

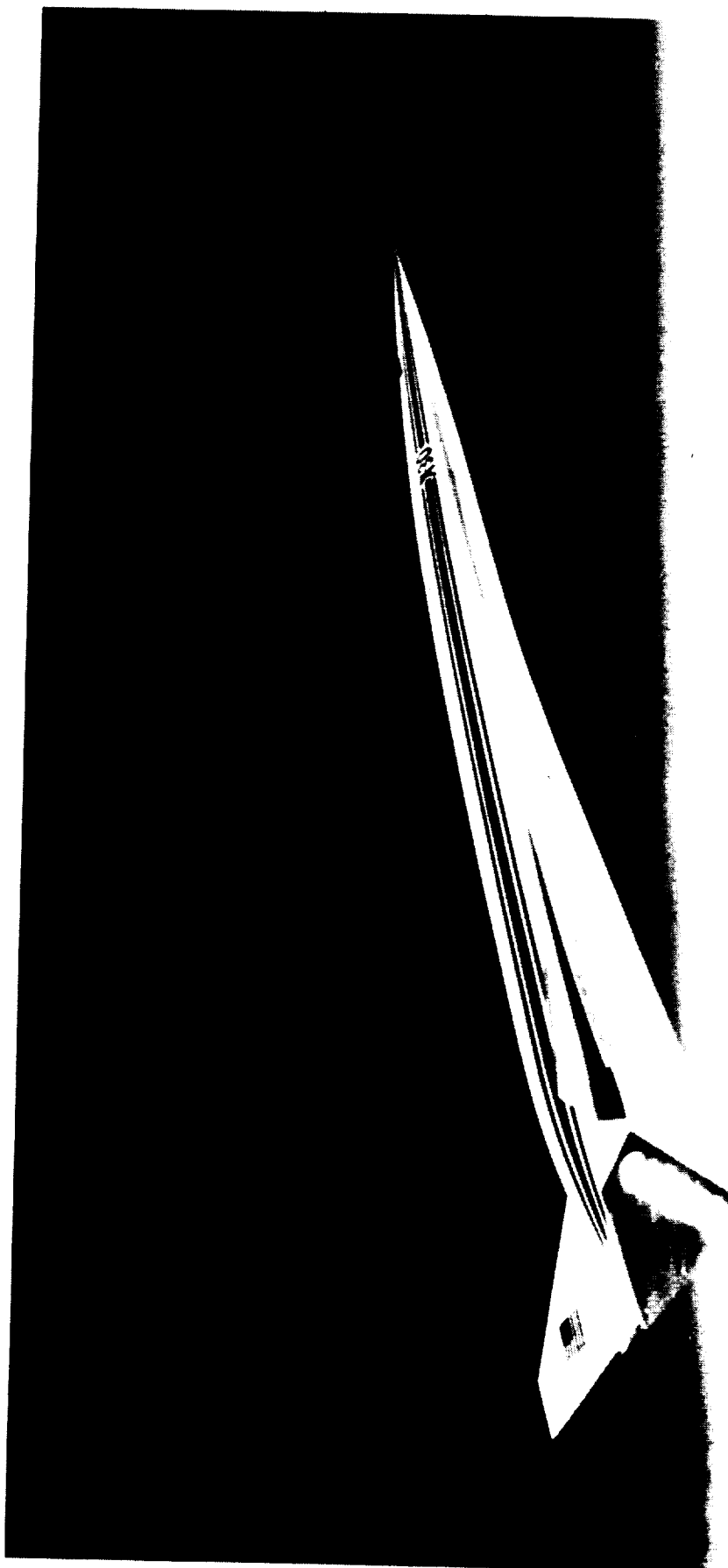
900

N91-28214

NATIONAL AERO-SPACE PLANE (NASP) PROGRAM

PENNSYLVANIA STATE UNIVERSITY
JUNE 26-29, 1990

MING H. TANG
Deputy Director, NASP NIO
Pentagon



NATIONAL AERO-SPACE PLANE

**A PROGRAM TO DEVELOP THE TECHNOLOGY FOR REUSABLE
AIRBREATHING HYPERSONIC/TRANSATMOSPHERIC VEHICLES**

**VALIDATE TECHNOLOGY BASE BY MID-1990'S ON
THE GROUND**

- AIRBREATHING PROPULSION
