base. INF and START notwithstanding, we can expect this to be true for the foreseeable future. In addition, renewed interest in ballistic missile defense has come about through the SDI, and high velocity interceptors are one of the many technologies that are vital to SDI. Important as these vehicles are, they are not, I'm sure, why the subject of hypersonic vehicles was put on today's agenda. The reason was NASP, the National Aero-Space Plane - a hypersonic vehicle that burst almost overnight from a small, classified technology program in an obscure DoD agency into a national program announced by the President in a State of the Union message.

So today I'll talk about NASP and focus my remarks on the why of NASP, and not dwell on the how or what. In doing this I will take a strategic planner's perspective on NASP, and leave the technical details to some other AIAA meeting.

Let's begin by asking strategic questions about NASP. What are the NASP's goals? Are they worthy? Do we have the technical ability to meet those goals? And finally, what is the political and economic environment in which NASP must be developed?

NASP is a "big deal" program. That's what the "N" means in its title - it is a national program. As such it has a call on national resources - the best people, sufficient funds and facilities - and the popular and political support to carry it through to a successful conclusion. The United States does undertake big deal programs (BDPs) from time to time and we do them for various reasons - political, economic, military, etc. And analysis of successful BDPs can be used as a framework to evaluate NASP goals. Historical BDPs include the building of the Panama Canal, the development of the atomic bomb, and sending a man to the moon and returning him in good health; Apollo. While there were multiple reasons for all of these, I believe the primary rationale for the Panama Canal was economic growth, the primary rationale for the atomic bomb was military and the primary rationale for Apollo was political. Apollo was an audacious demonstration of national leadership, and going to the Moon was a means to that end.

Note it is not necessary for a program to be a BDP for it to have an historical impact. For example, the ICBM has dominated U.S. strategic posture, but were developed through conventional channels. Indeed if the MX had been called Minuteman IV, and had not been made into a BDP, we might now have many more such missiles deployed.

In addition to the NASP, current BDPs would include the SDI, the Superconducting Supercollider and the Space Station. While SDI obviously contains strong political overtones, I would claim that its fundamental goal is military; if it can't be demonstrated that there can be an effective ballistic missile defense against a credible threat, then it is not likely to be deployed. The first statement in the Department of Energy's brochure for the Superconducting Super Collider is "The SSC is a tool to study the heart of matter," so the rationale for the SSC is scientific. Technological fallout or

international competition and cooperation are secondary. Like Apollo, the rationale of the Space Station is political. Its primary purpose is to maintain U.S. leadership in manned space, and that is a political goal. The current debate about the space station is not about its technical feasibility or its economic or scientific payoff, but whether its leadership return is worth the cost. And leadership is a political attribute.

So where does NASP fit?

The primary rationale for NASP is technology. Its official goal is "technology development and demonstration to provide the basis for hypersonic flight vehicles leading to space transportation systems, superior U.S. military aircraft, and civil transports that will have technical, cost and operational advantages over existing systems." Specifically, the immediate means for implementing this goal is a manned, air breathing, flight test vehicle - the X-30 - whose task will be to take off from a runway, accelerate into orbit, and descend and land in a conventional manner. Current plans call for a first flight of the X-30 around 1995.

As far as I know, NASP is the only big deal program, past or present, for which technology is the primary rationale. This means that, unlike previously successful BDPs, the real payoff for reaching the goal will not come with the successful completion of the X-30 project, but instead it will take place after a further generation of development-- some time in the 21st century.

We have no models on how to sustain a technology driven BDP. While others spanned several administrations, the payoff was so obvious, or the sunk costs were so deep, that subsequent administrations were able to stay the course. NASP is too immature and the ultimate return too far downstream to make accurate predictions.

The technical key to the NASP, of course is airbreathing propulsion. Ramjets and scramjets theoretically provide a significant improvement in specific impulse over conventional high energy liquid propellant rockets. Thus if efficient airframes and systems can be designed and fabricated out of realizable materials, corresponding large improvements in payload fraction would obtain.

The purpose of the X-30 is to demonstrate these critical technologies with sufficient fidelity so that the necessary engineering design information will be available to take the next step - a prototype or FSED vehicle.

Where are we now? On the bureaucratic front, the program has moved first from DARPA to a pentagonal consortium of sponsors - DARPA, Air Force, NAVY, SDIO, NASA, and now to an essentially joint program between the Air Force and NASA. NASA and the Air Force have worked together well in the past and can do so now.

Programmatically there are now three major airframe contractors - Rockwell, McDonnell Douglas, and General Dynamics and two propulsion primes - Pratt & Whitney and Rocketdyne - as well as all the appropriate major NASA and Air Force labs and myriad of other contractors, government and academic participants. They're all big boys with demonstrated records of success.

Technically we are at the stage where each problem solved seems to raise a new challenge. And the challenges go right to the heart of the aircraft designers art. New propulsion schemes require new materials which require new fabrication methods. The engine inlet and exhaust nozzle make up almost the entire underbody of the vehicle so there is little distinction between the propulsion system and the airframe. Large scale computation, both for simulation and design is essential. Fundamental phenomena as diverse as boundary layer transition and hydrogen embrittlement are still largely unknown and are critical to system performance. New, unprecedented integrated thermal and flight control systems must be developed. The right sort of ground testing facilities are not yet available. The list goes on and on till one's eyes either glaze over with discouragement or light up with enthusiasm. Fortunately, enthusiasm is the dominant emotional characteristic of the American aerospace industry, and those people involved with the X-30 program transmit the strong impression that an effective airbreathing hypersonic technology demonstrator can be designed, built and flown.

As befits a technology demonstration program, there is no single dominant application. If we look toward the future, none of the things suggested for an operational aerospace plane cannot be done by other means; the question is then one of marginal economic, political or military utility. How does it compare with alternatives?

One example of particular interest to this audience is strategic bombardment.

The U.S. approach to manned strategic bombardment in the early part of the 21st century will be based on the B-2 advanced technology bomber which uses stealth technology -- not trans-atmospheric hypersonics. Defenses that must defeat both technologies would clearly face a daunting task, but would it be more daunting than a continued mixture of advanced cruise and ballistic missiles and manned stealth carriers? Would it be cheaper? Will it help with SRTs? How would it fit into a START environment? How does it mesh with the types of ballistic missile defenses that are being considered under the SDI? It is difficult to answer these questions until we know the level of practical NASP technology.

Given this level of uncertainty in the ultimate utility for NASP technology, what is the probability that the X-30 program will be sustained. I need not tell this audience about the difficulty of starting or maintaining new programs during the next few years. The primary mission of the Air Force is to win or deter wars using airpower, not to develop technology. It has major new programs already on the books that are directly responsive to its fundamental missions - the Peacekeeper, MILSTAR, the ATB, the ATF, and it will no doubt be making a new thrust in launch vehicles using rocket technology. Air Force support for NASP up to this point has been most remarkable but there is clearly no near term mission requirement to sustain that support. Successful INF and START can only increase near term mission pressure. NASA, on the other hand, has both the technology development charter and a proclivity for BDPs as well as much of the technical expertise for NASP. But NASA will undoubtedly be preoccupied with Shuttle recovery, space station and perhaps even getting ready to go to Mars.

So where can NASP leadership come from? The answer is where all BDPs find their leadership - in the White House. NASP is a technology program that is driven by a vision of the U.S. aerospace enterprise of the future. It has gotten as far as it has by the conjunction of technological opportunity, programmatic chutspah and a President who is willing to make vision into policy.

So my answers to the strategic questions are as follows:

Is the goal of airbreathing hypersonic technology demonstration a worthy one? You bet. Aerospace is vital to the U. S., and hypersonic airbreathing technology could prove to be important to the future of aerospace.

Can we do the program? Yes. I think an X-type vehicle program is a good way to demonstrate the technology. We might well ask, however, what will happen when the X-30 succeeds? Do we have the technical, financial and political infrastructure to exploit that success.

Will we do it? I think the answer depends upon the next president and his advisors. The ante for NASP has been raised to the big stakes game of the BDP, and once you're in that game you can't easily back out. And I certainly don't know who the next president will be or what his policy will be toward NASP. I should point out, in closing, however, that the president who canceled nuclear propulsion was the same president who sent us to the moon.

So you never can tell.

~~ADT&F AF 12th 28~~~~McConnell/Wise~~~~10/18/90 2:30 pm~~

National Aero-Space Plane technology program

The House bill would authorize \$158 million for the National Aero-Space Plane (NASP) program, which is the amount contained in the amended budget request.

The Senate amendment would terminate further participation by the Defense Department in the joint DoD/NASA program.

The conferees agree to authorize \$119 million for NASP and to require the Secretary of Defense to provide a report to the Congressional defense committees by March 15, 1991, identifying the military requirements and missions for NASP and the rationale for continued DoD funding for this program. The report should include the most recent cost, schedule, and milestone data; planned funding shares between DoD and NASA; a technical risk assessment; and a priority ranking of NASP in relation to DoD's other advanced technology and space access programs.

Within the authorization of \$119 million for the NASP program, up to \$2 million would be authorized for the Defense Advanced Research Projects Agency to conduct an independent configuration study. The purpose of this independent study is to revise the design, and the analysis that supported the design, of the original government baseline configuration (including its air-breathing propulsion system) based on the latest NASP technical findings and to compare the results to the current NASP baseline configuration. The results of this independent study shall be provided to the NASP Steering Group chaired by the Under Secretary of Defense for Acquisition. The Steering Group shall evaluate the results of the independent study and provide its findings to the Congressional defense committees by May 1, 1991.

