

OP# 03110

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**NACA**

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*Inspection*



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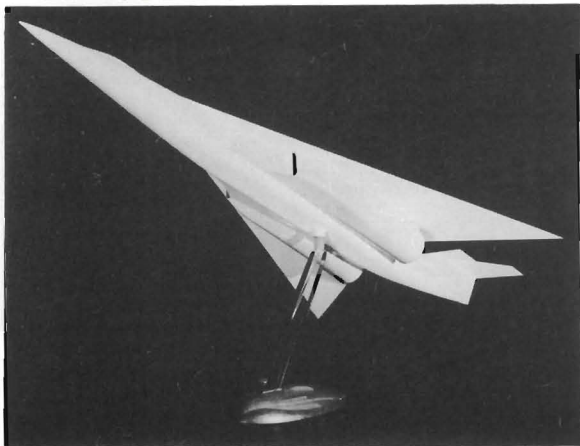
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Illustrations on these pages were taken from the charts and demonstrations in the program of the 1957 Triennial Inspection of the NACA Lewis Flight Propulsion Laboratory. Blank space is provided for notes.

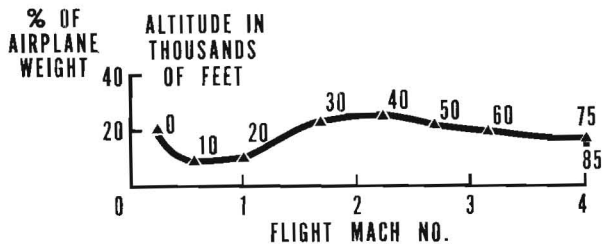
	Page
<i>Supersonic Turbojet Propulsion</i> .....	1
<i>Propulsion Research for Hypersonic Flight</i> .....	10
<i>High Temperature Materials</i> .....	18
<i>High Energy Aircraft Fuels</i> .....	23
<i>High Energy Rocket Propellants</i> .....	24
<i>Aircraft Nuclear Propulsion</i> .....	28
<i>Aircraft Noise Reduction</i> .....	35
<i>Research Newsreel</i> .....	38

HYPOTHETICAL MACH 4 TURBOJET AIRPLANE



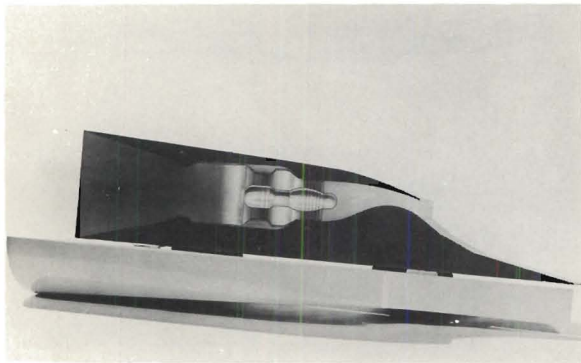
## *Supersonic Turbojet Propulsion*

DRAG OF HYPOTHETICAL AIRPLANE

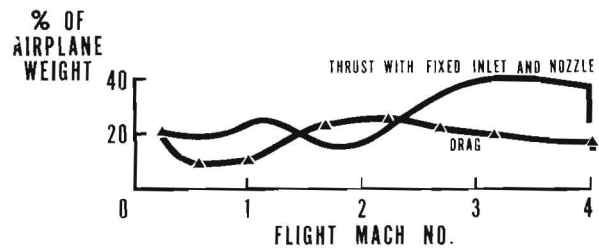
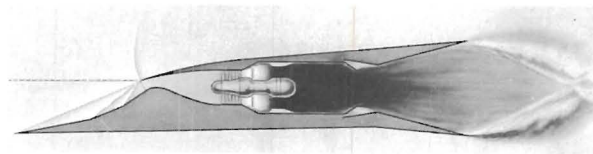




