OP# C 3110
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NACA 1957 *Inspection*

LEWIS FLIGHT
PROPULSION LABORATORY

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Illustrations on these pages were taken from the charts and demonstrations in the program of the 1957 Triennial Inspection of the NACA Lewis Flight Propulsion Laboratory. Blank space is provided for notes.

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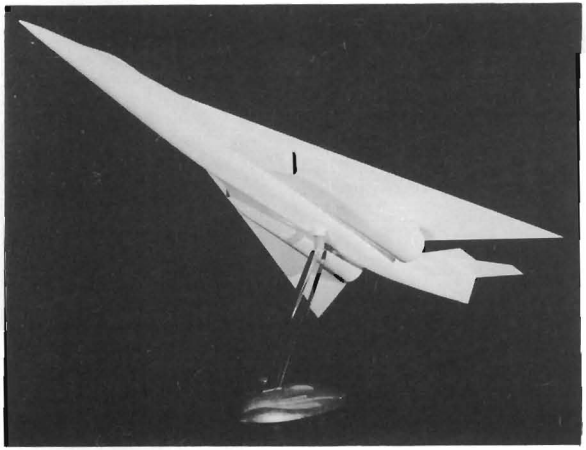
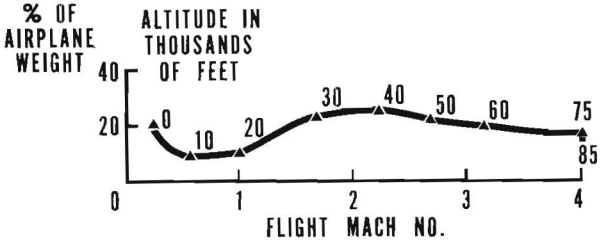
Supersonic Turbojet Propulsion