35 274 1175

DAVE McCURDY
4TH DISTRICT, OKLAHOMA

COMMITTEES:
ARMED SERVICES

SCIENCE, SPACE, AND TECHNOLOGY

PERMANENT SELECT COMMITTEE
ON INTELLIGENCE

CHAIRMAN,
OVERSIGHT AND EVALUATION

Congress of the United States
House of Representatives
Washington, DC 20515

November 7, 1990

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The Honorable John Welch, Jr.
Assistant Secretary for Acquisition
The Department of the Air Force
Room 4E964, The Pentagon
Washington, D.C. 20330-1000

Dear Jack:

In the report language that accompanies the 1991 Defense Authorization Bill, an amount of up to \$2 million is authorized for DARPA to conduct an independent configuration study of the National Aerospace Plane. I am writing to clarify the need for this study and ask that you take into consideration some specific design questions.

The need for this study arises due to conflicting engineering analysis that could interfere with NASP program progress and deter a clear-cut decision for phase three. Additionally, the current plans are significantly different from DARPA's original weight and dimensional concepts for the X-30. Congressional inquiries to NASA and the Joint Program Office regarding conceptual differences in the NASP design have not been sufficiently answered.

In light of these differences and the advances that have been made during the development stage, it would seem appropriate that the original conceptual team perform a study to refine the initial configuration. There are four questions that have been particularly contentious and should be addressed in the study. They are: (1) Have the requirements changed?; (2) Is engineering error involved?; (3) Has excessive conservatism crept in?; and, (4) Is the increase in size due solely to new knowledge? To assure that these issues are resolved in a manner consistent with the intent of the program, a full review is necessary. The Joint Program Office seems the most logical administrator of this review.

The Honorable John Welch, Jr.,
Page Two

Many decisions in Congress were based on the original DARPA/duPont Aerospace Company proposals. An evaluation of apparent departures from the original concept is key if Congressional support of the National Aerospace Plane is to expand and its programs continue.

I appreciate your personal attention to this and all NASP issues. I look forward to your response.

Sincerely,

Dave McCurdy, M.C.

DM:as

NASP/DARPA Study Discussion

In report # _____ that accompanies the 1991 Defense Authorization Bill (PL _____) an amount of up to \$2 million is authorized for DARPA to conduct an independent NASP configuration study. The reason for this is to preclude having a major disagreement between reputable engineering analyses that could interfere with NASP program progress and a clear cut decision for phase 3.

The principals of the original DARPA NASP conceptual team defined a vehicle that differed from current plans by an order of magnitude in size. We, in Congress had worked with these people since 1978 in developing the NASP idea. All efforts, on our part, to define and resolve the substance of the difference through NASA and the Program Office have resulted in indeterminate responses.

We would like to have the original team preform a study to refine and update the original configuration work, in light of today's knowledge, to learn if: 1) requirements have changed, 2) engineering error is involved, 3) excessive conservatism has crept in, 4) the growth is simply a "new knowledge" impact, or, 5) whatever can be clearly assessed when compared to the current configuration.

Then, and only then, can we make adjustments, if warranted, and get on with the NASP program free of this technical wrangle. We, in the Congress, made a number of decisions based upon the DARPA/duPont Aerospace Company proposals and we feel the need for their specific update to assure that we are on our planned course. We, of course, expect full cooperation and direction from the JPO and its contractors. We envision that this effort will be administered by the JPO in keeping with our intent.

All efforts are to be exercised to preclude this update from becoming another of the myriad of "expert" analyses by peripheral interests. It should be done by the original engineering team as free of opinion and sales as possible.

A STRAWMAN WORK STATEMENT

Update and refine the original DARPA/duPont Government Baseline NASP configuration proposal in light of today's knowledge contributed by the NASP program industry team and NASA. The report of this update is to clearly delineate all engineering methodology and assumptions including the budget of fixed weights that are independent of vehicle size. Presentation of unique or innovative or "stylized" or controversial methodology shall be such as to permit thorough engineering scrutiny and comparisons.

Denman, New DARPA Deputy from Wright Field.

Du Pont: Put up or shut up

NASP STEERING GROUP MEETING

November 21, 1990

BRIEFING BOOK

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TAB A

NASP STEERING GROUP MEETING
November 21, 1990
Room 3D1019

AGENDA

1400	Opening Remarks	Mr. Betti Mr. Thompson
1405	Minutes of Last Meeting (Tab J)	Mr. Siewert
1410	Issues for Decision (Tab B) - Review Procedures (Tab C) - DoD/NASA NASP MOU (Tab D)	Mr. Siewert
1425	Phase II Exit Criteria/ Tracking Milestones (Tab E)	Dr. Barthelemy
1455	Technical Status (Tab F)	Dr. Barthelemy
1510	Acquisition Strategy	Dr. Barthelemy
1530	Phase III Vehicle Plan (Tab G)	Dr. Barthelemy
1540	Steering Group Discussion	Mr. Betti Mr. Thompson
1600	Adjourn	

TAB B

ISSUES FOR DECISION

PROCEDURAL

- o STEERING GROUP REVIEW PROCEDURES/NASP AS A DAB PROGRAM

ADMINISTRATIVE

- o MOU IS NOT CURRENT
 - STEERING GROUP MEMBERSHIP AND FUNDING

TECHNICAL/PROGRAMMATIC

- o APPROVAL OF PHASE II EXIT CRITERIA/TRACKING MILESTONES
 - THRESHOLD SIZE OF VEHICLE - 425,000 LBS
 - ENGINE TECHNOLOGY DEMONSTRATION DOES NOT INCORPORATE MATERIALS
- o APPROVAL OF PHASE III VEHICLE PLAN
 - FIRST VEHICLE HAS NO CAPABILITY FOR SSTO
- o PHASE III AFFORDABILITY
 - SSTO PROGRAM COST PROBABLY IN EXCESS OF \$10 BILLION

TAB C

STEERING GROUP REVIEW PROCEDURES: DISCUSSION/RECOMMENDATIONS

- o AT LAST MEETING (OCT 20 1989), USD(A) TASKED EXECUTIVE SECRETARY TO FORMULATE REVIEW PROCEDURES, TO BE USED IN LIEU OF DAB PROCEDURES
- o PROCEDURES DISTRIBUTED FOR COMMENT IN DECEMBER, 1989; PRINCIPAL FEATURES:
 - FOUR SCHEDULED STEERING GROUP REVIEWS, FOLLOWED BY A FULL DAB REVIEW FOR THE FLIGHT VEHICLE DECISION
 - A "PROGRAM CONCEPT/BASELINE PAPER" TO BE UPDATED BY THE AIR FORCE PRIOR TO EACH STEERING GROUP REVIEW (LATER CHANGED TO "PROGRAM SUMMARY")
 - A DAB S&T COMMITTEE MEETING PRIOR TO EACH STEERING GROUP REVIEW TO IDENTIFY ISSUES AND FORMULATE ALTERNATIVES AND RECOMMENDATIONS
- o OSD OFFICES CONCURRED WITH PROCEDURES WITH MINOR REVISIONS; AIR FORCE OBJECTED TO DAB S&T COMMITTEE MEETINGS AND FULL DAB REVIEW; NASA OBJECTED TO DAB S&T COMMITTEE MEETINGS; NAVY, OSTP AGREED WITH AIR FORCE
- o AIR FORCE PROPOSED TO USE NASP QUARTERLY TECHNICAL REVIEWS AS SUBSTITUTE FOR DAB S&T COMMITTEE REVIEWS; PROBLEMS ARE:
 - NOT ISSUE-ORIENTED
 - DO NOT ACCOMMODATE ADEQUATE OSD MEMBERSHIP
 - ARE NOT HELD IN WASHINGTON
- o USD(A) APPROVED REVIEW PROCEDURES (WITH MINOR REVISIONS) ON MARCH 29, 1990
- o DUE TO CONTINUED AIR FORCE OBJECTIONS, PROCEDURES HAVE NOT BEEN DISTRIBUTED TO STEERING GROUP MEMBERS
- o RECOMMEND STEERING GROUP REVIEW PROCEDURES BE IMPLEMENTED
 - PROCEDURES HAVE BEEN SLIGHTLY MODIFIED TO ELIMINATE DAB S&T COMMITTEE (SOON TO BE ABOLISHED) IN FAVOR OF "NASP REVIEW COMMITTEE"

(A more detailed chronology of events is at Attachment 1; the recommended procedures are at Attachment 2)

NASP STEERING GROUP REVIEW PROCEDURES Attachment 1
CHRONOLOGY OF EVENTS

SYNOPSIS: The oversight process for the NASP program has been a contentious issue for almost three years, and is still not resolved. All parties agree that NASP is a pre-Milestone 0 program. USD(A) has generally advocated making the NASP a DAB program and adapting DAB procedures for review; Air Force and NASA have generally advocated no formal review procedures other than Steering Group meetings. Mr. Betti approved program review procedures to be used in lieu of DAB procedures, but these have not been transmitted to the NASP Steering Group members. The next NASP Steering Group meeting is scheduled for November 21, 1990, and an OUSD(A) position on the review process is desirable before then.