- ADVANCED MATERIALS
- CFD
- ACTIVELY-COOLED STRUCTURES

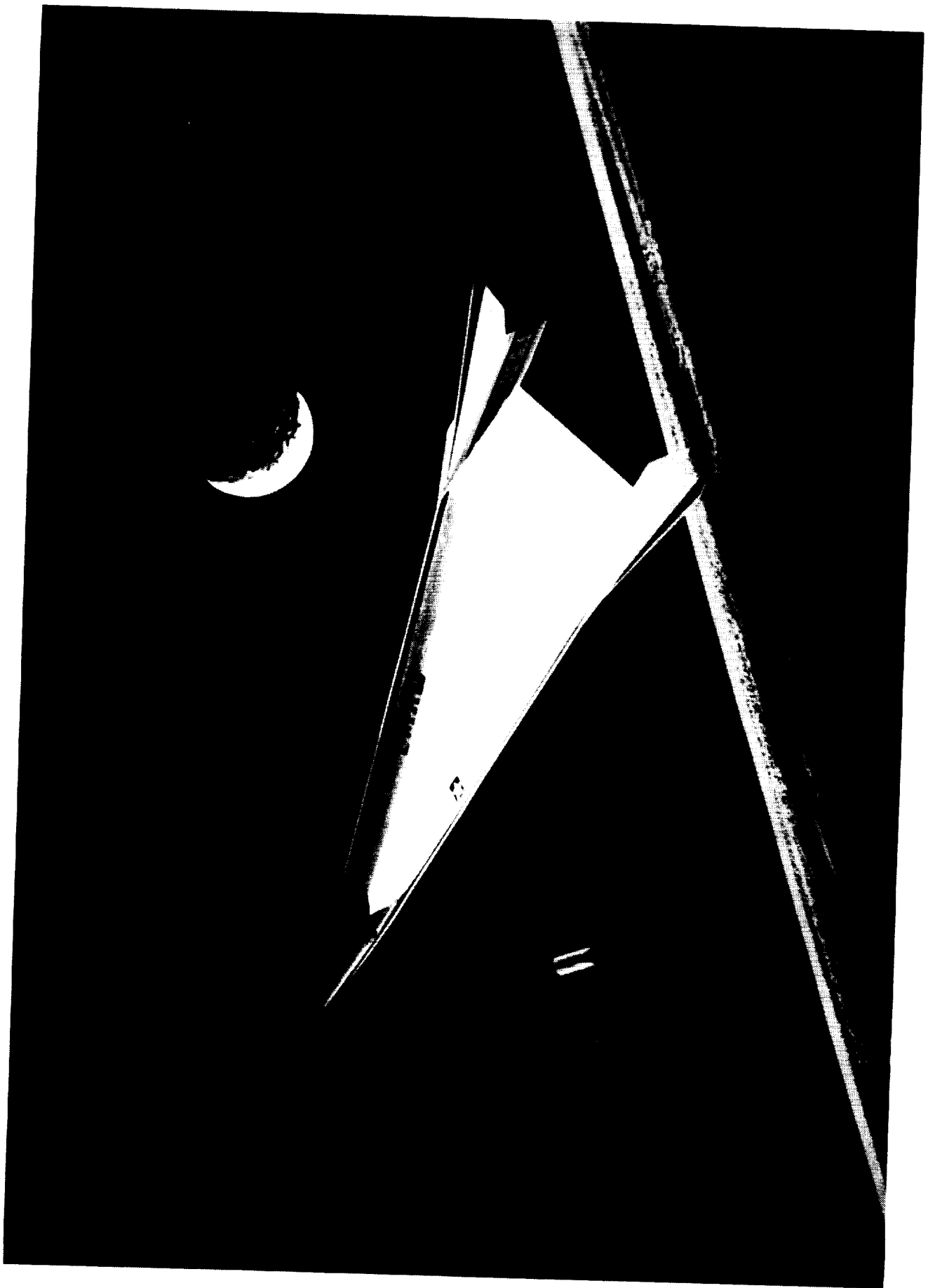
AND WITH AN EXPERIMENTAL VEHICLE

- HORIZONTAL TAKEOFF / CONVENTIONAL RUNWAY
- SINGLE-STAGE TO ORBIT
- HYPERSONIC CRUISE

**PROVIDE OPTIONS FOR NEXT GENERATION OF AEROSPACE
VEHICLES**

OST

**ORIGINAL PAGE IS
OF POOR QUALITY**

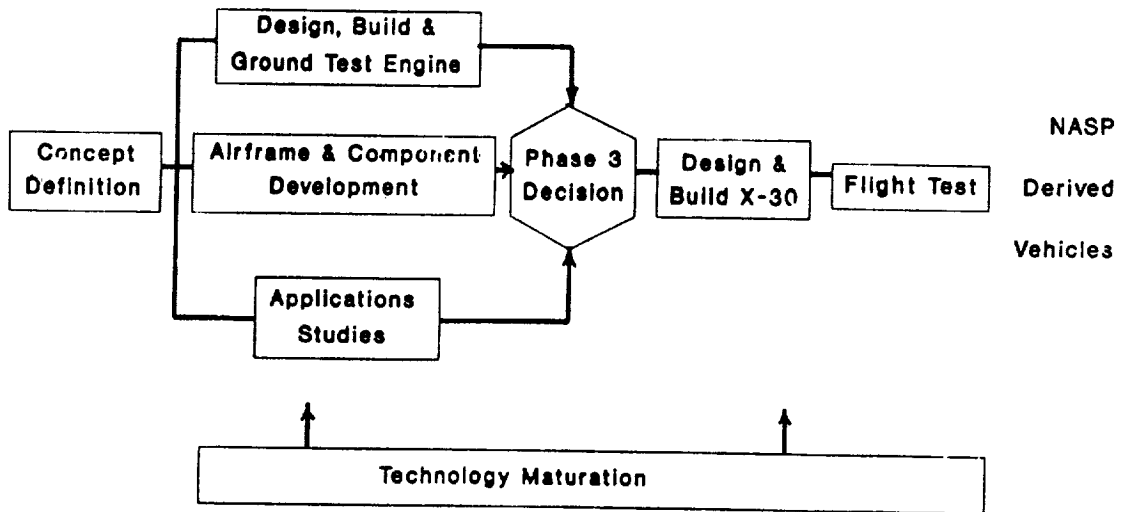
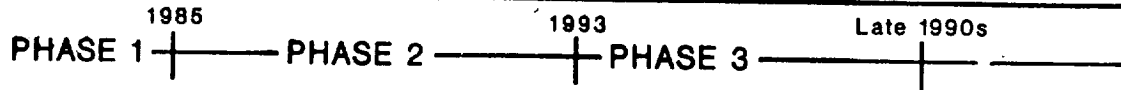