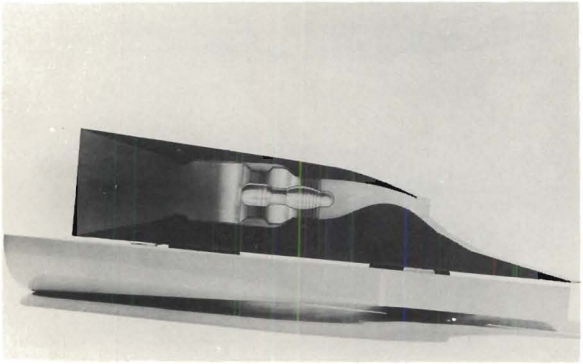
HYPOTHETICAL MACH 4 TURBOJET AIRPLANE



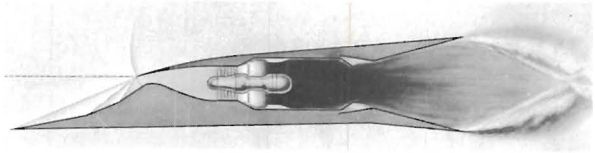
DRAG OF HYPOTHETICAL AIRPLANE

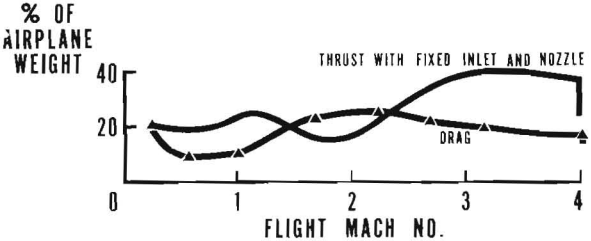


TYPICAL ENGINE POD FOR MACH 4

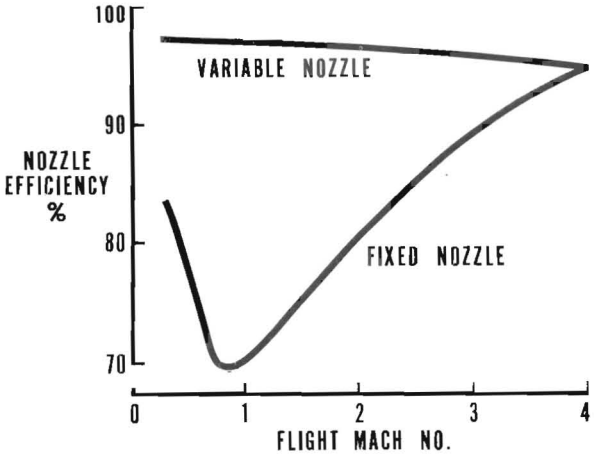


FIXED GEOMETRY THRUST IS INADEQUATE

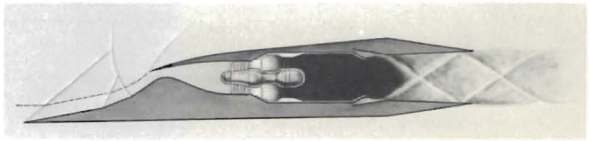


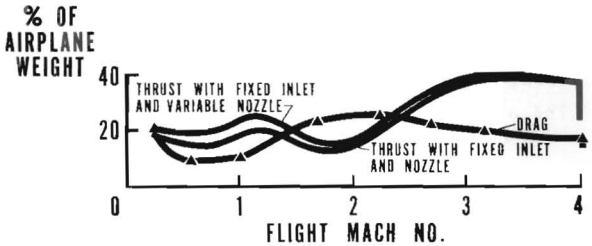


FIXED EXHAUST NOZZLE IS INEFFICIENT



NOZZLE CHANGES ALONE ARE INSUFFICIENT

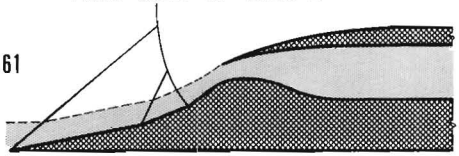




SPILLAGE PATTERN AFFECTS DRAG

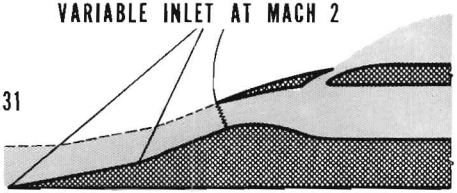
FIXED INLET AT MACH 2

$\frac{\text{DRAG}}{\text{THRUST}} = .61$

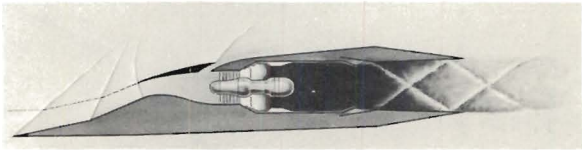


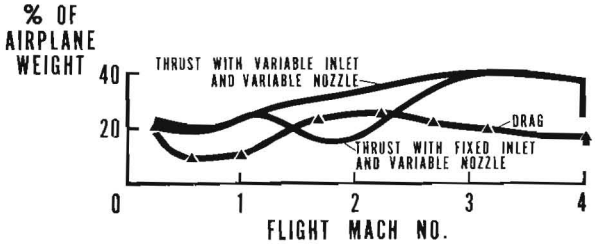
VARIABLE INLET AT MACH 2

$\frac{\text{DRAG}}{\text{THRUST}} = .31$

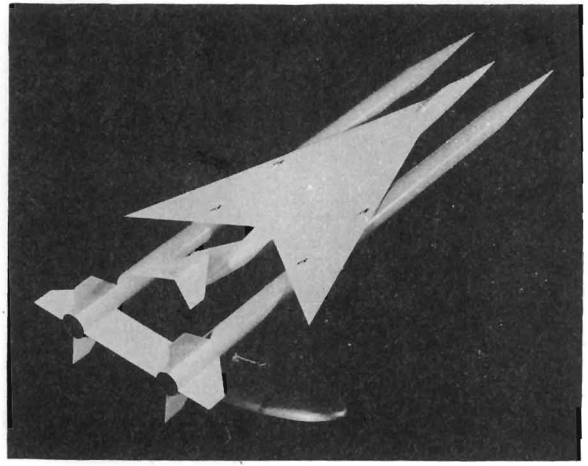


ADDING VARIABLE INLET SOLVES PROBLEM

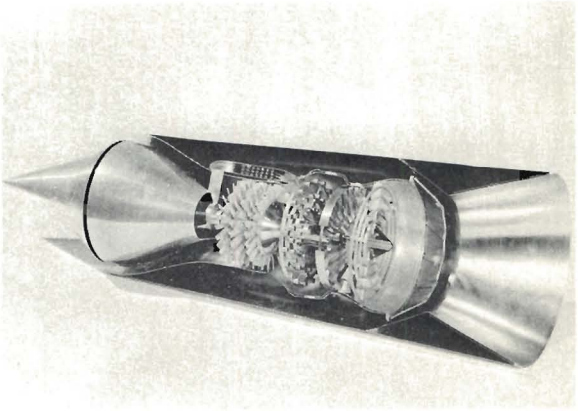




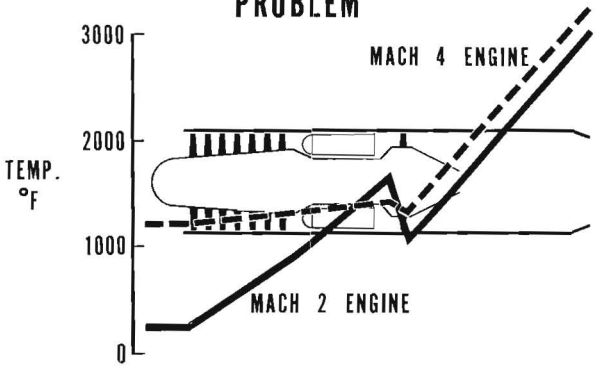
HYPOTHETICAL MACH 4 RAMJET AIRPLANE



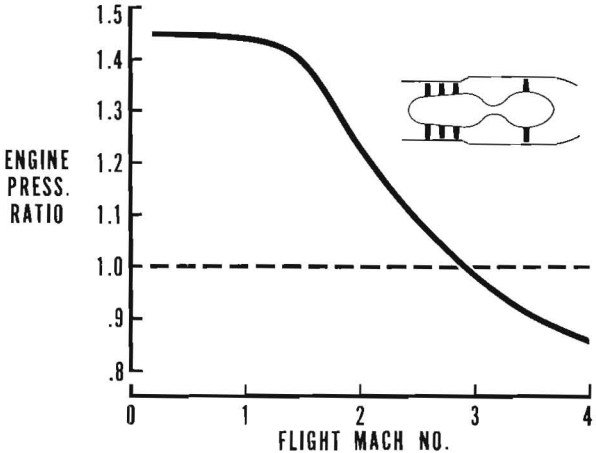
POSSIBLE MACH 4 TURBOJET ENGINE



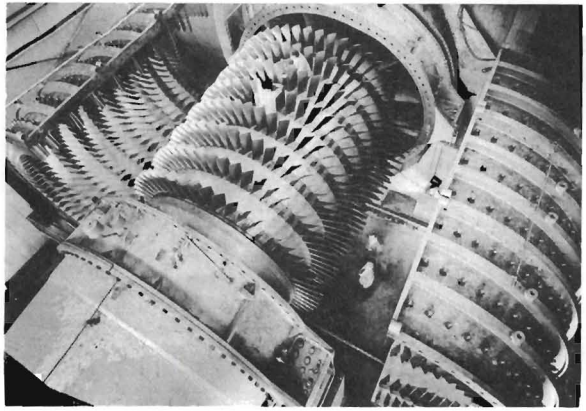
HIGH SPEED CREATES TEMPERATURE PROBLEM



HIGH SPEED REDUCES ENGINE PERFORMANCE

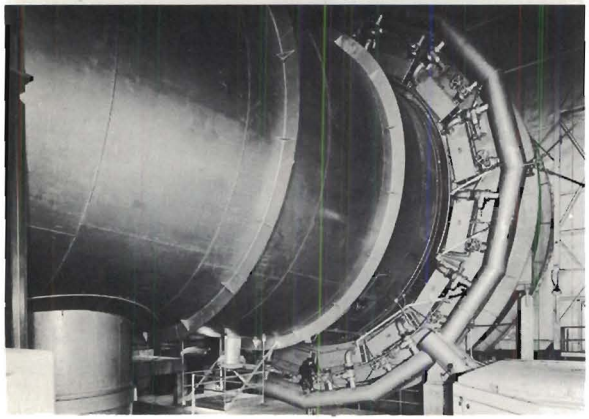


PRIMARY AXIAL-FLOW COMPRESSOR

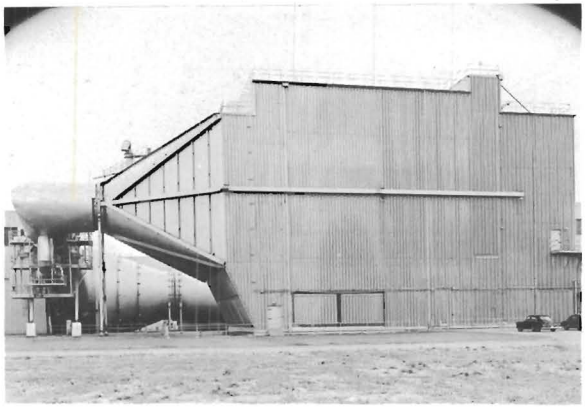


PRIMARY DRIVE SYSTEM

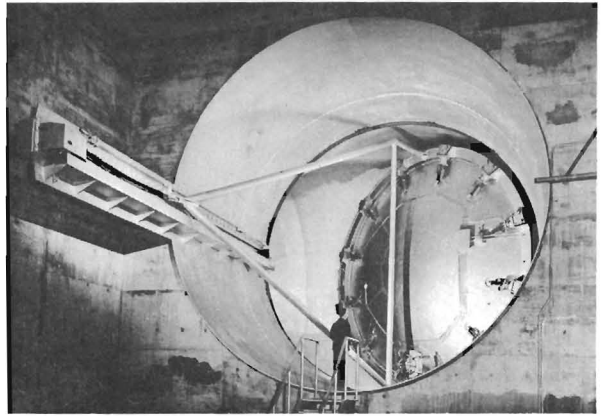
PRIMARY AIR COOLER



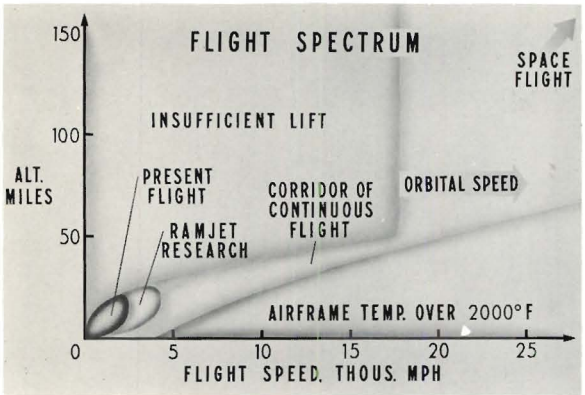
AIR DRYER



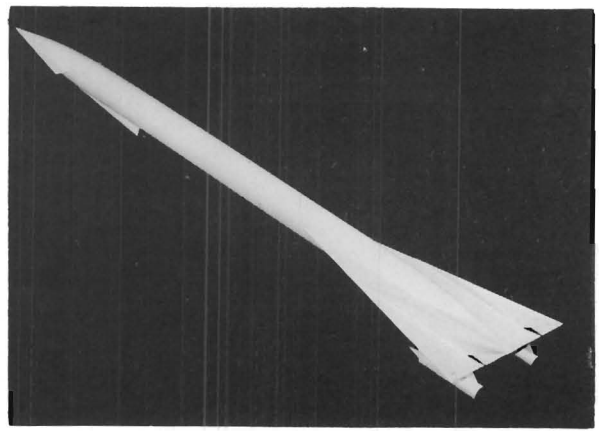
FLOW TRANSFER VALVE



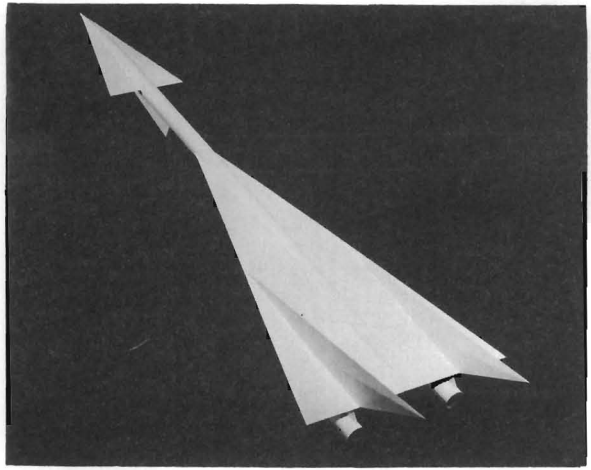
Propulsion Research for Hypersonic Flight