The chronology of events:

- o January, 1988: Dr. Costello designates NASP program as a DAB program.
- o November, 1988: USD(A), through NASP Steering Group, directs that DAB procedures be adapted to the NASP program.
- o February, 1989: DAB procedures adapted for NASP program, but no action taken pending new administration.
- o October, 1989: At NASP Steering Group meeting, Air Force and NASA request NASP be removed from list of DAB programs. Mr. Betti defers, directing that he wants to see procedures to be used for Steering Group review, in lieu of DAB procedures, before making decision. Executive Secretary, DDDR&E(R&AT), tasked to formulate procedures and distribute for comment.
- o December, 1989: DDDR&E(R&AT) distributes proposed review procedures for comment. Mr. Betti conditionally approves. The principal features are:
 - Four scheduled Steering Group reviews, followed by a full DAB review for the flight vehicle decision.
 - A "Program Concept/Baseline Paper" to be submitted by the Air Force prior to each Steering Group review.
 - A DAB S&T Committee meeting prior to each Steering Group review to identify issues and formulate guidance alternatives and recommendations.
- o January, 1990: PA&E, Comptroller, ODDR&E(S&TNF), OUSDA(AP&PI) concur with procedures, with minor revisions. DARPA, SDIO, and ODDR&E(T&E) do not reply, and their concurrence is assumed. Air Force objects to S&T Committee meetings and full DAB review; NASA objects to S&T Committee meetings; Navy and OSTP agree with Air Force.
- o February, 1990: The major issue can not be resolved. Air Force proposes to use NASP Quarterly Technical Reviews as substitute for DAB S&T Committee meetings. These meetings are not issue oriented, can not accommodate adequate OSD representation, and are not held in Washington.

- o March 29, 1990: Mr. Betti approves proposed procedures, with minor revisions. DAB S&T Committee meetings and full DAB review of flight vehicle decision are retained.
- o April 5, 1990: DDDR&E(R&AT) forwards a memo for USD(A) signature advising Steering Group members of the review procedures.
- o April 13, 1990: We are advised that the Air Force has discussed the review procedures with PDUSD(A), and the matter is "put on hold."
- o The next NASP Steering Group meeting is scheduled for November 21, 1990. The review procedures will be an unresolved issue from the last meeting.

REVIEW PROCESS FOR NASP STEERING GROUP

1. Purpose

The process to be used for review of the NASP program by the Steering Group is outlined here. The primary goals of this process are to ensure that issues needing resolution by the Steering Group are clearly identified, that guidance alternatives and recommendations are formulated, and that the Steering Group receives the relevant information for their deliberations. An additional important goal of this process is to minimize the administrative burden on program personnel. The membership of the Steering Group is shown in Annex A.

2. Terminology

The NASP program, in its conventional terminology, consists of two phases: Phase II, Technology Development; and Phase III, Experimental Flight Vehicle. The goal of Phase II is to develop and demonstrate technology which makes a single-stage-to-orbit experimental flight vehicle a feasible undertaking. The goal of Phase III is to demonstrate this technology integrated into an experimental flight vehicle. Within the DoD acquisition system, the NASP program is a science and technology program and in RDT&E category 6.3A, Advanced Technology Development.

The Phase II and Phase III terminology has sometimes caused confusion with the standard DoD acquisition milestones. Within the DOD acquisition system, the NASP program, in its entirety, is a pre-Milestone 0 program. If successful, the NASP program could form the basis for a subsequent Milestone 0 for an operational system.

3. Scheduled Review Points for Steering Group

There will be three scheduled Steering Group reviews of the NASP program, related to significant events in the program. These events and the current best estimates of the dates are:

1. October, 1991: Mid-term status review
2. April, 1992: Approve proceeding toward DAB review of Phase III decision
3. December, 1992: Full DAB review for Phase III Decision, to include appropriate Steering Group participation

Non-scheduled Steering Group meetings may be held as events dictate.

The following procedures apply to review of Phase II of the NASP program until Review 3; the procedures for this review will be addressed at a later time. Further, review procedures for Phase III are not addressed.

4. Documentation Requirements for Scheduled Reviews

a. Program Summary (Management Plan and Status)

This document, as outlined in Annex B, will be submitted by the Air Force to the Executive Secretary of the Steering Group at least 21 days prior to Reviews 1 and 2. Coordinated OSD/NASA comments on this draft will be returned to the Air Force within 7 days of receipt, in order that they can be addressed at the preparatory NASP Review Committee meeting (see Section 5).

b. Independent Cost Estimate

Prior to Review 2, a cost estimate for Phase III prepared by the NASP Joint Program Office (JPO) and an independent cost estimate prepared by appropriate DoD and NASA personnel will be reviewed by the OSD CAIG; the CAIG will brief the results of this review at the preparatory NASP Review Committee meeting.

c. Issues for Steering Group Consideration

A summary of issues, alternatives and recommendations resulting from the S&T Committee review (see Section 5) will be distributed by the Executive Secretary to all Steering Group members at least 7 days prior to each scheduled review.

d. Minutes of Steering Group Meeting

Draft minutes of all Steering Group reviews, reflecting the proceedings of the meeting, decisions made, guidance given, and actions to be taken, will be distributed by the Executive Secretary for review and comment within 10 days after each review. Concurrence will be obtained from all Steering Group members, and the final minutes will be distributed within 30 days after each review.

5. Preparation Through the NASP Review Committee

At least 10 days prior to a scheduled review, the NASP Review Committee will meet to consider issues and formulate guidance alternatives and recommendations. The membership of this Committee will include representatives from:

- | | |
|---------------------------|-----------------------|
| 1. DDDR&E(R&AT), Chairman | 8. SDIO |
| 2. COMPTROLLER | 9. DDDR&E(T&E) |
| 3. OUSD(A)[AP&PI] | 10. S&TNF |
| 4. OASD(PA&E) | 11. OAET, NASA |
| 5. AIR FORCE | 12. COMPTROLLER, NASA |
| 6. NAVY | 13. OSTP |
| 7. DARPA | 14. OSD(CAIG) |

At this meeting, the Air Force will be responsible for providing briefings which address issues raised by the documentation submitted; these briefings may include overall program status, independent cost estimates, and test results and plans.

The chairman shall endeavor to resolve as many potential issues as possible, and shall ensure that the remaining issues, alternatives and recommendations for Steering Group consideration are clearly identified.

6. Steering Group Review

The Executive Secretary shall formulate an agenda for each Steering Group review to consider the issues involved, and shall present a summary of the issues, alternatives and recommendations resulting from the NASP Review Committee review to the Steering Group.

NASP STEERING GROUP MEMBERSHIP

ANNEX A

UNDER SECRETARY OF DEFENSE FOR ACQUISITION, Chairman

DEPUTY ADMINISTRATOR, NASA, Vice-Chairman

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

ASSISTANT SECRETARY OF THE NAVY (RESEARCH, DEVELOPMENT AND ACQUISITION)

ASSISTANT SECRETARY OF THE AIR FORCE (ACQUISITION)

ASSOCIATE ADMINISTRATOR, OAET, NASA

DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

**DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY,
Honorary Member**

**DEPUTY DIRECTOR, DEFENSE RESEARCH AND ENGINEERING
(RESEARCH AND ADVANCED TECHNOLOGY),
Executive Secretary**

PROGRAM SUMMARY
(Outline)
(Not to exceed 30 pages)

ANNEX B

1. Brief Description of the Program: One short paragraph.
2. History: Summarize any previous major guidance, decisions, and congressional actions, including those of current fiscal year.
3. Mission Area and Role: The mission area is Science and Technology. Briefly describe how the NASP program supports the mission area in both broad and specific terms.
4. Threat Assessment: Describe the threat addressed by the NASP program (e.g., needs for ready access to space, other military needs, aerospace leadership, foreign programs to develop similar capabilities, etc.).
5. Cooperative Opportunities: Assess the advantages and disadvantages of a cooperative program with one or more of the Allied nations. Include a recommendation as to whether the United States government should explore the feasibility of a cooperative program.
6. Description of the Program: Sufficient description of the program to enable the uninitiated to understand the program goals, major activities (e.g., airframe, engine, materials, technology maturation) and their relationships. Include a high-level Work Breakdown Structure.
7. Organization and Responsibilities: Briefly describe management structure, reporting, and reviews.
8. Acquisition Strategy: Discuss general strategy for the entire program, and detailed strategy for Phase III. Specifically address competition, contracting, and streamlining.
9. Phase II Exit Criteria: Vehicle Design and Performance and Characteristics: See Attachment 1 for notional examples. Include Phase III Estimated Cost and Duration. Discuss as appropriate.
10. Phase II Exit Criteria: Level of Technology Demonstration: See Attachment 1 for notional examples. Discuss risks of satisfying these criteria but not satisfying the criteria in Section 9 above. Include description of test plans. Include tracking milestones (see Attachment 2 for notional examples) and discuss their relationship to the relevant exit criteria.
11. Schedule: Major tasks, tracking milestones and overall status.

12. Program Status: Discuss: (1) current status of X-30 vehicle design and performance characteristics, including expected values and uncertainty bands; (2) overall program status with respect to satisfying Phase II Exit Criteria in Section 9 above, including any failure to meet program thresholds and related recovery plans; (3) overall program status with respect to satisfying Phase II Exit Criteria in Section 10 above, including test results, any failure to meet a tracking milestone and related recovery plans; and (4) identified alternatives for Phase III flight vehicles, including discussion of technical risks for each, given that Phase II Exit Criteria are satisfied, and implications on cost and schedule of Phase III.
13. Cost: Include cost status of Phase II, a brief discussion of cost-estimating methodology for Phase III and, by Review 1, a reasonably detailed parametric cost estimate for Phase III which will be updated with more detail as the Phase III decision point is approached.
14. Known Issues: Discuss issues identified by participating organizations.
15. Decisions Needed: Summarize necessary decisions.