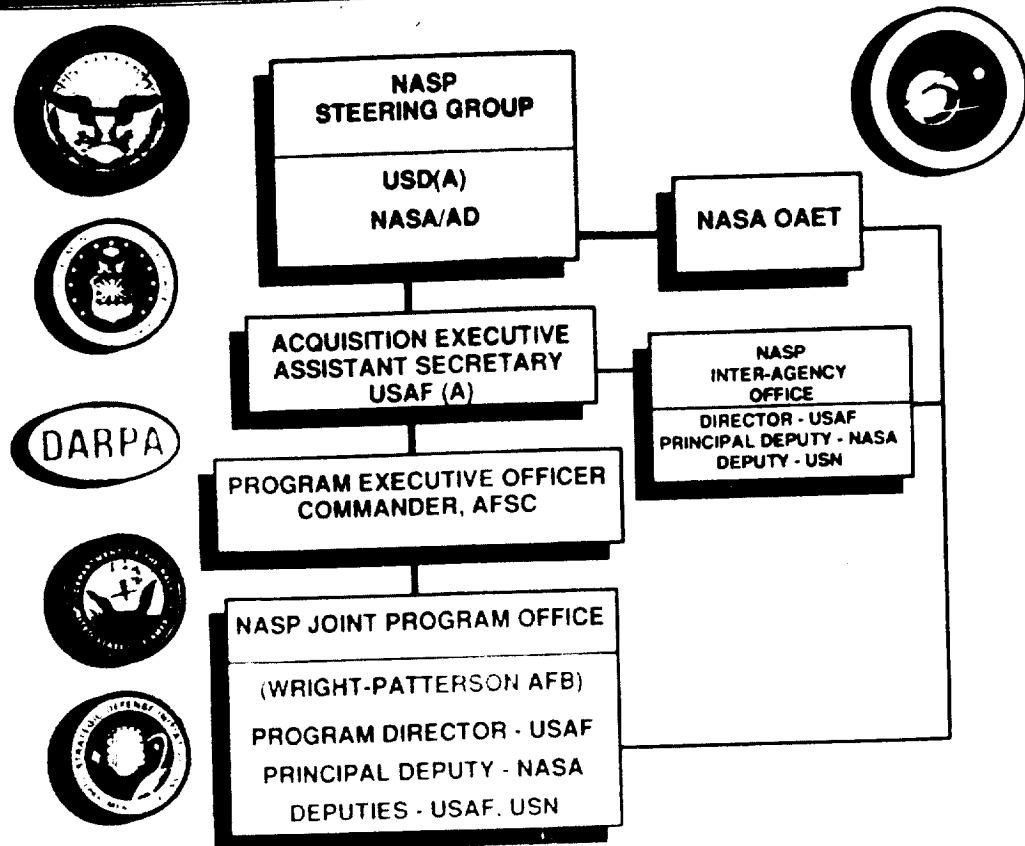
ORIGINAL PAGE IS
OF POOR QUALITY



NASP PROGRAM SCHEDULE



NATIONAL AERO-SPACE PLANE PROGRAM ORGANIZATION





Competitive Strategy

Phase 2

Engine

General Electric
Pratt & Whitney
Rocketdyne

→ E
→ C
-----> R

Pratt & Whitney
Rocketdyne

National
Team

Airframe

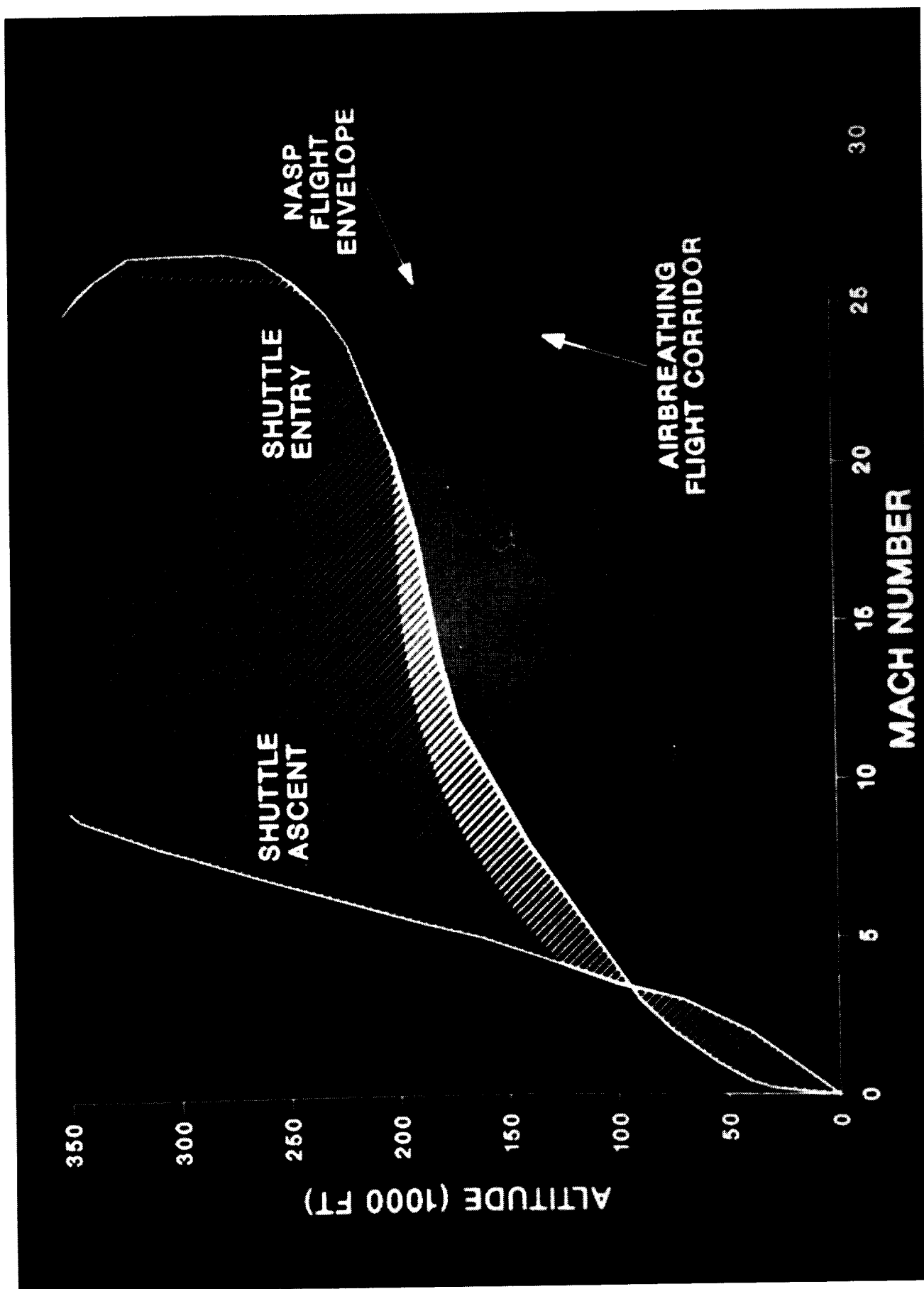
Boeing
General Dynamics
Lockheed
McDonnell Douglas
Rockwell