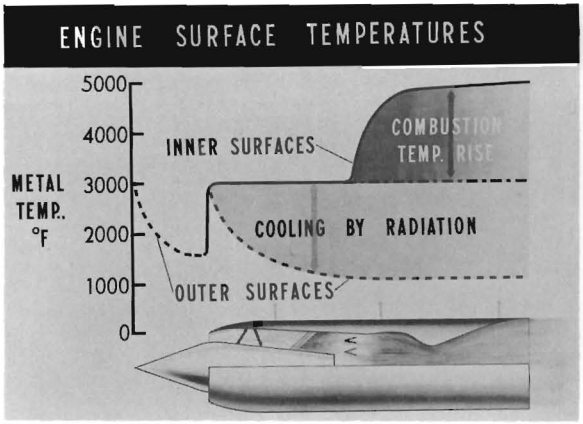


HYPERSONIC AIRCRAFT FOR OPERATION WITHIN FLIGHT CORRIDOR

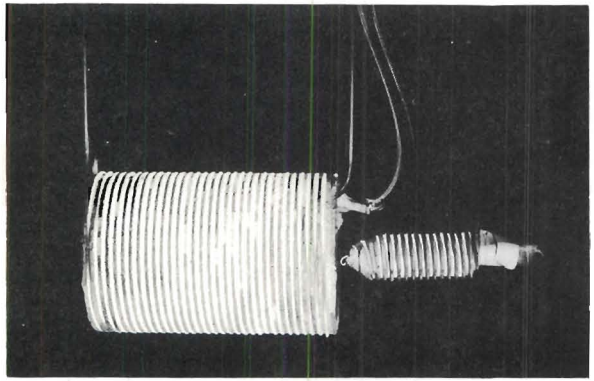


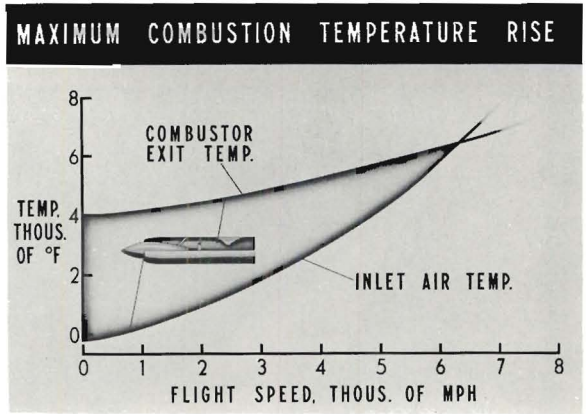
HYPERSONIC AIRCRAFT FOR OPERATION ABOVE FLIGHT CORRIDOR

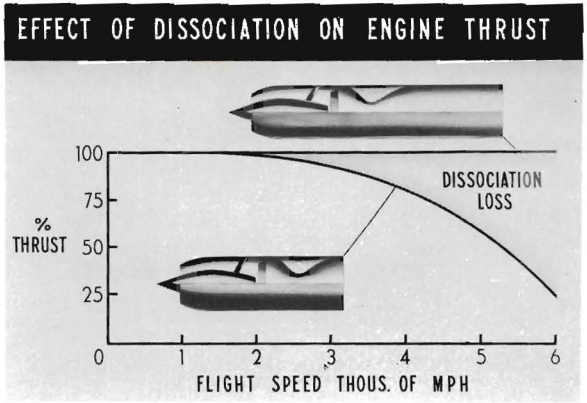


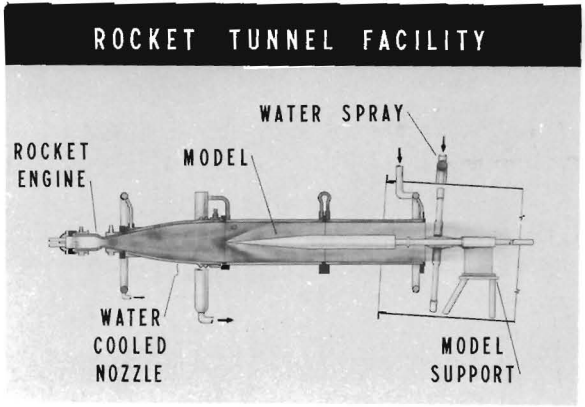


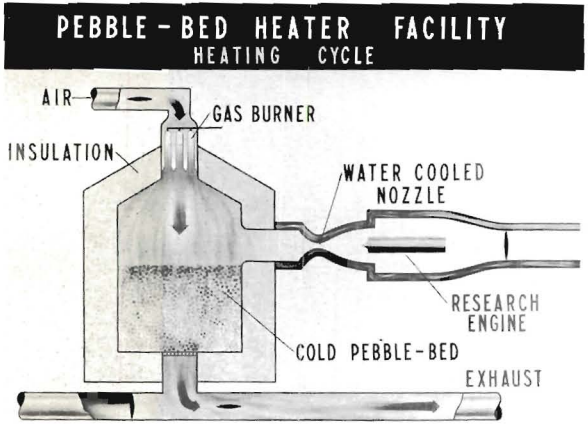
DEMONSTRATION OF RADIATION ON ENGINE SURFACE TEMPERATURES

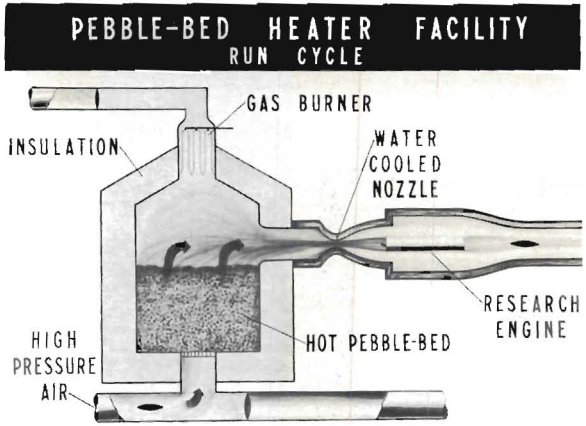




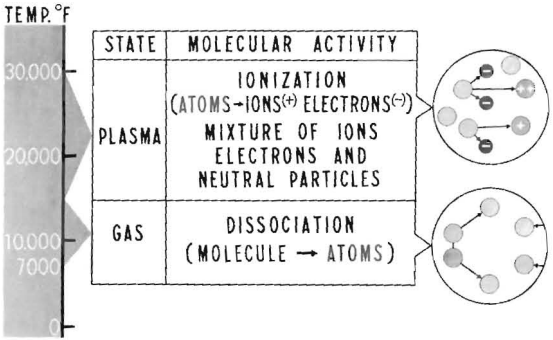

EFFECT OF DISSOCIATION ON ENGINE THRUST
100
75
50
25
0
% THRUST
DISSOCIATION LOSS
1
2
3
4
5
6
FLIGHT SPEED THOUS. OF MPH


ROCKET TUNNEL FACILITY
WATER SPRAY
ROCKET ENGINE
MODEL
WATER COOLED NOZZLE
MODEL SUPPORT

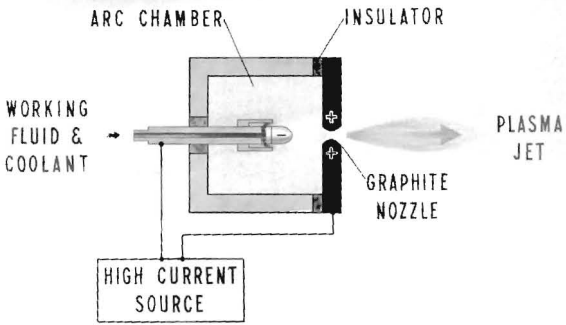

PEBBLE - BED HEATER FACILITY
HEATING CYCLE
AIR
GAS BURNER
INSULATION
WATER COOLED NOZZLE
RESEARCH ENGINE
COLD PEBBLE-BED
EXHAUST