PHASE II EXIT CRITERIA
(Illustrative)

ANNEX B
ATTACHMENT 1

VEHICLE DESIGN AND PERFORMANCE CHARACTERISTICS

	<u>Goal</u>	<u>Threshold</u>
Payload	2500 lbs	2000 lbs
Gross Take-Off Weight	250,000 lbs	300,000 lbs
Uncertainty in GTOW	10%	20%
Maximum Speed	Orbital (Polar)	Orbital (Easterly)
Life	150 flts	20 flts
Fuel	Liquid H ₂	Slush H ₂
Phase III Cost	\$5 billion	\$6 billion
Phase III Duration	5 years	6 years

LEVEL OF TECHNOLOGY DEMONSTRATION

Definition of Demonstration Levels

METHOD	ANALYTICAL DATA	EXPERIMENTAL DATA
A-Actual Model	1- Actual Cond	1- Actual Cond
B-Large-Scale Experiment	2- Real Gas	2- Equivalent Cond
C-Small-Scale Experiment	3- 3-dimensional	3- Simulated Cond
D-Simulated Experiment	4- 2-dimensional	4- Detailed Data
E-Analysis/Computation	5- 1-dimensional	5- General Data

Critical Demonstrations

Airframe	
Weight	E1: 25,000 lbs +5%
Structure	C4: Integrity at $M=13$
Drag	C2: $C_D = xx$, $C_L = xx$ at $M = xx$ E1: $0 < M < 25$, +10%
Inlet Performance	C2: $\eta_{KE} = 0.99 + 0.5\%$ at $M = 15$ E1: $0 < M < 25$, +1.0%
Nozzle Performance	C2: $C_{t_0} = 0.98 + 0.5\%$ at $M = 15$ E1: $0 < M < 25$, +1.0%
Engine Module Performance	
Weight	E1: 24,000 lbs +5%
Structure	C4: Integrity at $M=13$
Low Speed System	B1: $0 < M < 3$
Ramjet	B2: $L_{\eta} = 2300 + 5\%$, Thrust = $xx + 5\%$ @ $M = 5$ E1: $2 < M < 6$, +10%
Scramjet	B2: $L_{\eta} = 1500 + 5\%$, Thrust = $xx + 5\%$ @ $M = 8$ E1: $6 < M < 15$, +10%
High-Speed Rocket	E1: $15 < M < 25$, +5%

TRACKING MILESTONES (Illustrative)

ANNEX B ATTACHMENT 2

As defined here, tracking milestones are the key program events leading to the satisfaction of Phase II Exit Criteria. Each such event must accordingly be related to one or more of the exit criteria. The following list is intended to be illustrative.

<u>MILESTONE</u>	<u>DATE</u>	<u>RELATED EXIT CRITERION</u>
<u>Airframe</u>		
Materials Candidates Characterized	6/89	Weight, Structure
Materials Selected	9/89	.
Materials Components Fabricated	3/90	.
Component A		.
Component B		.
...		.
Materials Components Demonstrated	9/92	.
Component A		.
Component B		.
...		
Drag Design Data Obtained	4/91	Drag
Vehicle Drag Demonstrated	6/92	.
Vehicle Drag Estimated	9/92	.
Inlet Preliminary Design Data Obtained	3/89	Inlet Performance
Inlet Design Data Obtained	3/90	.
Inlet Component Performance Demonstrated	9/91	.
Nozzle Preliminary Design Data Obtained	3/89	Nozzle Performance
Nozzle Design Data Obtained	3/90	.
Nozzle Component Performance Demonstrated	9/91	.
<u>Engine Module</u>		
Materials Candidates Characterized	6/89	Weight, Structure
Materials Selected	9/90	.
Combustor Design Data Obtained	3/90	Scramjet Performance
Combustor Performance Demonstrated	3/91	.
Critical Design Review	3/91	All Engine Criteria
First Engine Module to Test	3/92	Engine Perf Criteria
Engine Module Low-Speed Performance Demo	6/92	Low-Speed Performance
Engine Module High-Speed Performance Demo	9/92	Ramjet, Scramjet Perf

TAB D

DOD/NASA NASP MOU: DISCUSSION/RECOMMENDATIONS

- o CURRENT DOD/NASA MOU DOES NOT CONTAIN THE CORRECT STEERING GROUP MEMBERSHIP
 - DEPUTY NASA ADMINISTRATOR NEEDS TO BE ADDED AS VICE CHAIR
 - A FEW TITLES NEED TO BE UPDATED
- o FUNDING PROFILE IS ALSO OUT OF DATE
 - NO NEED TOO UPDATE FUNDING PROFILE (IT IS ALMOST ALWAYS OUT OF DATE)
- o RECOMMEND THAT ANNEX A TO THE MOU (STEERING GROUP MEMBERSHIP) BE REVISED VIA MEMO SIGNED BY USD(A) AND DEPUTY ADMINISTRATOR, NASA
 - VISIBILITY OF NASP PROGRAM LEADS TO OCCASIONAL REQUESTS FOR THE MOU, SO BEST TO KEEP IT AS UP TO DATE AS NECESSARY

(The current version of the MOU is attached)

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE DEPARTMENT OF DEFENSE
AND
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
FOR THE CONDUCT OF
THE NATIONAL AERO-SPACE PLANE PROGRAM

(Revision B)

PURPOSE

The purpose of this Memorandum of Understanding (MOU) is to establish the mechanisms for the joint conduct of a National Aero-Space Plane (NASP) Program by the Department of Defense (DoD) and the National Aeronautics and Space Administration (NASA).

OBJECTIVE

The National Aero-Space Plane Program is a technology program to provide the basis for hypersonic flight vehicles that will result in space transportation systems, superior U.S. military aircraft, and civil transports that will have technical, cost and operational advantages over existing systems into the next century. The objective of the NASP Program is to develop, and then demonstrate in an experimental flight vehicle, the requisite technologies to permit the Nation to develop both military and civil vehicles capable of operating at sustained hypersonic speeds within the atmosphere and/or as space launch vehicles with the capability of delivering payloads into orbit. The NASP is envisioned to be an airbreathing, hydrogen-fueled, horizontal takeoff and landing vehicle with single-stage-to-orbit capability.

BACKGROUND

During the past decade, substantial progress has been made in hypersonic airbreathing propulsion, advanced materials and structures, and computational technologies contributing to the consensus that operational hypersonic/transatmospheric vehicles may be possible around the turn of the century. However, establishing a valid data base, including the interactive solutions to the propulsion, structures, and aerodynamic problems, is dependent upon accelerating ground-based technology development and verifying the results at sufficient scale in flight over the entire speed range. The DOD and NASA, having engaged in an aerospace plane concept feasibility study in 1984-1985, and having considered the additional technology and operational data needed to support potential future applications, have concluded that the combined objectives and the National interest are best served by a joint program.

PROGRAM DESCRIPTION

The first phase (Phase I) was a Defense Advanced Research Projects Agency (DARPA) concept feasibility study (Copper Canyon) that began in 1982 and concluded in 1985 with NASA, Air Force and Navy participation in the latter part of the study. The study results form a point of departure for the NASP Program.

The NASP Program consists of two phases: Phase II, Technology Development and Application Studies, and Phase III, Experimental Flight Vehicle. The goals of Phase II are to (1) demonstrate the technology maturity, and (2) provide the supporting utility and survivability assessments of potential applications before committing to an experimental flight vehicle. The results of Phase II will be the basis for a decision, prior to the commitment of large resources, on whether to proceed to Phase III. The goal of Phase III is to accomplish sufficient flight demonstration to provide a verified technological basis for future operational vehicles.

PROGRAM DIRECTION

The NASP Program is governed by this MOU between the Secretary of Defense and the NASA Administrator. Under the broad framework of this MOU, the Under Secretary of Defense for Acquisition (USD(A)) and the Associate Administrator, Office of Aeronautics and Space Technology (AA/OAST) are responsible for DoD and NASA participation in the program through a NASP Steering Group. Annex A to this MOU establishes the Terms of Reference and membership for the Steering Group. The Steering Group will provide policy, guidance, and broad programmatic direction and will have issue resolution authority. The Steering Group will make the decision whether to proceed to Phase III, which will be subject to the consent of the Secretary of Defense and the NASA Administrator. The Steering Group will be chaired by USD(A) with AA/OAST as vice-chair.

ORGANIZATION AND RESPONSIBILITIES

The DoD is responsible for overall management of the joint NASP program. Within this program NASA has lead responsibility for civil applications and an integral role in the overall program. Personnel from both agencies will participate in all phases of the technology development, application studies and the design, fabrication, and flight test of experimental flight vehicles. Within the DoD, the Air Force has been assigned the overall responsibility for the NASP program.

The Air Force will maintain the NASP Joint Program Office (JPO) at Wright-Patterson Air Force Base, Ohio with an Air Force Program Manager (PM), a NASA Principal Deputy, and Air Force, Navy and NASA Deputies. The management responsibilities within the JPO will be shared jointly between DoD and NASA. The JPO is responsible for planning and conducting Phase II and Phase III of the NASP program. All JPO Deputies and Directors will be located full time at the JPO.

The Air Force shall establish a NASP Inter-Agency Office (NIO) reporting directly to the Assistant Secretary of the Air Force for Acquisition, with an Air Force Director, a NASA Principal Deputy, and joint Air Force, Navy and NASA staffing. The NIO is responsible for coordination and oversight of policy, budgetary, program progress, congressional and public affairs, and other matters, as required.