→ A
→ C
→ C
→ R
→ R

General Dynamics
McDonnell Douglas
Rockwell

ECR/ACR
Jul-Aug 87

Apr 90



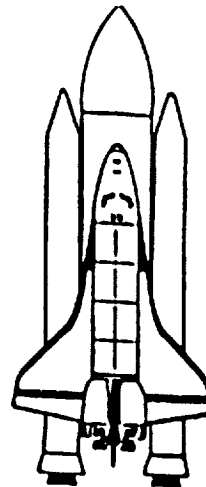
AEROSPACE PLANE SHUTTLE COMPARISONS

AEROSPACE PLANE







- SINGLE STAGE TO ORBIT
- AIR-BREATHING PROPULSION
- HORIZONTAL TAKE-OFF
FROM CONVENTIONAL RUNWAY
- ORBIT ON DEMAND
- ALTERNATE MISSION:
HYPERSONIC CRUISE

SPACE SHUTTLE



- MULTI-STAGE VEHICLE
- ROCKET PROPULSION
- VERTICAL TAKE-OFF -
SPECIALIZED LAUNCH REQMTS
- WEEKS FOR LAUNCH PREPARATION
- NO ALTERNATE MISSION
CAPABILITY

NASP CONFIGURATION MATRIX

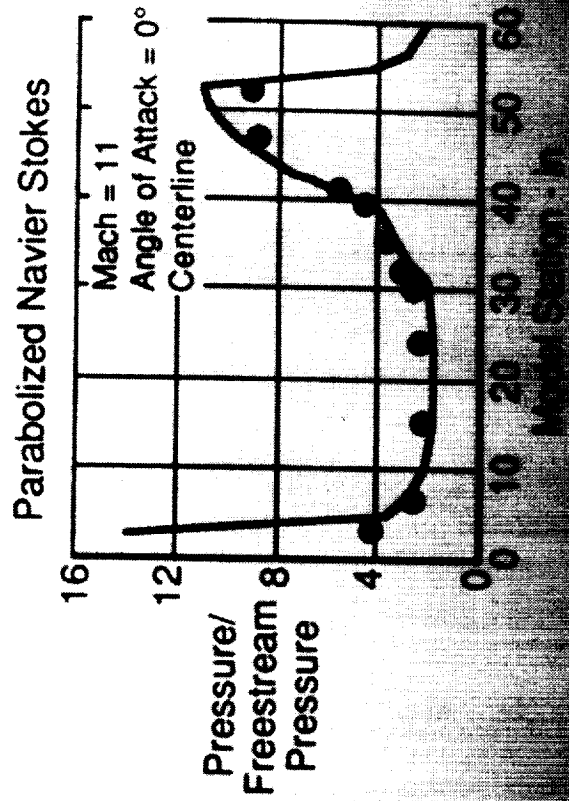
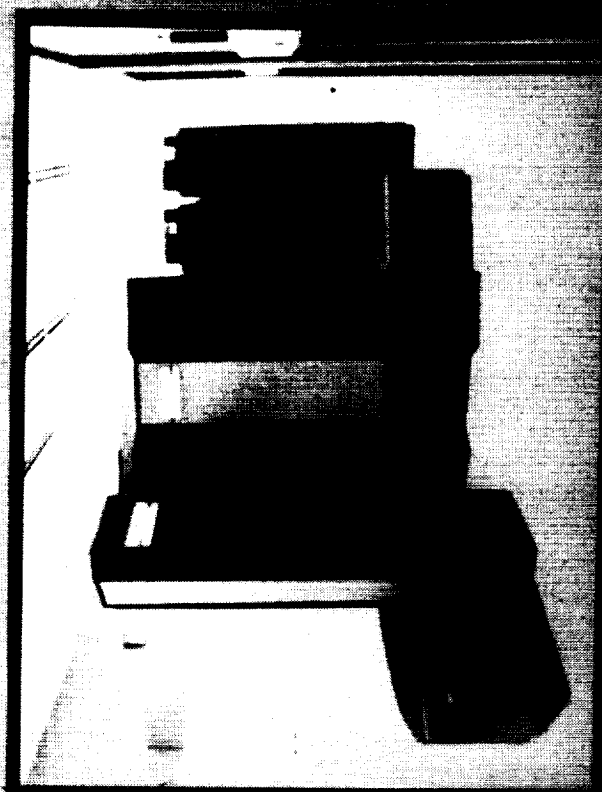
| | |
|--|---|
| <p>WING / BODY</p>  <p>Advantages</p> <ul style="list-style-type: none"> -Low speed aero -Tankage design <p>Disadvantages</p> <ul style="list-style-type: none"> -Wing/inlet coupling -Overexpanded flow to inlet | <p>BLENDED BODY</p>  <p>Advantages</p> <ul style="list-style-type: none"> -Precompression efficiency -Structural weight <p>Disadvantages</p> <ul style="list-style-type: none"> -Low speed aero -Elliptical tanks |
| <p>CONICAL ACCELERATOR</p>  <p>Advantages</p> <ul style="list-style-type: none"> -Thrust margin -Precompression efficiency -Tankage design <p>Disadvantages</p> <ul style="list-style-type: none"> -Sensitivity to angle of attack -Cruise efficiency | <p>CONFINED FLOW FIELD</p>  <p>Advantages</p> <ul style="list-style-type: none"> -Precompression efficiency -Aero efficiency <p>Disadvantages</p> <ul style="list-style-type: none"> -Structural weight -Thermal protection -Off-design sensitivity |