PEBBLE-BED HEATER FACILITY
RUN CYCLE
GAS BURNER
INSULATION
WATER COOLED NOZZLE
RESEARCH ENGINE
HIGH PRESSURE AIR
HOT PEBBLE-BED

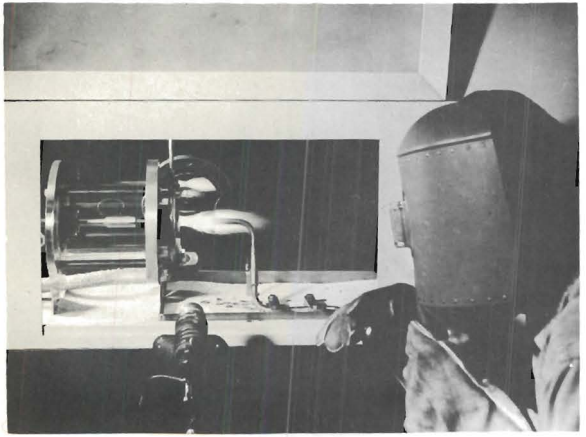
EFFECT OF TEMPERATURE ON MOLECULAR STRUCTURE OF NITROGEN



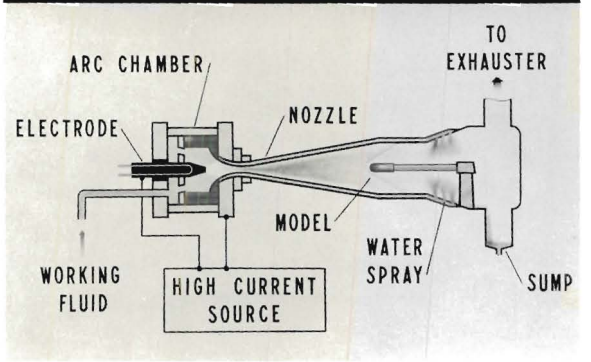
PLASMA JET



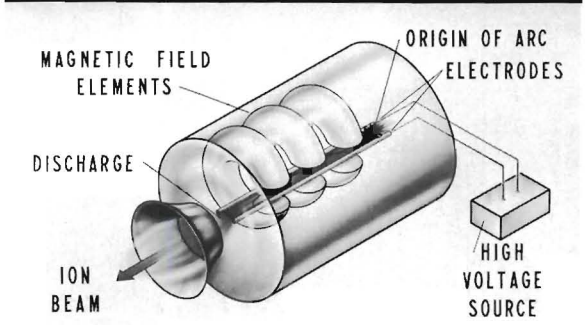
PLASMA JET PRODUCED BY ARC CHAMBER



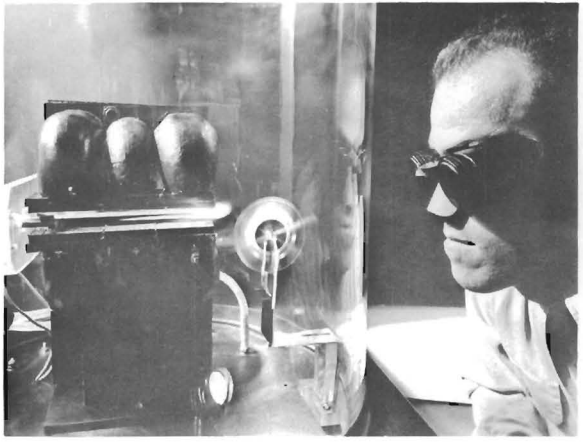
ARC TUNNEL



ION-PROPULSION UNIT (AT EXTREME ALTITUDES)

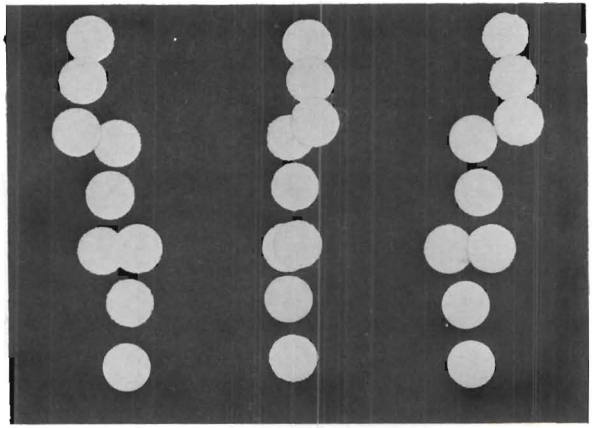


ION ROCKET IN OPERATION

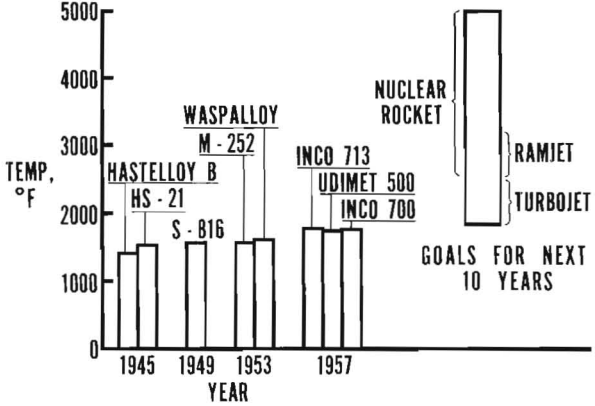


High Temperature Materials

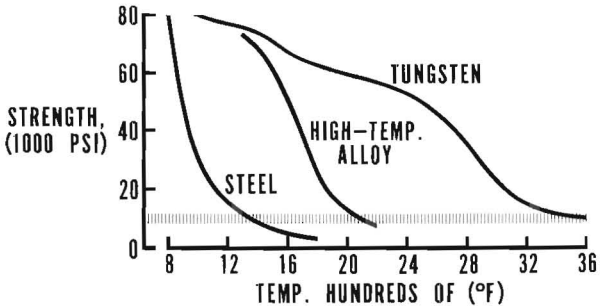
ATOMIC STRUCTURE



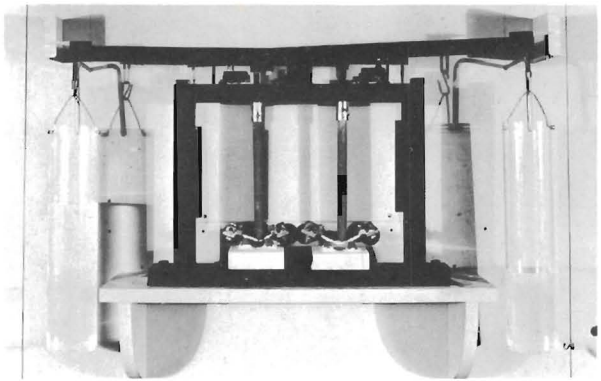
OPERATING TEMP. OF MATERIALS



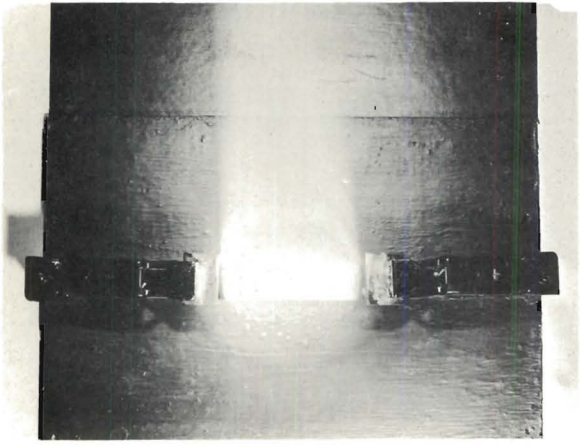
COMPARATIVE STRENGTHS OF SEVERAL MATERIALS