SECURITY

The joint DoD/NASA NASP Program Security Guide will be maintained by the JPO; proposed changes will be submitted to the Steering Group for concurrence. Overall security cognizance will be maintained by the Air Force. For NASA, the focal point for security cognizance will be NASA Headquarters. The JPO will have primary responsibility for implementing and managing NASP program security procedures.

PUBLIC AFFAIRS/LEGISLATIVE MATTERS

Guidelines for public affairs activities will be prepared by DoD and NASA, and will be submitted to the Steering Group for approval. Both DoD and NASA will retain the right to release, within these guidelines, information in their respective areas of responsibility. Approval for public affairs activities will be obtained through the normal DoD or NASA channels in accordance with these guidelines.

Although each organization will have specific responsibility for legislative inquiries from their respective oversight committees, prior coordination will be accomplished.

PROGRAM PLANS

The Program Management Plan (PMP) for the overall NASP program will set forth program goals, major tasks and milestones, organization and responsibilities, resources and procurement approach. The PMP will also define a resource allocation and control system. The PMP will be reviewed annually, updated as required, and will be approved by the Steering Group. For substantive changes to the program, approval to proceed must be obtained from the Steering Group prior to change implementation. Updates for the PMP will be the responsibility of the JPO.

RESOURCES

For planning purposes, the funding required for the NASP program is currently estimated to be (then-year dollars in millions):

	Prior	FY88	89	90	91	92	93	94	95	96
DoD	155	183	245	300	390	425	425	413	357	125
NASA	78	70	104	149	119	72	46	46	46	38

DoD and NASA will provide this funding in accordance with the PMP, and their own internal administrative procedures, subject to the availability of funds or other constraints which may be imposed on DoD and NASA. DoD and NASA will be individually responsible for providing accountability for the funds appropriated to their respective agencies by the Congress which are applied to the joint program. Proposed changes in program funding will be reviewed by the Steering Group. Changes endorsed by the Steering Group will be recommended to each agency for approval, allocated on a pro-rata share based on the percentage of each agency's funding for any particular year affected, unless specified otherwise. Each agency will endeavor to provide its share of any recommended increases in program funding. Appropriate institutional support will also be provided by each agency.

DURATION

This MOU will remain in effect when signed by both parties until or unless modified or extended by mutual agreement. Either party to this MOU may terminate its participation upon 120 days written notice to the other party. In the case of such a termination the party terminating will undertake payment of costs incurred up to the point of termination.

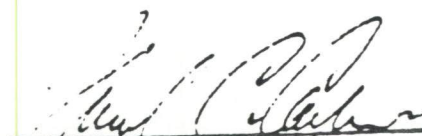
MOU REVIEW

If the Steering Group determines the NASP Program is to proceed to Phase III, this MOU will be reviewed for its applicability and revised as necessary.

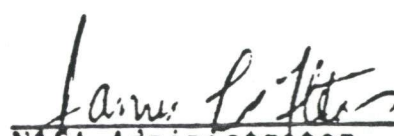
SIGNATURES

Department of Defense

National Aeronautics and
Space Administration


Secretary of Defense

Date: 31 AUG 1988


NASA Administrator

Date: SEP 27 1988

ANNEX A

TERMS OF REFERENCE

NATIONAL AERO-SPACE PLANE STEERING GROUP

I. PURPOSE

The purpose of this Group is to provide policy, guidance, and broad programmatic direction for the conduct of the National Aero-Space Plane Program.

II. SCOPE

The scope includes current and future phases of the National Aero-Space Plane Program which are concerned with technology development and demonstration, but does not include any subsequent phases which may be devoted to operational systems development.

III. MEMBERSHIP

Chairman: Under Secretary of Defense
(Acquisition) (USD(A))

Vice Chairman: National Aeronautics and Space
Administration, Associate Administrator for
Aeronautics and Space Technology (AA/OAST)

Executive Secretary: Deputy Under Secretary of Defense
(Research and Advanced Technology)
DUSD (R&AT)

Members: Director of Defense Research and
Engineering (DDR&E)

Assistant Secretary of the Navy
(Research, Engineering and Systems) ASN(RE&S)

Assistant Secretary of the Air Force
(Acquisition) ASAF(A)

Director, Defense Advanced Research Projects
Agency (DARPA)

Director, Strategic Defense Initiative Office
(SDIO)

Honorary Member: Director, Office of Science and Technology
Policy (OSTP)

ANNEX A

IV. RESPONSIBILITIES

The Group is responsible for:

1. Ensuring that the Program is conducted in accordance with this MOU.
2. Periodically reviewing progress of the Program.
3. Providing policy, guidance and broad programmatic direction for the conduct of the Program, consistent with both the needs of the Program and the other needs of the organizations involved.
4. Resolving such policy and guidance issues as may be brought before it.

V. PROCEDURES

1. The Group shall meet, at the call of the Chairman or Vice Chairman, as needed to fulfill its responsibilities.
2. Records of such meetings will be maintained by the Executive Secretary, and distributed to all Group members.
3. The Executive Secretary is responsible for all administrative and procedural matters related to the functioning of the Group.

ANNEX A

TAB E

PHASE II EXIT CRITERIA ISSUES: DISCUSSION/RECOMMENDATIONS

- o VEHICLE WEIGHT THRESHOLD OF 425,000 LBS
 - VEHICLE OF THIS SIZE TO CARRY LITTLE PAYLOAD TO EASTERLY ORBIT RAISES QUESTIONS ABOUT EVENTUAL OPERATIONAL UTILITY BASED ON THIS TECHNOLOGY
 - VEHICLE SIZE ALSO SIGNIFICANTLY INFLUENCES COST OF PHASE III
 - COUNTER ARGUMENT TO OPERATIONAL UTILITY IS THAT VEHICLE IS MERELY A RESEARCH AIRCRAFT
 - RECOMMEND ACCEPTANCE OF 425,000 LBS
- o NO DEMONSTRATION OF NEEDED ENGINE MATERIALS IN ENGINE
 - NOT A GOOD DEMONSTRATION IN PHASE II OF TECHNOLOGY NEEDED IN PHASE III
 - REQUIRING SUCH A DEMONSTRATION WOULD INCREASE COST AND TIME OF PHASE II (NO ESTIMATE AVAILABLE)
 - HIGH PROBABILITY THAT PHASE III WILL ENCOUNTER SIGNIFICANT DELAYS AND COST INCREASES WHILE NEEDED MATERIALS ARE BEING DEVELOPED AND INCORPORATED INTO ENGINE
 - COUNTER ARGUMENT IS THAT DEMONSTRATION OF SPECIMEN MATERIALS IN ENGINE ENVIRONMENT, BUT NOT IN ENGINE CONFIGURATION, IS ACCEPTABLE
 - RECOMMEND:
 - CONDITIONAL ACCEPTANCE OF JPO CRITERIA
 - JPO BE TASKED TO PROVIDE ESTIMATE OF COST AND TIME REQUIRED TO INCORPORATE NEEDED MATERIALS IN ENGINE DEMONSTRATION WITHIN SIX MONTHS FOR STEERING GROUP REVIEW

TAB E

NASP PROGRAMMATIC/TECHNICAL STATUS
(STAFF ASSESSMENT)

- o **GOOD PROGRESS MADE IN DEVELOPMENT AND SELECTION OF AIRFRAME MATERIALS**
- o **OBTAINED SUBSTANTIAL DATA ON ENGINE COMPONENT PERFORMANCE**
 - **MORE REALISTIC BASIS FOR ENGINE PERFORMANCE ESTIMATES**
- o **TEAMING SHOULD INCREASE PACE OF TECHNOLOGY DEVELOPMENT (AFTER START-UP PROBLEMS ARE OVERCOME)**
- o **TWO AREAS OF MAJOR TECHNICAL CONCERN:**
 - **ESTIMATED VEHICLE WEIGHT INCREASING DUE TO LACK OF SUFFICIENT SUCCESS WITH CERTAIN AIRFRAME MATERIALS**
 - **LACK OF PROGRESS IN ENGINE MATERIALS – UNLIKELY ENGINE MODULE WITH NEEDED MATERIALS CAN BE EVALUATED BEFORE SCHEDULED PHASE III DECISION DATE (3Q, FY93)**
- o **SINGLE-STAGE-TO-ORBIT (SSTO) VEHICLE STATUS:**
 - **ROUGHLY 250,000 - 300,000 LBS GTOW FOR NO PAYLOAD, EASTERLY ORBIT**
 - **SENSITIVITIES ARE HIGH**
 - **SCHEDULE CANNOT BE MET**
- o **PHASE II RISK AND UNCERTAINTY REMAIN HIGH**
 - **PHASE II COST NOW ESTIMATED AT \$1.8 BILLION (WAS \$600 MILLION IN DEC 85)**
 - **UNLIKELY TO DEMONSTRATE TECHNOLOGY REQUIRED FOR SSTO BY FY93**
- o **SSTO FLIGHT VEHICLE PROGRAM COST PROBABLY IN EXCESS OF \$10 BILLION**

TAB 9

PHASE III ISSUES: DISCUSSION/RECOMMENDATIONS

- o PHASE III VEHICLE PLAN - FIRST VEHICLE HAS NO CAPABILITY FOR SSTS
 - JPO PLAN IS TO INTRODUCE MORE ADVANCED TECHNOLOGY SEQUENTIALLY
 - WILL INVOLVE MAJOR MODIFICATIONS DURING COURSE OF PHASE III
 - RECOMMEND A DETAILED ASSESSMENT OF MODIFICATIONS REQUIRED BY NEXT STEERING GROUP MEETING