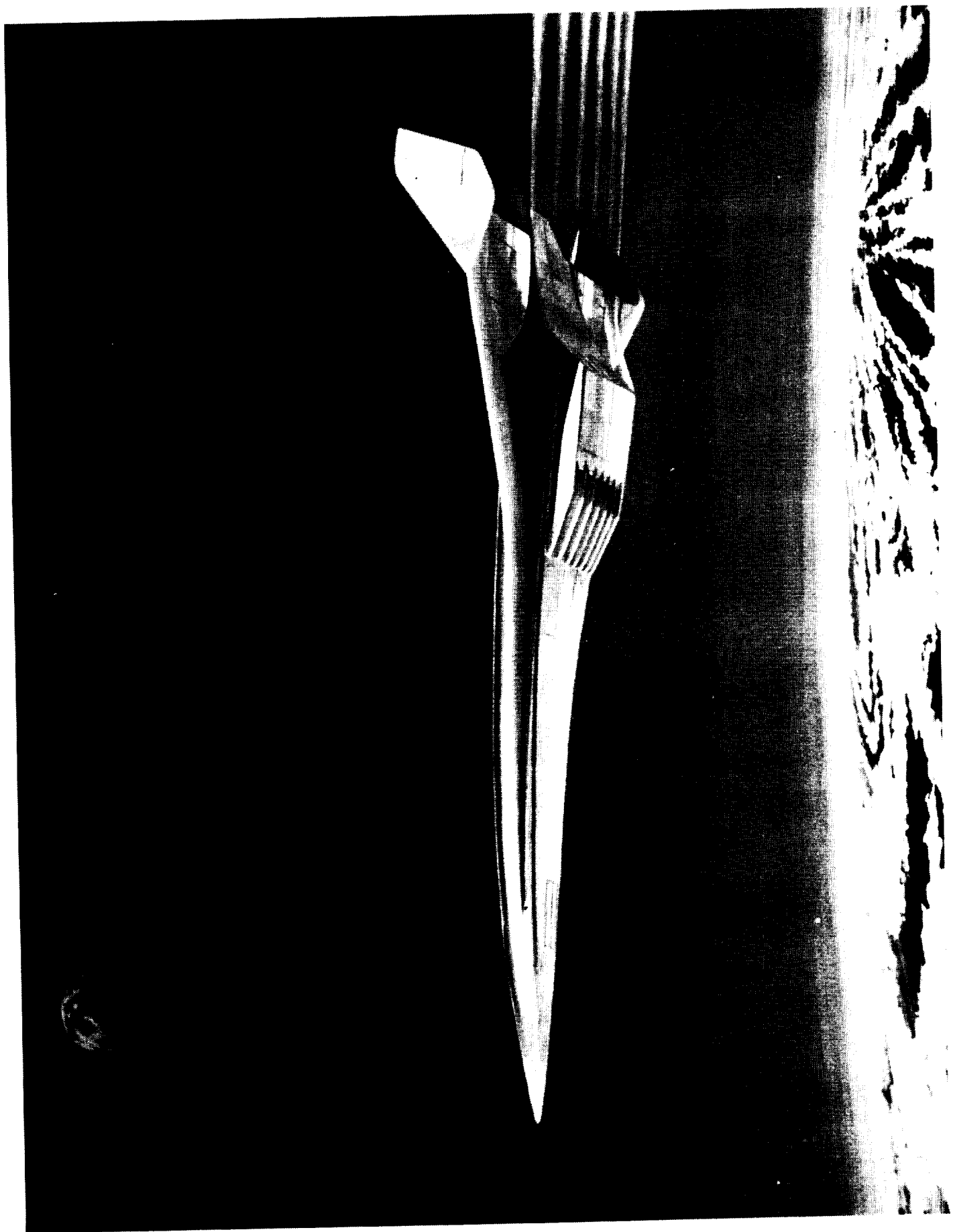


Computational Fluid Dynamics



Model in Hypersonic Tunnel





350

300

250

200

150

100

ALTITUDE (1000 FT)