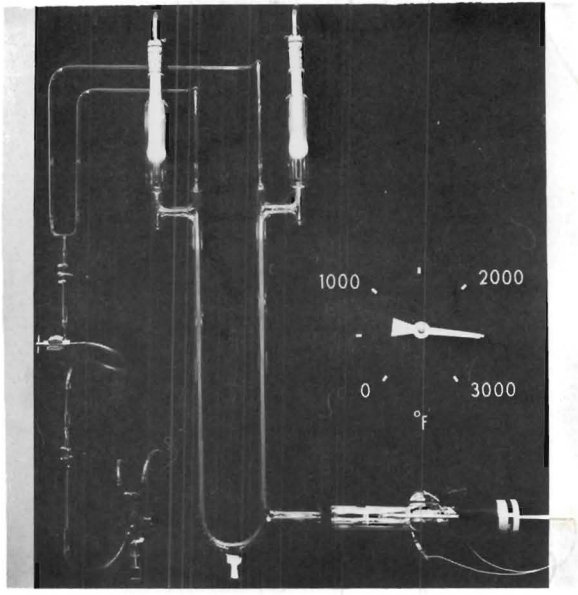
HARD PARTICLES DISPERSED IN MATRIX INCREASE STRENGTH



TUNGSTEN OXIDIZES RAPIDLY IN AIR

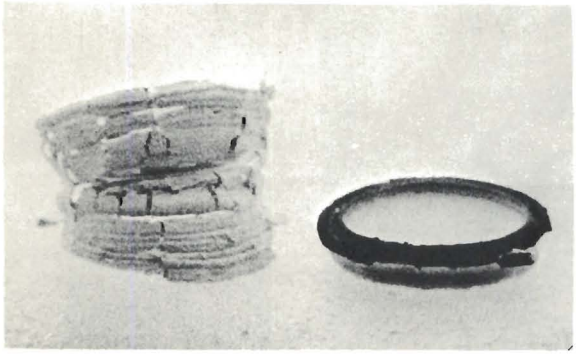


ATOM RECOMBINATION RAISES SURFACE TEMPERATURE

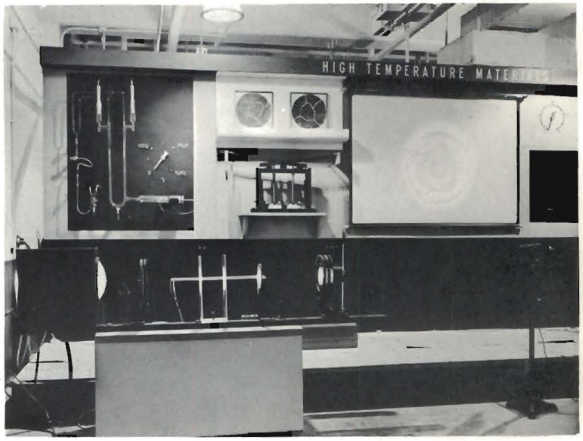


COMPARISON OF PURE & ALLOYED COLUMBIUM

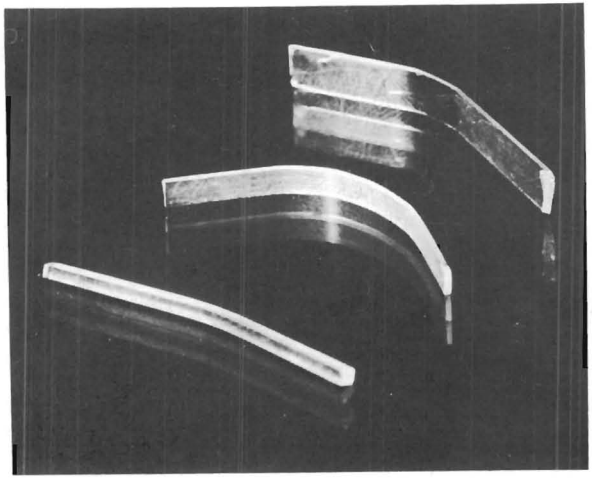
OXIDATION AT 1500 F IN AIR



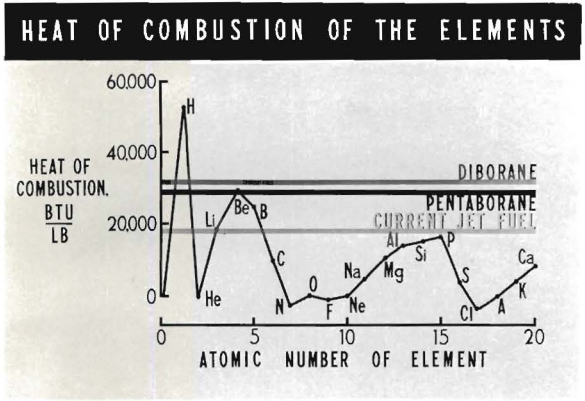
DEMONSTRATION OF THERMAL STRESS FAILURE

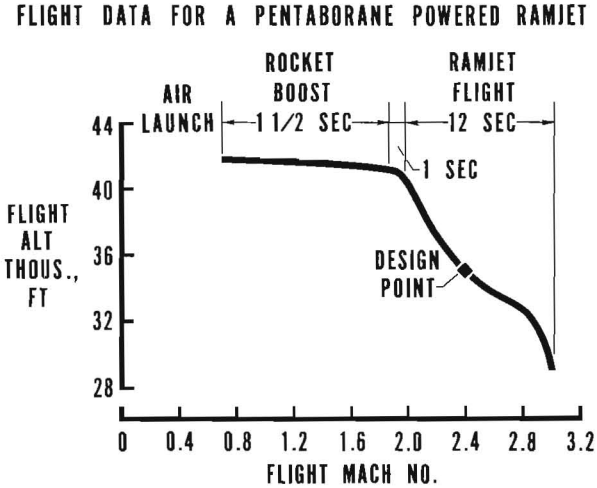


DUCTILITY OF MAGNESIUM OXIDE CRYSTALS



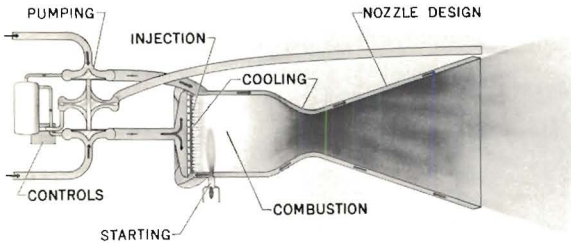
High Energy Aircraft Fuels



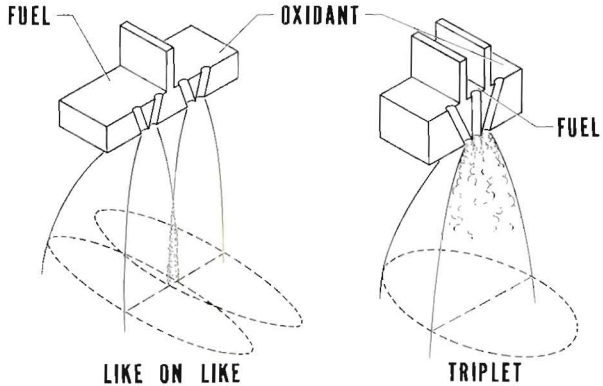


High Energy Rocket Propellants

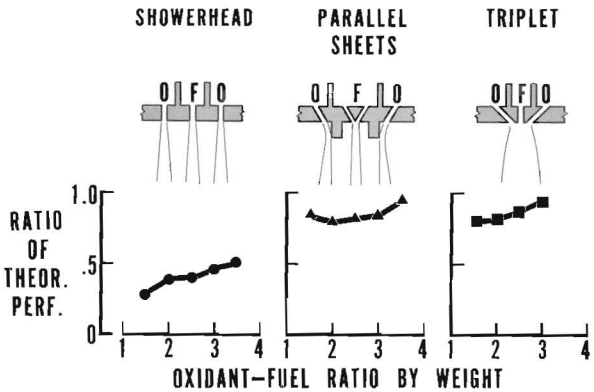
ROCKET ENGINE PROBLEM AREAS



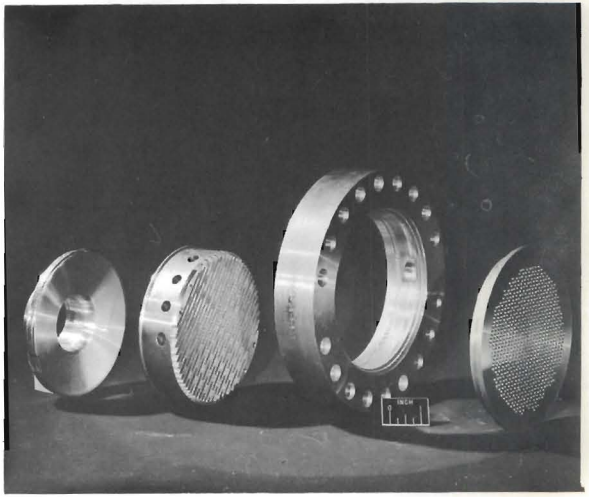
INJECTOR ELEMENT SPRAY PATTERNS