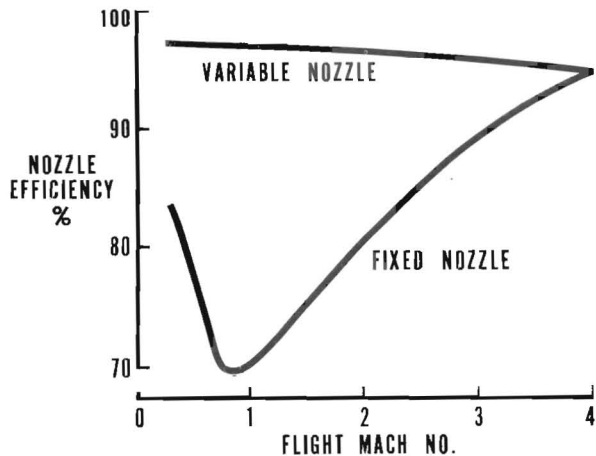
TYPICAL ENGINE POD FOR MACH 4



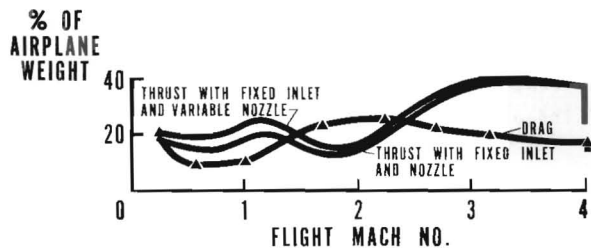
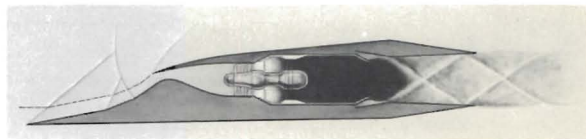
FIXED GEOMETRY THRUST IS  
INADEQUATE



## FIXED EXHAUST NOZZLE IS INEFFICIENT



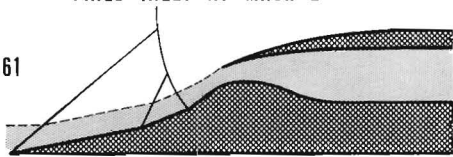
## NOZZLE CHANGES ALONE ARE INSUFFICIENT



## SPILLAGE PATTERN AFFECTS DRAG

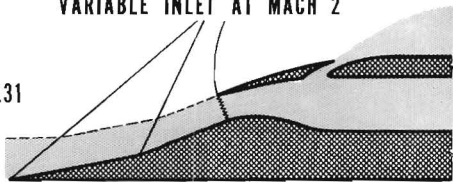
FIXED INLET AT MACH 2

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

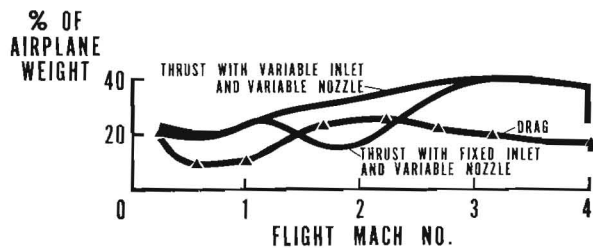
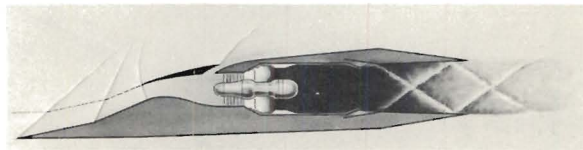


VARIABLE INLET AT MACH 2

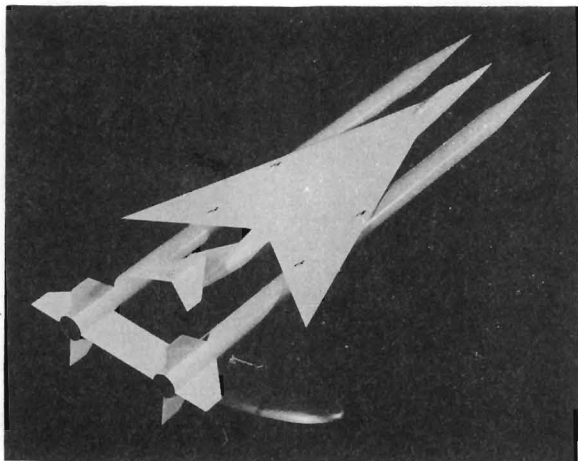
$$\frac{\text{DRAG}}{\text{THRUST}} = .31$$