- o PHASE III AFFORDABILITY - SSTS COST PROBABLY IN EXCESS OF \$10 BILLION
 - JPO PLAN IS TO HAVE A COST ESTIMATE FOR PHASE III AT END OF FY91
 - CURRENTLY PLANNED PHASE III INVESTMENT THROUGH FY97 - \$2.6B+
 - IF STEERING GROUP IS NOT PREPARED TO ACCEPT SUBSTANTIAL INCREASES OVER PLANNED AMOUNTS, THEN SSTS VEHICLE FOR PHASE III WOULD HAVE TO BE ABANDONED
 - IF SUBSTANTIAL INCREASES OVER PLANNED AMOUNTS ARE ACCEPTABLE, THEN THEY WILL NEED TO BE BUDGETED IN THE FY93 ABS
 - RECOMMEND JPO BE TASKED TO PROVIDE BEST ESTIMATES OF PHASE III COSTS WITHIN SIX MONTHS FOR STEERING GROUP REVIEW; INCLUDING A BREAKDOWN INTO:
 - FIRST VEHICLE COSTS
 - SUBSEQUENT VEHICLE MODIFICATION COSTS
 - TECHNOLOGY DEVELOPMENT COSTS

SUMMARY OF PROGRAM RECOMMENDATIONS

- o **CONDITIONALLY ACCEPT PHASE II EXIT CRITERIA PENDING REVIEW OF ESTIMATED REQUIREMENTS TO INCORPORATE ENGINE MATERIALS DEMONSTRATION; EXAMINE RESTRUCTURE OF PHASE III TO FIRST VEHICLE ONLY FOLLOWED BY VEHICLE MODIFICATIONS**
 - **BOUNDS PHASE II TIME AND COST PENDING ENGINE MATERIALS DEMONSTRATION**
 - **EXTENDS DURATION OF PHASE III**
 - **WOULD NOT NEED TO COMMIT TO ALL OF PHASE III IN FY93**

TAB H

NASP PROGRAM BACKGROUND

- o GOAL TO DEMONSTRATE TECHNOLOGY REQUIRED FOR AIRBREATHING VEHICLES ULTIMATELY CAPABLE OF SINGLE-STAGE-TO-ORBIT (SSTO)
- o JOINT WITH NASA; GOVERNED BY MOU
 - DOD HAS OVERALL MANAGEMENT RESPONSIBILITY; AIR FORCE LEAD
- o TWO-PHASE PROGRAM
 - PHASE II: TECHNOLOGY DEVELOPMENT
 - PROPULSION SYSTEM MODULE DEVELOPMENT
 - AIRFRAME DESIGN/COMPONENT DEVELOPMENT
 - TECHNOLOGY MATURATION
 - PHASE III: EXPERIMENTAL FLIGHT VEHICLE
- o MAJOR TECHNOLOGY ISSUES
 - HIGH SPEED SUPERSONIC COMBUSTION RAMJET (SCRAMJET) PERFORMANCE
 - LIGHT WEIGHT, HIGH TEMPERATURE COMPOSITE MATERIALS
 - EXTERNAL AERODYNAMIC PERFORMANCE
- o PERSISTENT CONFLICT BETWEEN "EVENT-DRIVEN" AND "SCHEDULE-DRIVEN" PROGRAM
- o HIGHLY POLITICAL PROGRAM - NATIONAL SPACE COUNCIL REVIEW IN 1989 RESULTED IN PRESIDENTIAL DIRECTION (SEE TAB L)

TAB I

NASP PROGRAM ADMINISTRATIVE/BUDGETARY STATUS - I

- o LAST STEERING GROUP MEETING: OCTOBER 20, 1989
- o PENDING ACTIONS/STATUS:
 - PHASE II EXIT CRITERIA, TRACKING MILESTONES/REPORT THIS MEETING
 - PHASE III EXPERIMENTAL FLIGHT VEHICLE OPTIONS/REPORT THIS MEETING
 - ACQUISITION STRATEGY FOR ONE AIRFRAME-ENGINE TEAM/REPORT THIS MEETING
 - REVISION C OF DOD-NASA MOU/ON HOLD (ONLY CHANGE REQUIRED IS STEERING GROUP MEMBERSHIP)
 - DRAFT PROCEDURES FOR STEERING GROUP REVIEW/COMPLETED; NOT IMPLEMENTED-ISSUE FOR THIS MEETING
- o ARRANGEMENTS HAVE BEEN MADE FOR ONE TEAM COMPOSED OF ALL FIVE CONTRACTORS (ROCKWELL, GENERAL DYNAMICS, McDONNELL DOUGLAS, PRATT & WHITNEY, ROCKETDYNE)

o	FY91 APPROPRIATIONS OUTCOME:	<u>REQUEST</u>	<u>APPROPRIATION</u>
	DOD	158	163
	NASA	<u>119</u>	<u>95</u>
	TOTAL	277	258

o HISTORICAL AND PLANNED FUNDING

	<u>PRIOR</u>	<u>FY90</u>	<u>FY91</u>	<u>FY92</u>	<u>FY93</u>	<u>FY94</u>	<u>FY95</u>	<u>FY96</u>	<u>FY97</u>
DOD	569	194	163	233	330	388	425	475	525
NASA	<u>238</u>	<u>60</u>	<u>95</u>	<u>72</u>	<u>120</u>	<u>145</u>	<u>175</u>	<u>200</u>	<u>TBD</u>
TOTAL	807	254	258	305	450	533	600	675	TBD

NASP PROGRAM ADMINISTRATIVE/BUDGETARY STATUS - II

FY 1991 AUTHORIZATION CONFERENCE LANGUAGE (TAB M)

- o **REQUIRES A SECDEF REPORT TO THE COMMITTEES BY MARCH 15, 1991, THAT INCLUDES:**
 - **MILITARY REQUIREMENTS AND MISSIONS FOR NASP**
 - **RATIONALE FOR CONTINUED DoD FUNDING**
 - **LATEST COST, SCHEDULE AND MILESTONE DATA; DoD/NASA PLANNED FUNDING SHARES; TECHNICAL RISK ASSESSMENT; PRIORITY RANKING OF NASP IN DoD'S OTHER ADVANCED TECHNOLOGY AND SPACE ACCESS PROGRAMS**
- o **REQUIRES UP TO \$2 MILLION FOR DARPA TO ASSESS ORIGINAL "GOVERNMENT BASELINE" VEHICLE (TAB M)**
 - **STEERING GROUP REVIEW OF RESULTS REQUIRED**
 - **REPORT TO COMMITTEES BY MAY 1, 1991**

TAB J



OFFICE OF THE DIRECTOR OF
DEFENSE RESEARCH AND ENGINEERING

WASHINGTON, DC 20301

29 NOV 1989

(R&AT)

MEMORANDUM FOR MEMBERS OF THE NATIONAL AERO-SPACE PLANE (NASP)
STEERING GROUP

SUBJECT: Minutes of the Fifth NASP Steering Group Meeting

The final version of the minutes of the October 20, 1989,
meeting is attached.

George P. Millburn
for George P. Millburn
Executive Secretary
NASP Steering Group

Attachment

Distribution:

Mr. Betti
Mr. Thompson, NASA
Dr. Rosen, NASA
Dr. Bromley, OSTP
Dr. Duncan
Mr. Rumpf, ASN(RE&S)
Mr. Welch, SAF/AQ
Dr. Fields, DARPA
Lt. Gen. Monahan, SDIO

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Minutes	Minutes of NASP Steering Group meeting (7 pp.)	10/20/89	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: National Security Files
WHORM Cat.:
File Location: [National Aero-Space Plane] [2 of 4] [1990]

Date Closed:	5/12/2010	OA/ID Number:	62071-015
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
 P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
 P-3 Release would violate a Federal statute [(a)(3) of the PRA]
 P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
 P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
 P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
 (b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
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 (b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
 (b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
 (b)(9) Release would disclose geological or geophysical information

TAB K.

STEERING GROUP MEMBERS

MR. BETTI	USD(A)	CHAIRMAN
MR. THOMPSON	DEP ADM, NASA	VICE-CHAIRMAN
DR. HERZFELD	DDR&E	
MR. WELCH	SAF/AQ	
MR. CANN	ASN(RD&A)	
DR. REIS	DIR, DARPA	
AMB. COOPER	DIR, SDIO	
MR. ALDRICH	AA/OAET/NASA	
DR. BROMLEY	DIR, OSTP	HONORARY MEMBER
MR. SIEWERT	DDDR&E(R&AT)	EXECUTIVE SECRETARY

OTHER MAIN PARTICIPANT

DR. BARTHELEMY	NASP JPO	NASP PM
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TAB L

**NATIONAL SPACE COUNCIL
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20500**

July 20, 1989

MEMORANDUM FOR MS. EMILY L. WALKER
Executive Secretary
Department of Treasury

MR. FRANK HODSOLL
Associate Director
Office of Management
and Budget

MR. J. STAPLETON ROY
Executive Secretary
Department of State

MR. G. PHILIP HUGHES
Executive Secretary
National Security Council

COL. GEORGE P. COLE JR.
Executive Secretary
Department of Defense

DR. THOMAS RONA
Acting Director
Office of Science and
Technology Policy

MR. CRAIG R. HELSING
Chief of Staff
Department of Commerce

MR. H. LAWRENCE SANDALL
Executive Secretary
Central Intelligence
Agency

MS. RUTH KNOUSE
Director, Executive
Secretariat
Department of
Transportation

MR HENRY E. CLEMENTS
Executive Officer
National Aeronautics and
Space Administration

CAPT ANTHONY MANESS
Executive Assistant to the
Chairman
Joint Chiefs of Staff

FROM:

MARK J. *[Signature]*

SUBJECT:

Presidential Decision on the National Aero-Space
Plane

The President has approved the following policy with regard to the National Aero-Space Plane (NASP) program.