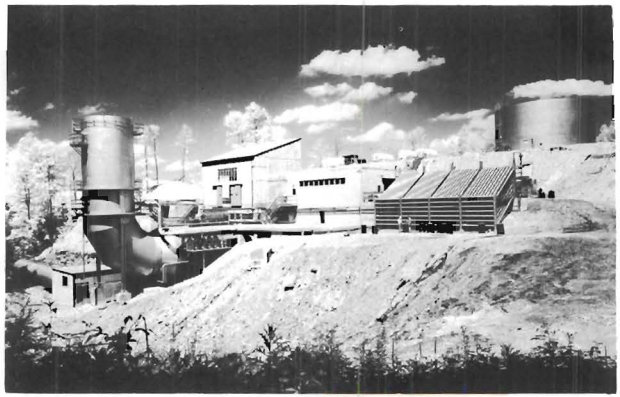
SINGLE ELEMENT INJECTOR PERFORMANCE



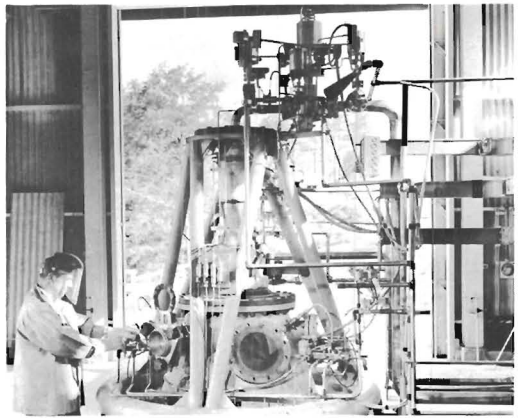
MULTI UNIT ROCKET INJECTOR



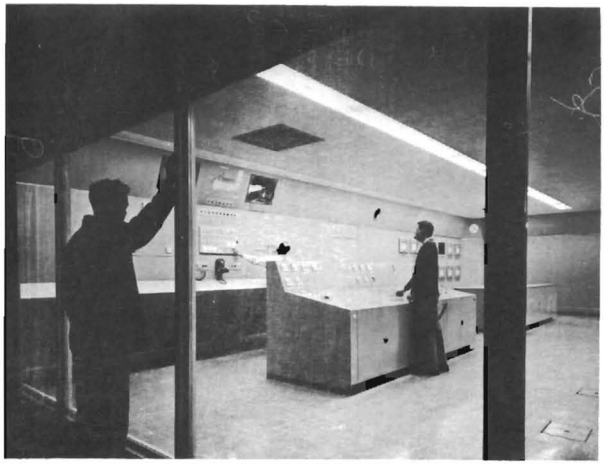
ROCKET ENGINE RESEARCH FACILITY



THRUST STAND, ROCKET ENGINE RESEARCH FACILITY

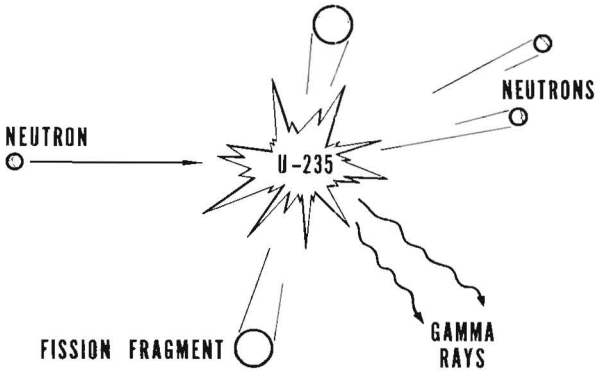


CONTROL ROOM, ROCKET ENGINE RESEARCH FACILITY

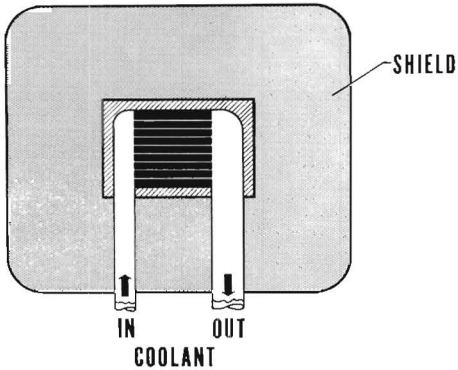


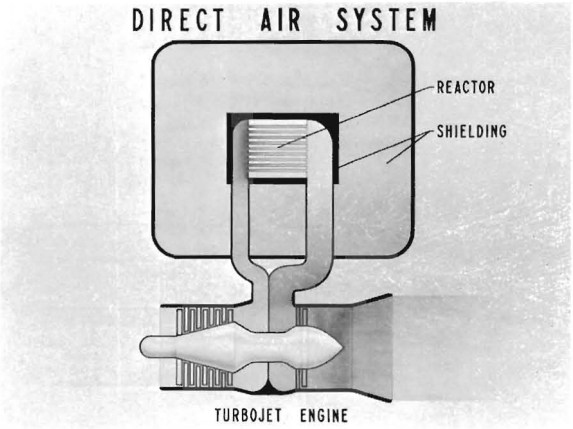
Aircraft Nuclear Propulsion

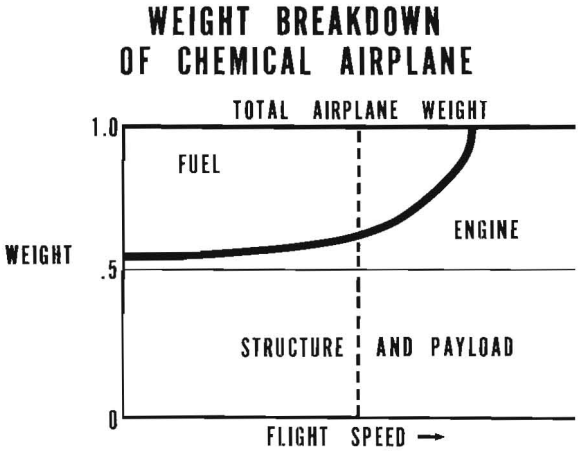
FISSION PROCESS



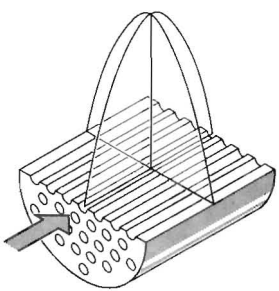
REACTOR



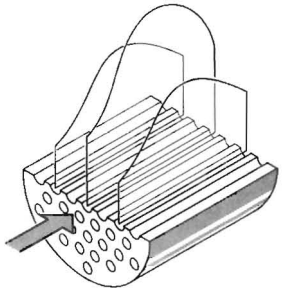

DIRECT AIR SYSTEM
REACTOR
SHIELDING
TURBOJET ENGINE


WEIGHT BREAKDOWN
OF CHEMICAL AIRPLANE
TOTAL AIRPLANE WEIGHT
1.0
FUEL
ENGINE
WEIGHT
.5
STRUCTURE
AND PAYLOAD
0
FLIGHT SPEED →