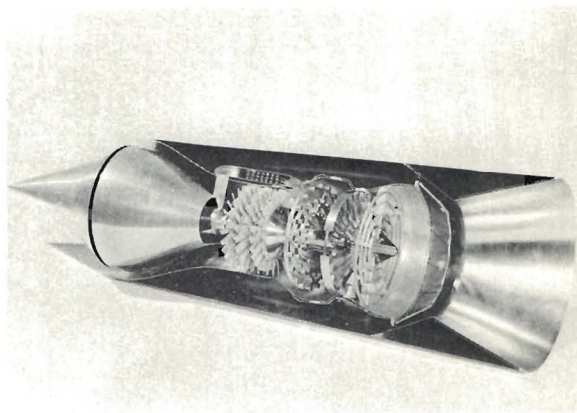
## ADDING VARIABLE INLET SOLVES PROBLEM



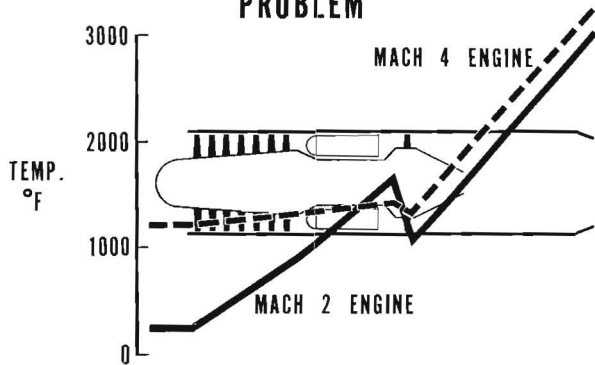
**HYPOTHETICAL MACH 4 RAMJET AIRPLANE**



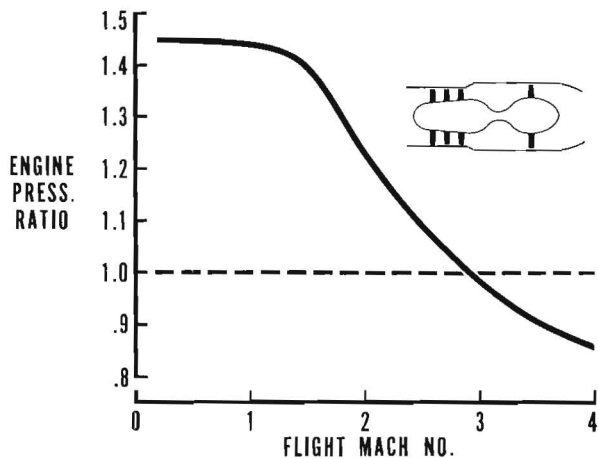
**POSSIBLE MACH 4 TURBOJET ENGINE**



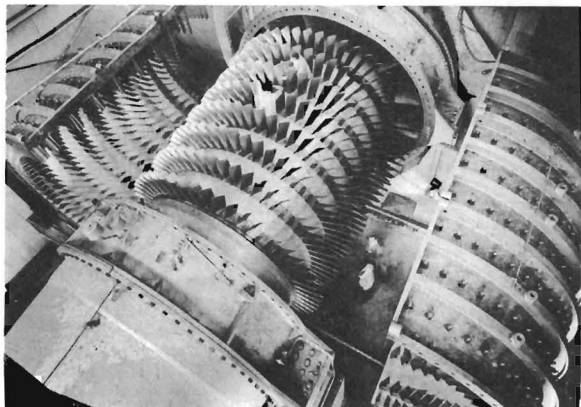
## HIGH SPEED CREATES TEMPERATURE PROBLEM