ROCKET

AIRBREATHING
FLIGHT CORRIDOR

SCRAMJET

RAMJET

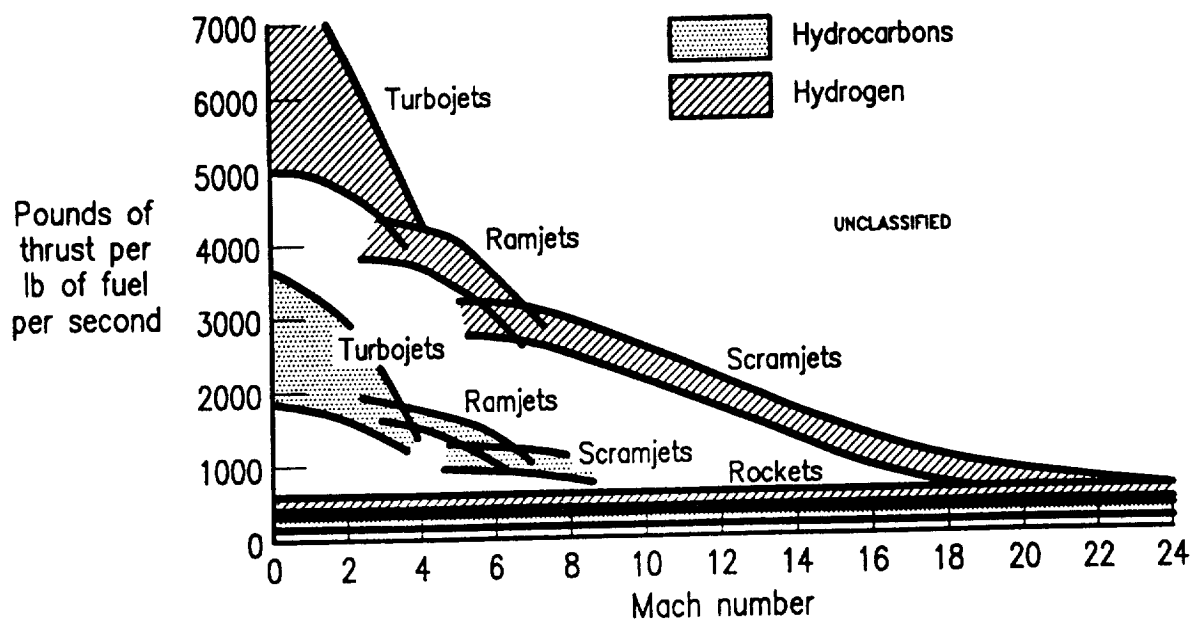
TURBOJET



UNCLASSIFIED

PROPULSION OPTIONS (U)