POWER AND TEMP. DISTRIBUTION

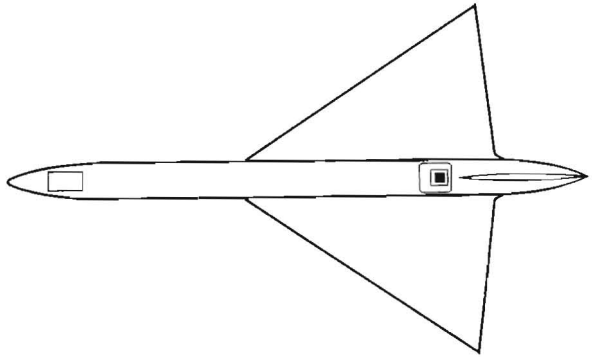


POWER



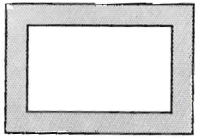
TEMPERATURE

SHAPED SHIELD

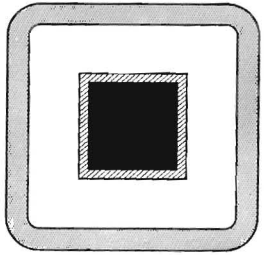


DIVIDED SHIELD

CREW SHIELD

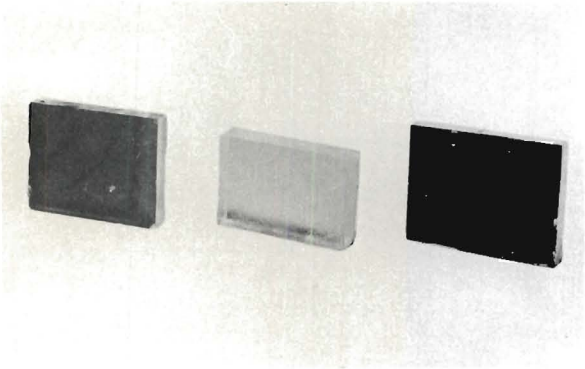


REACTOR SHIELD

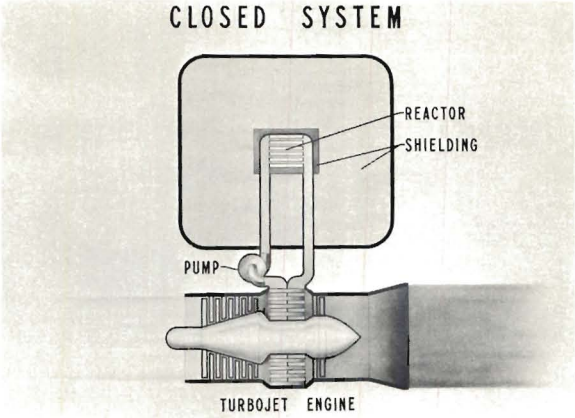


NACA 60" CYCLOTRON

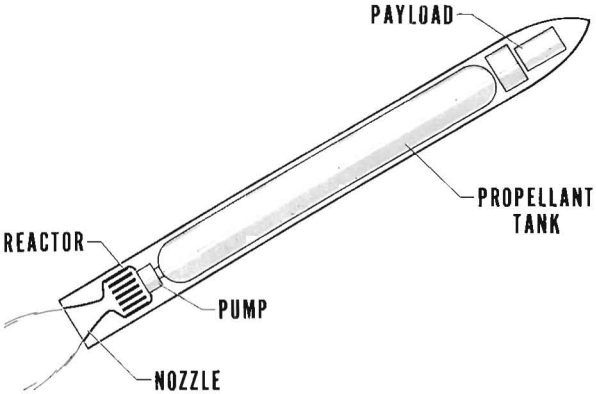
RADIATION DAMAGE



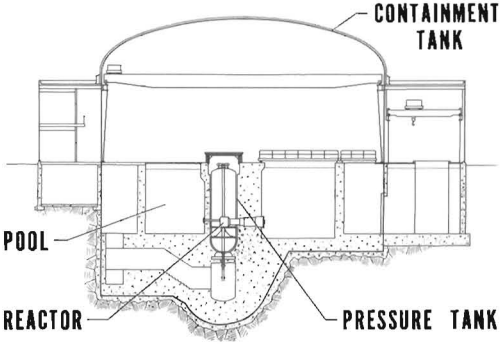
CLOSED SYSTEM



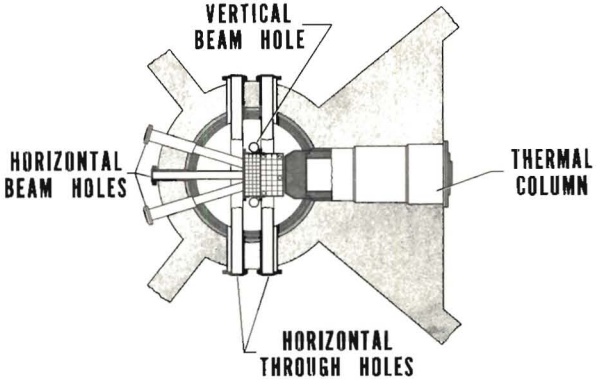
NUCLEAR ROCKET



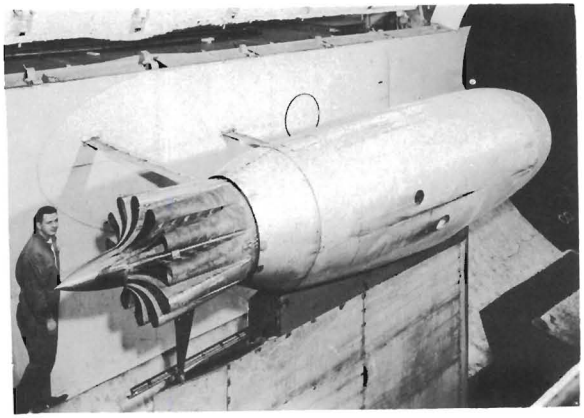
REACTOR BUILDING

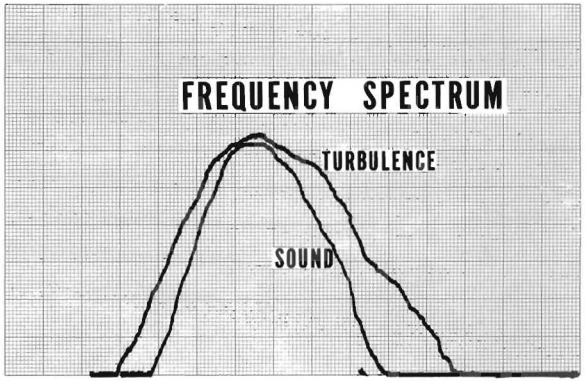


TEST FACILITIES

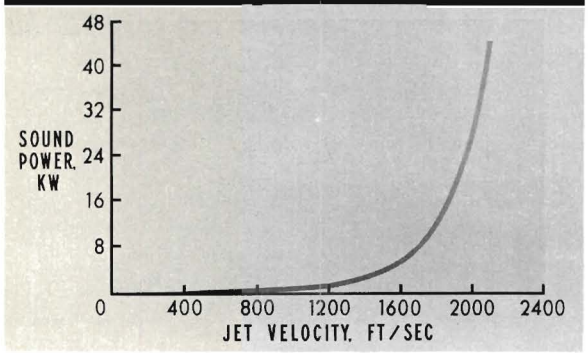


A NOISE SUPRESSOR NOZZLE

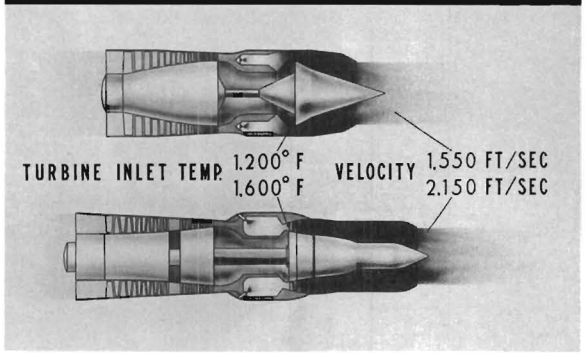