"The United States will continue the NASP program as a high priority national effort to develop and demonstrate hypersonic technologies with the ultimate goal of single-stage-to-orbit. The government will complete the Phase II technology development program and plan to develop an experimental flight vehicle after completion of Phase II, if technically feasible. Performance of the experimental flight vehicle will be constrained to the minimum necessary to meet the highest priority research, as opposed to operational, objectives. Unmanned as well as manned designs will be considered and the program will

be conducted in such a way as to minimize technical and cost uncertainty associated with the experimental vehicle."

The President also approved the following actions to implement the policy decision.

- o Retain an appropriate joint DOD/NASA management structure.
- o Restructure the NASP technology program to focus only on research and technology objectives.
- o Extend the technology development phase of the program approximately 2 1/2 years and plan to begin experimental flight vehicle development in early 1993. The Space Council will review the program prior to initiation of vehicle development.
- o Within currently approved DOD budget levels, increase NASP funding by \$27 million in FY 1990, \$158 million in FY 1991, \$233 in FY 1992 and by appropriate amounts in FY 1993 and FY 1994.

TAB M

AUTHORIZATION CONFERENCE LANGUAGE

(From H.R. 101-923, October 23, 1990)

530

National Aero-Space Plane technology program

The House bill would authorize \$158 million for the National Aero-Space Plane (NASP) program, which is the amount contained in the amended budget request.

The Senate amendment would terminate further participation by the Defense Department in the joint DoD/NASA program.

The conferees agree to authorize \$119 million for NASP and to require the Secretary of Defense to provide a report to the Congressional defense committees by March 15, 1991, identifying the military requirements and missions for NASP and the rationale for continued DoD funding for this program. The report should include the most recent cost, schedule, and milestone data; planned funding shares between DoD and NASA; a technical risk assessment; and a priority ranking of NASP in relation to DoD's other advanced technology and space access programs.

Within the authorization of \$119 million for the NASP program, up to \$2 million would be authorized for the Defense Advanced Research Projects Agency to conduct an independent configuration study. The purpose of this independent study is to revise the design, and the analysis that supported the design, of the original government baseline configuration (including its air-breathing propulsion system) based on the latest NASP technical findings and to compare the results to the current NASP baseline configuration. The results of this independent study shall be provided to the NASP Steering Group chaired by the Under Secretary of Defense for Acquisition. The Steering Group shall evaluate the results of the independent study and provide its findings to the Congressional defense committees by May 1, 1991.

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02. Talking points	Talking points for NASP Steering Group Meeting (2 pp.)	11/21/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: National Security Files
WHORM Cat.:
File Location: [National Aero-Space Plane] [2 of 4] [1990]

Date Closed:	5/12/2010	OA/ID Number:	62071-015
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 (b)(9) Release would disclose geological or geophysical information

12/5/90

NATIONAL AERO-SPACE PLANE (NASP): CANCEL PHASE 3

DESCRIPTION: JOINT DOD/NASA PRESIDENTIALLY-DIRECTED, AF-LED NATIONAL PROGRAM FOR A HYPERSONIC FLIGHT/SINGLE-STAGE-TO-ORBIT RESEARCH AIRCRAFT. FUNDS PHASE 2 TECHNOLOGY DEV. CANCELS PHASE 3 FLIGHT VEHICLE FABRICATION/DEMONSTRATION.

FUNDING:	(\$M)	FY91	FY92	FY93	FY94	FY95	FY96	FY97
BES:		163.0	233.0	330.0	388.4	425.0	475.0	525.0
PBD: 216		163.0	233.0	330.0	388.4	425.0	475.0	525.0
634		163.0	228.0	330.0	388.4	425.0	475.0	525.0
MBI:	N/A	PBD 216 PROPOSED PHASE 3 CANCELLATION. MBI CANDIDATE. AF SUCCESSFULLY RECLAMA'D. FULL BES FUNDING RESTORED.						
GUIDANCE:		163.0	203.0	31.0	0.0	0.0	0.0	0.0
PREFERRED REV:		163.0	233.0	170.0	0.0	0.0	0.0	0.0

THIS IS THE AF POSITION

ALTERNATIVE 1:

- COMMENT:**
- PBD 634 REDUCED FY92 BY \$5M BASED ON CONGR \$5M FY91 PLUS UP.
 - THE AF PREFERRED REVISION REFLECTS THE ACTUAL PHASE 2 COSTS.
 - PREEMPTS 1993 SPACE COUNCIL DECISION ON FLIGHT VEHICLE PHASE.

12/5/90

NASP - CANCEL PHASE 3

(U) BACKGROUND:
JOINT PRESIDENTIALLY-DIRECTED, AF-LED NAT'L PGM FOR A HYPERSONIC AEROSPACE RESEARCH VEH. THE NASP WILL BE AN AIRBREATHING, LIQUID HYDROGEN FUELED, SINGLE-STAGE-TO-ORBIT, SCRAMJET VEH. TWO X-30 RESEARCH VEH WILL BE BUILT & FLIGHT TESTED IN PHASE 3 TO DEMONSTRATE CONCEPTS, UTILITY, & TECHNOLOGIES.

	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
3018 NATIONAL AERO-SPACE PLANE	158.0	233.0	330.0	388.4	425.0	475.0	525.0
RD&E ONLY							
J763 NASP - CANCEL PHASE 3	5.0	0.0	-160.0	-388.4	-425.0	-475.0	-525.0

END STRENGTH OFFICER
ADJUSTMENT ENLISTED
 CIVILIAN

N O N E

(U) JUSTIFICATION:
CANCELS PHASE 3 FLIGHT VEHICLE FABRICATION/DEMO. TERMINATES REVOLUTIONARY TECHNOLOGY WITH SIGNIFICANT IMPLICATIONS TO FUTURE WARFIGHTING CAPABILITY, LOW COST SPACE ACCESS, & US AEROSPACE LEADERSHIP. PREEMPTS 1993 SPACE COUNCIL DECISION ON FLIGHT VEHICLE PHASE-TERMINATES PRESIDENTIAL INITIATIVE

MARGINALIA:

27 NOV 90 CINCSAC & AFSPACECON/CC NOA "COMMITTING BOTH COMMANDS TO ADVOCATING THIS DEVELOPMENT PROGRAM (NASP)." THE AF FUNDING PROFILE (SHOWN) REFLECTS THE ACTUAL PHASE 2 COSTS. PBD 216 PROPOSED CANX NASP AFTER PH 2 (MBI CANDIDATE); SECDEF RECLAMATION; DEPSECDEF FULLY FUNDED NASP-NO SLIP. PBD 634 CUTS \$5M IN 92. EXPECT STRONG NEGATIVE CONGR REACTION DIRECTED AT AF.

PBD 216: TERMINATE NASP PHASE III (FLT DEMO)

PBD RATIONALE:

THE NATIONAL AEROSPACE PLANE (NASP) PHASE III IS UNAFFORDABLE; PROGRAM OBJECTIVES HAVE BEEN COMPROMISED BY EASING PHASE II (TECH DEV) EXIT CRITERIA; AND \$30.0M OF FY 1992 FUNDS WILL NOT BE OBLIGATED UNTIL FY 1993.

OSD PROPOSAL:

REDUCE FY 1992 FUNDING BY \$30.0M AND INCREASE FY 1993 FUNDING BY \$31.1M, AND DELETE ALL PHASE III FUNDING.

AF RESPONSE:

ACTION PREEMPTS FY 1993 PHASE III DECISION AND USURPS NATIONAL SPACE COUNCIL REVIEW. PREMATURELY TERMINATES TECHNOLOGY PROGRAM SECAF FEELS IS "ESSENTIAL NOT ONLY TO THE AIR FORCE'S FUTURE BUT ALSO TO THE NATION'S ABILITY TO MAINTAIN ITS COMPETITIVE EDGE..."

PBD 216: TERMINATE NASP PHASE III (FLT DEMO)**PBD RATIONALE:**

NASP PHASE III IS UNAFFORDABLE AND UNDER-BUDGETED BY AF.

AF RESPONSE:

PHASE III COST DEPENDS ON RESULTS OF ONGOING TECHNOLOGY DEVELOPMENT AND FINAL X-30 DESIGN. ACCURATE COST ESTIMATE WILL BE AVAILABLE BY PHASE III DECISION IN EARLY FY 1993.

PBD RATIONALE:

NASP PROGRAM OBJECTIVES COMPROMISED BY EASING PHASE II EXIT CRITERIA, REDUCING VEHICLE FLIGHT PERFORMANCE.

AF RESPONSE:

PHASE II EXIT CRITERIA REVISED TO REFLECT PRESIDENTIAL DIRECTION TO FOCUS PROGRAM ON HIGHEST PRIORITY RESEARCH, RATHER THAN OPERATIONAL, OBJECTIVES. BOTH PHASE III VEHICLES ARE BEING DESIGNED FOR SINGLE-STAGE-TO-ORBIT FLIGHT.

PBD RATIONALE:

\$30.0M OF FY 1992 FUNDS WILL NOT BE OBLIGATED UNTIL FY 1993.