Fuel consumption comparison



UNCLASSIFIED

RAGNET

MACH 2 TO 4

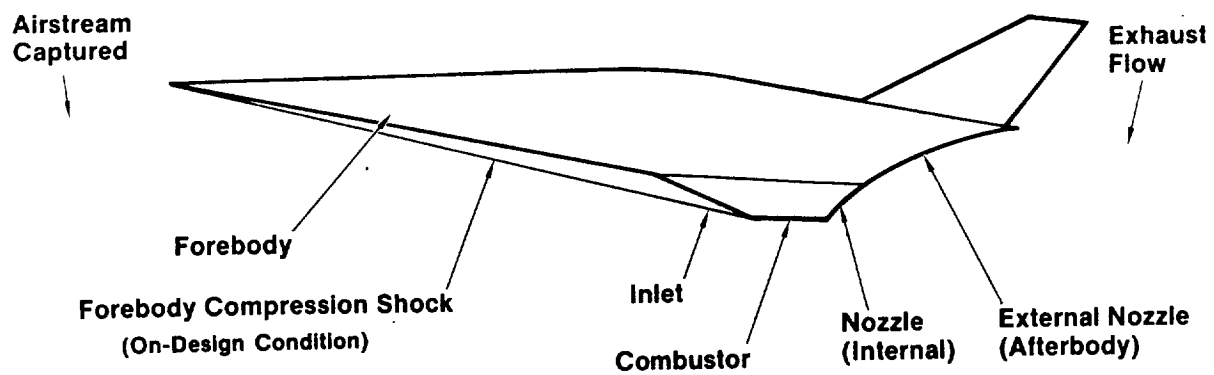
NORMAL SHOCK



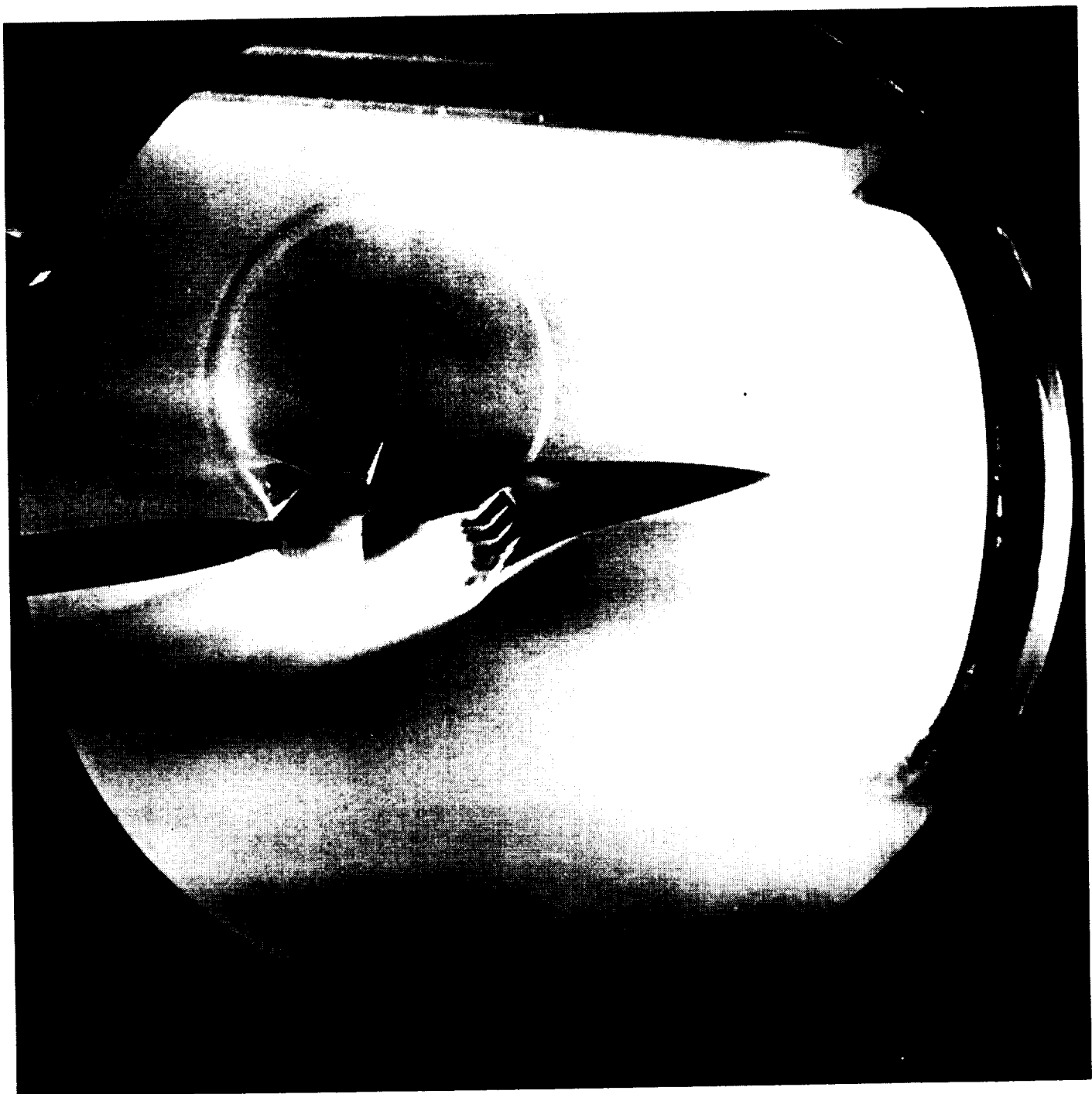
SUBSONIC COMBUSTION

4666 86W GW25/2

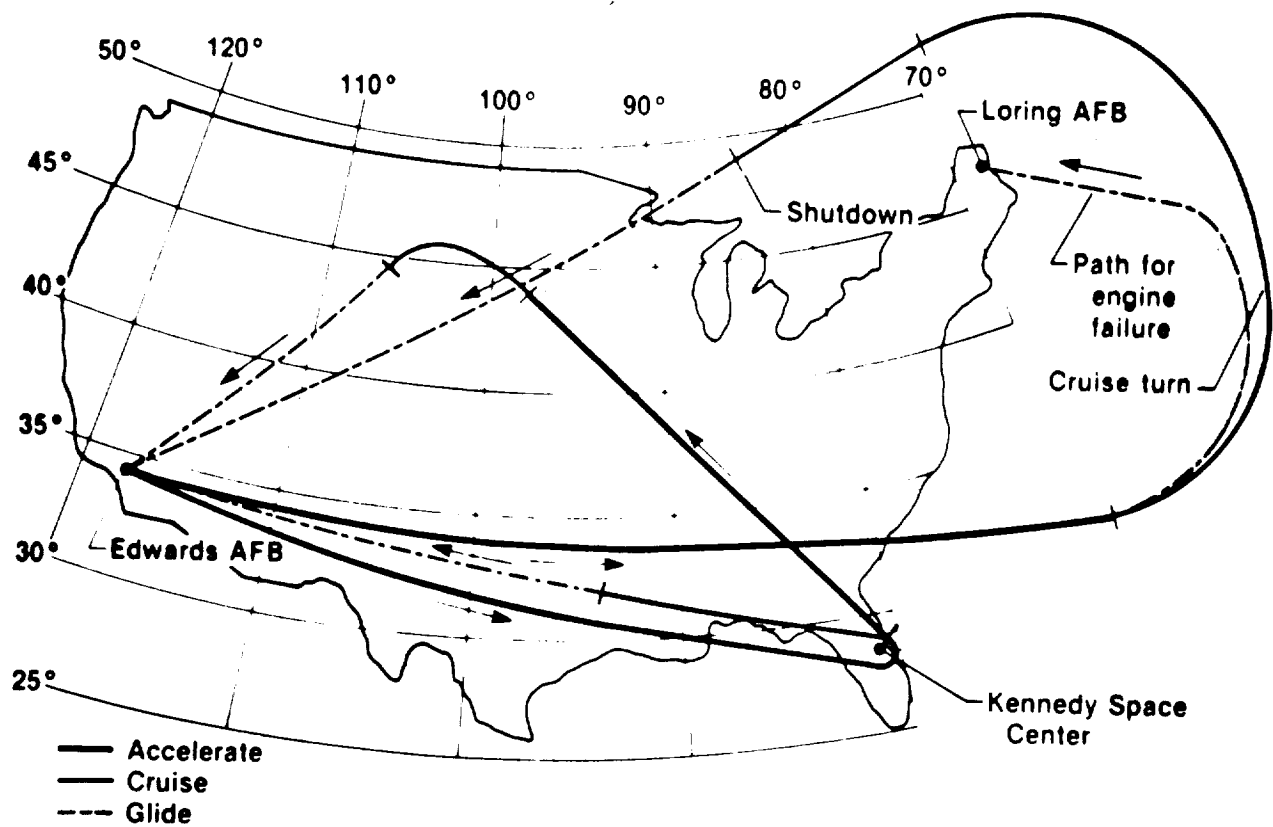
Propulsion Concept High-Speed Scramjet



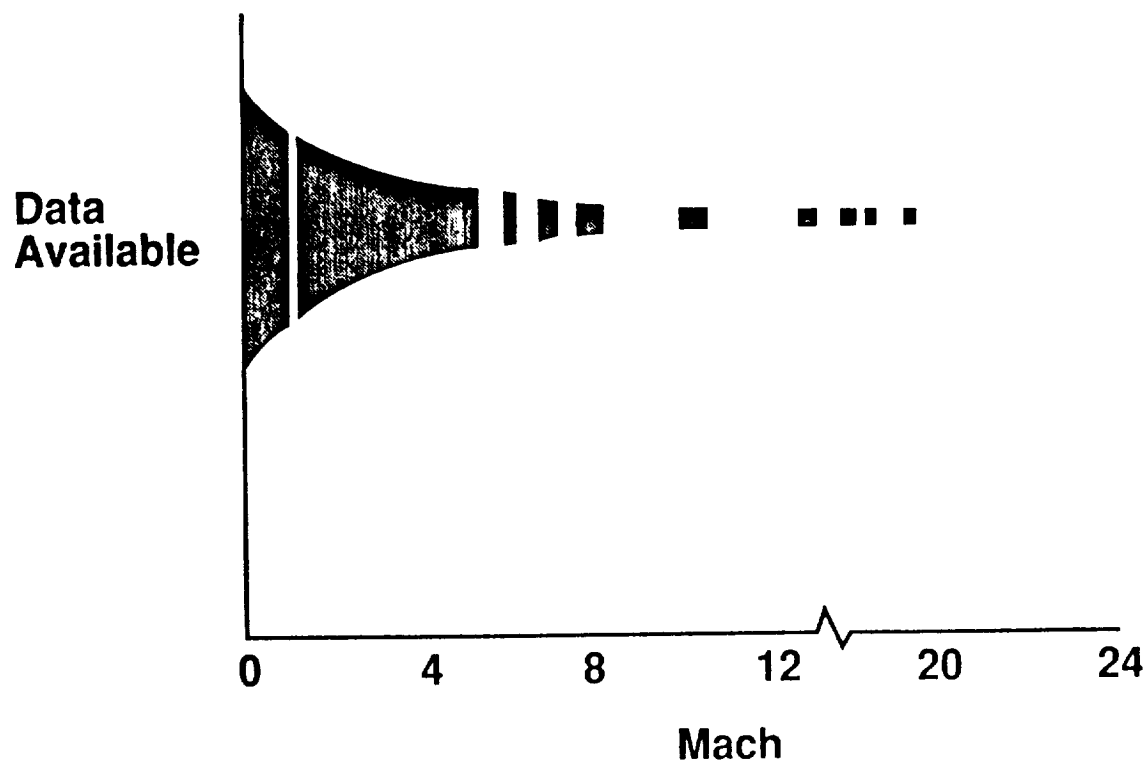