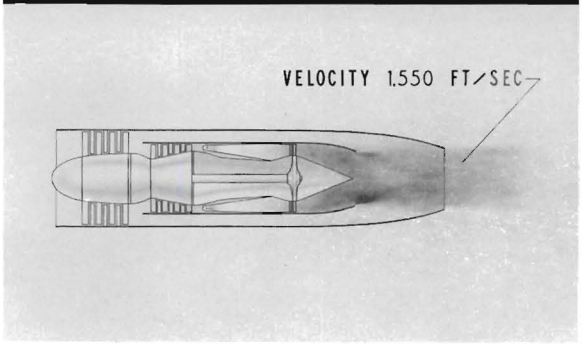
TURBOJET NOISE GENERATION



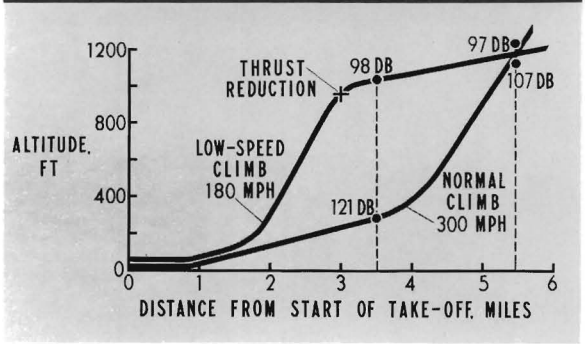
LOW AND HIGH TEMPERATURE ENGINES



BY-PASS ENGINE

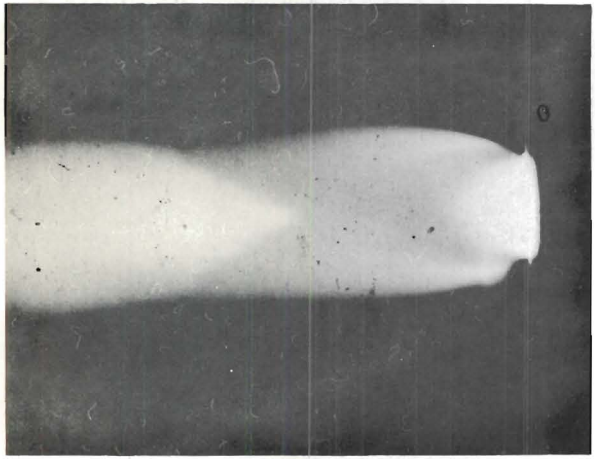


EFFECT OF CLIMB PROCEDURE ON NOISE



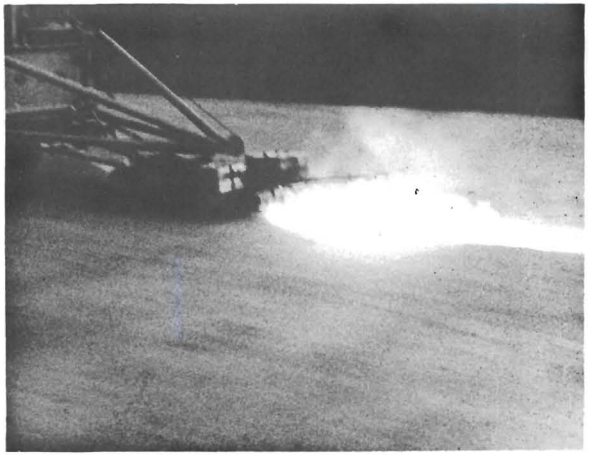
Research Newsreel

ROCKET BURNING IN SUPERSONIC TUNNEL

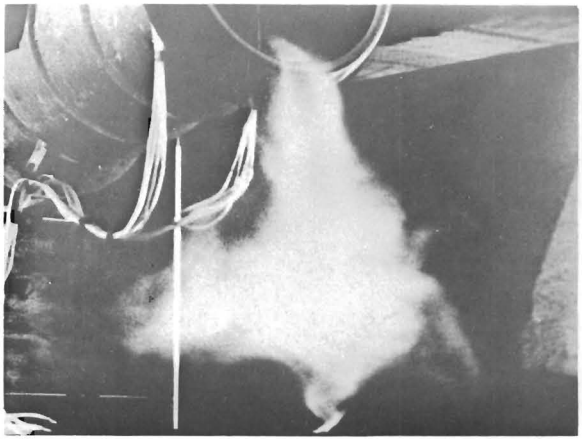


COOLED TURBINE BLADE FABRICATION

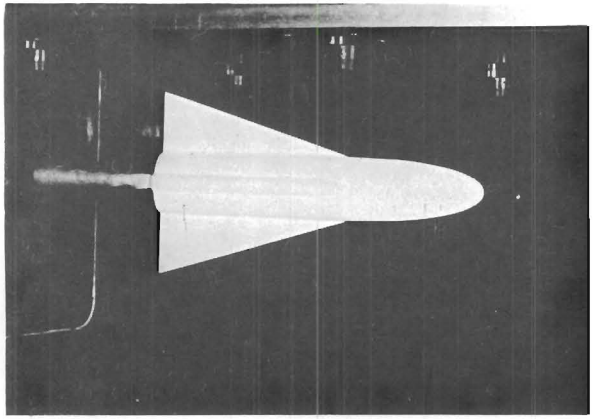
MAGNESIUM FRICTION SPARKS



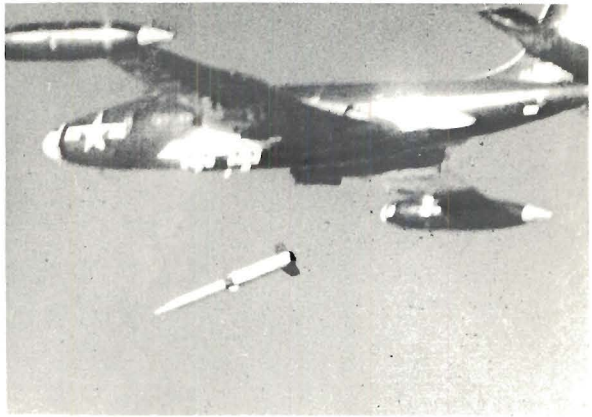
INLET VORTEX FORMATION



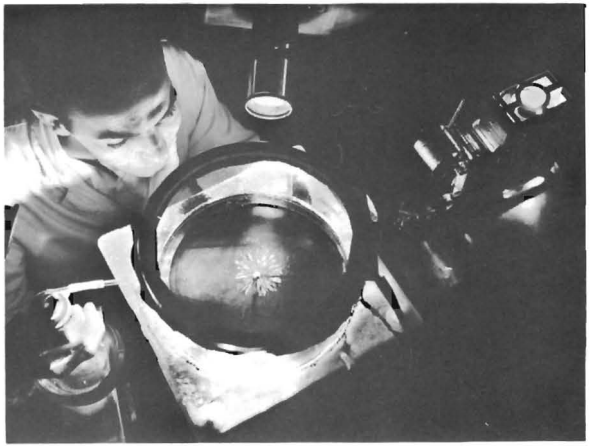
BOUNDARY-LAYER STUDIES IN BLOCK TUNNEL



FREE FLIGHT HYPERSONIC RESEARCH



ALPHA PARTICLES IN CLOUD CHAMBER



NACA-CLEVELAND

NACA

CLEVELAND, OHIO