AF RESPONSE:

NO BUDGET HISTORY TO SUPPORT PREDICTION. NASP FY 1990 DOD FUNDS 99.9% OBLIGATED BY 30 SEP 90. THE SAME SHOULD BE TRUE FOR FY 1991 AND FY 1992 FUNDS.

NASP FUNDING



*Orig 80% : DOD
20% NASA*

FY86 FY87 FY88 FY89 FY90 FY91 FY92 FY93 FY94 FY95 FY96 FY97

	45	110	183	231	194	163	233	330	388	425	475	525
DOD								180	100	100	100	100
NASA	16	62	71	89	60	95	72	120	145	175	200	TBD

Govt	61	172	254	320	254	258	305	450	533	600	675	TBD
Total												

Contractor	190	153	119	147	127							
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Total Program	251	325	373	467	381							
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Cumulative Total	251	576	949	1,416	1,797							
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4 December 1990

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MEMORANDUM OF AGREEMENT (MOA)

BETWEEN

STRATEGIC AIR COMMAND AND AIR FORCE SPACE COMMAND

CONCERNING THE NATIONAL AEROSPACE PLANE (NASP)

1.0 PURPOSE

The purpose of this MOA is to delineate command positions and responsibilities concerning support for the NASP program. It represents a formal statement committing both commands to advocate this development effort.

2.0 SCOPE

This MOA will establish a basic working agreement between SAC and AFSPACECOM to ensure operational involvement is maintained in the NASP program. The joint effort will include development of a multicommand System Operational Requirements Document (SORD) and other requirements documents, as required. It shall be effective upon the date of the final signature. It will be signed by CINCSAC and AFSPACECOM/CC. This MOA will be reviewed and amended upon mutual agreement as required.

3.0 PROGRAM DESCRIPTION

The NASP program is a joint effort between the Department of Defense and the National Aeronautics and Space Administration. The primary objective is to develop the technologies to enable construction and flight testing of an experimental aerospace vehicle (the X-30) capable of direct (single stage) insertion into orbit and hypersonic endoatmospheric cruise. Another important objective is to define the operational utility of a NASP Derived Vehicle (NDV), and incorporate, wherever possible, operationally required features into the design of the X-30.

4.0 PRINCIPLES OF AGREEMENT

4.1 SAC and AFSPACECOM recognize the following principles as the basis for this MOA.

a. The NASP program represents a significant technology effort of enormous potential to the country and the military.

b. The risks and substantial costs of this program necessitate strong involvement and advocacy by the operational community.

c. Each command can contribute unique strengths and expertise to the development of the NASP and the NDV.

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P.3/4

d. SAC and AFSPACECOM agree to provide advocacy for the program during appropriate Planning, Programming and Budgeting System (PPBS) cycles/activities.

e. Because of the complexity and cost of the program, multicommand advocacy is essential. Both commands recognize that unilateral withdrawal of support by one party could seriously jeopardize the future of the program.

5.0 SPECIFIC RESPONSIBILITIES

5.1 AFSPACECOM and SAC agree to:

a. Interface with NASP Joint Program Office (JPO) to define operational requirements for NDV. The immediate vehicle for addressing operational requirements will be a SORD written cooperatively between SAC and AFSPACECOM.

b. Participate in technology reviews with contractors and JPO to stay abreast of technology developments and provide operational perspective on critical design decisions.

c. Participate in joint SAC/AFSPACECOM NASP Operators Steering Committee.

d. Advocate the NASP program in command budget submissions.

5.2 Joint SAC and AFSPACECOM Operator's Steering Committee:

This committee will report to CINCSAC through SAC/XR and AFSPACECOM/CC through AFSPACECOM/XR and will be composed of a Steering Committee and a Working Group.

5.3 Steering Committee will be composed of:

AFSPACECOM/XR	(07) (Co Chair)
SAC/AXR	(07) (Co Chair)
AFSPACECOM/XP	(06)
SAC/DXP	(07)

5.4 Working Group will be composed of:

AFSPACECOM/XRS	(06) (Co Chair)
SAC/XRF	(06) (Co Chair)
AFSPACECOM/XPX	(06)
SAC/XPX	(06)
AFSPACECOM/DOS	(06)
SAC/DOK	(06)
AFSPACECOM/ALK	(06)
SAC/LGX	(06)
AFSPACECOM/XRR	(06)
SAC/XRR	(06)
AFSPACECOM/INX	(06)
SAC/INC	(06)
SAC/XOK	(06)

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Representatives from AF/XO and NASP JPO will serve in an advisory role.

5.5 Under the guidance of the Steering Group, the Working Group will:

- a. Work all issues relevant to joint advocacy.
- b. Review long term national and military needs in space and identify how the NASP program and NDV can fulfill these needs.
- c. Analyze the political issues associated with building a military variant of the NASP and develop the rationale for supporting deployment.
- d. Consolidate a prioritized list of design reference missions and sortie rates which capture the full range of operational requirements.
- e. Review X-30 and NDV development efforts for required operational, maintenance and test capabilities.
- f. Ensure all multicommand operational requirements documents are developed and validated, and operational issues and recommendations are provided to the NASP program office.
- g. Evaluate the advantages and disadvantages of SAC or AFSPACECOM as the operator.

6.0 In regards to NDV operations:

- a. SAC will be the lead agency on NDV development activities.
- b. Initially, SAC will be designated the prime operator of the NDV.
- c. This decision will be reviewed when the ultimate use of the system is defined and the vehicle achieves operational capability.

7.0 There are two originals of this agreement. One original is held by CINCSAC; the other by AFSPACECOM/CC.


JOHN T. CHAIN, JR.
General, USAF
Commander in Chief
Strategic Air Command

27 NOV 90


THOMAS S. MOORMAN, JR.
Lieutenant General, USAF
Commander
Air Force Space Command

27 NOV 90

ADVANCED LAUNCH TECHNOLOGY AND VEHICLE DEVELOPMENT

Issue: Implementation of the recommendation of the Augustine Commission to establish and fund a firm program for development of an evolutionary, unmanned (but man-rateable) launch vehicle development program immediately. Such a new vehicle would also provide heavy-lift capability to reduce the burden on the Space Shuttle.

Proposed Implementation Strategy:

- o Program Objectives:
 - Provide a range of cargo capabilities including heavy-lift.
 - Provide a man-rateable capability for some applications.
 - Provide for both a near-term capability that is evolutionary and a longer-term capability that incorporates new technology.
 - Achieve significant improvements in operations costs (particularly launch support manpower) and operational resilience compared to existing systems.
- o Funding: NASA and DOD will jointly manage this effort and share 50:50 in the costs of the program.
- o Near-Term Action: NASA and DOD should immediately prepare a joint assessment of applicable launch technologies, potential development strategies, and possible design reference missions, as well as several options for a development program. Report to be delivered to the National Space Council and OMB by February 1, 1991. Selection of a national strategy for this effort will occur before substantive Congressional action on the FY 1992 budget.

Current Funding Status:

		<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>
NASA:						
Technology and Devel.		175	275	275	375	775
Advanced Studies		25	25	25	25	25
Total, NASA	BA	200	300	300	400	800
	OL	119	209	255	327	560

DOD Current Estimate	BA	78	92	166	172	190
	OL	71	85	132	160	179

(Continues propulsion technology and vehicle trade studies. Defers decision on development of new launch vehicles. Funding represents 50 percent of current propulsion technology work. OMB passback indicated that Space Council would address issue in near future (no date specified)).

Increase to DOD for
vehicle development
(50:50 with NASA)

BA	97	183	109	203	585
OL	56	135	127	167	414

Total for DOD

BA	175	275	275	375	775
OL	127	220	259	327	593

National Aerospace Plane

Program Objective and Rationale: To demonstrate hypersonic and single-stage-to-orbit technologies. These technologies (and potential future NASP-derived vehicles) could have significant benefits for both civil and military applications in the next century.

Program Status: The Phase II technology development for NASP is nearing completion, with a decision on whether to proceed with Phase III flight research vehicle scheduled for mid-1993. The 5 NASP contractors, NASA and DOD are working together in a unique, first-time, "national team" arrangement. Corporate investment by the contractors has amounted to about \$775 million (compared to \$1.6 billion of Federal funds).

The cost estimates for Phase III are highly uncertain, ranging from \$5 to \$8 billion (which is probably conservative). More detailed estimates are expected in December, 1991.

Issue: Should Phase III funding be reflected for planning purposes in the FY 1993 - FY 1996 budgets for DOD and NASA?

Current Funding Status:

		1992	1993	1994	1995	1996
NASA	BA	72	120	145	175	200
	OL	80	103	129	144	181

(Assumes completion of Phase II technology development. Assumes, for planning purposes, initiation of Phase III flight research vehicle program (beginning in 1993). National Space Council to review program prior to any commitment of Phase III funds. (consistent with 1989 Presidential decision).

DOD Current Estimate	BA	233	180	39	42	51
	OL	208	196	103	58	53

(Assumes completion of Phase II technology development. Determines feasibility of vehicle development program and completes preliminary design. Defers Phase III decision. Funds future hypersonic technology research.

Increase to DOD for Phase III

Phase III	BA	0	160	388	425	475
	OL	0	92	273	377	438
Total for DOD	BA	233	340	427	467	526
	OL	208	288	376	435	491

Withdrawal/Redaction Sheet

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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03. Talking points	NASP Talking Points (3 pp.)	12/28/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: National Security Files
WHORM Cat.:
File Location: [National Aero-Space Plane] [2 of 4] [1990]

Date Closed:	5/12/2010	OA/ID Number:	62071-015
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
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