Ground Track for Envelope Expansion (U)



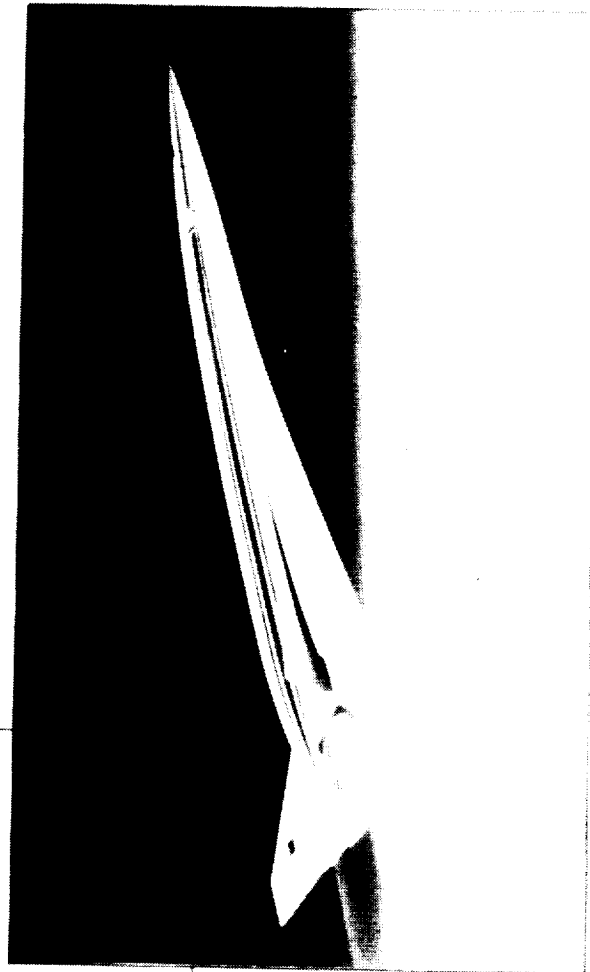
WIND TUNNEL DATA AVAILABLE FOR NASP (U)



UNCLASSIFIED



X-15



X-30

NASA

OASD
RN87 493(3)

*Revolutionary
Capability*

USA
USA

*Leadership in a
World Economy*

**PROPULSION SYSTEMS OPTIONS-
FUTURISTIC SYSTEMS**

PRESENTATION 1.4.1

NUCLEAR AND SOLAR ELECTRIC PROPULSION