## HIGH SPEED REDUCES ENGINE PERFORMANCE



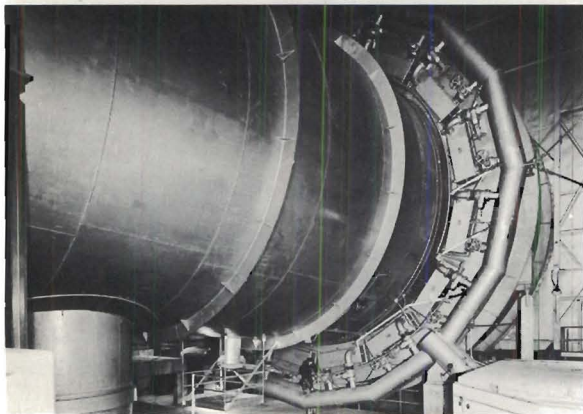
PRIMARY AXIAL-FLOW COMPRESSOR



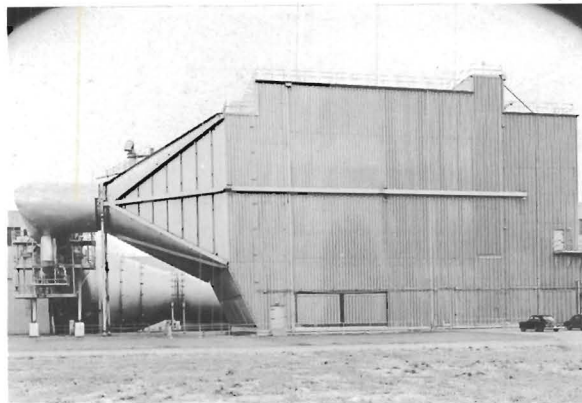
PRIMARY DRIVE SYSTEM



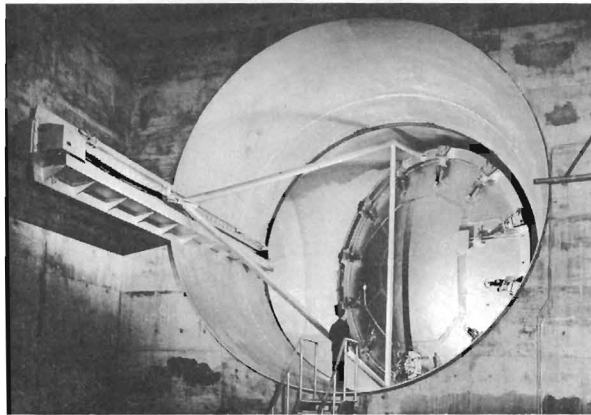
PRIMARY AIR COOLER



AIR DRYER

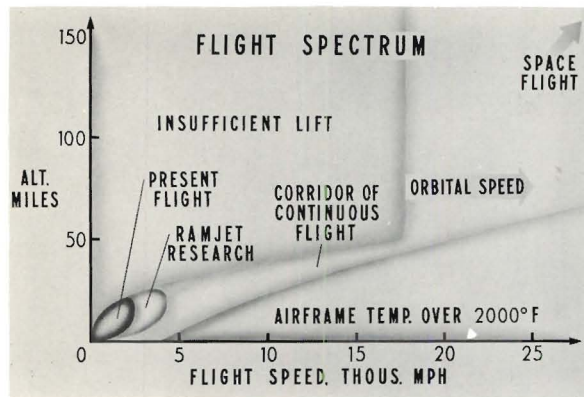


**FLOW TRANSFER VALVE**

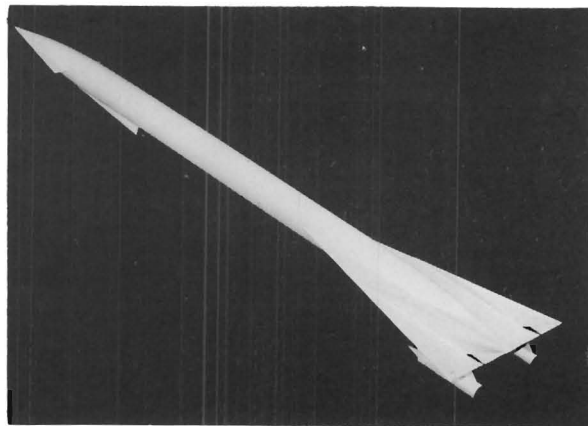




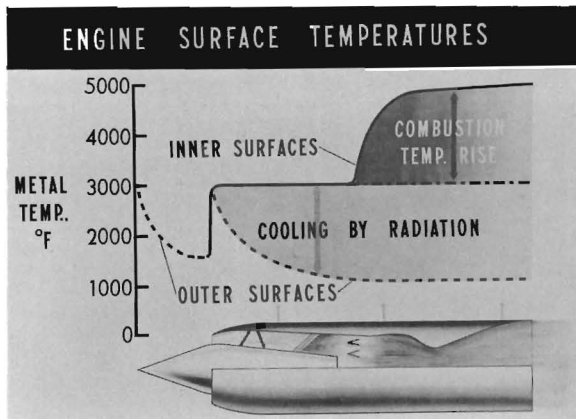
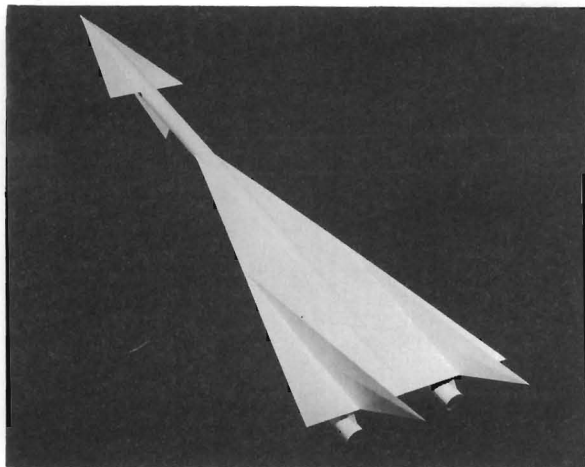
# Propulsion Research for Hypersonic Flight



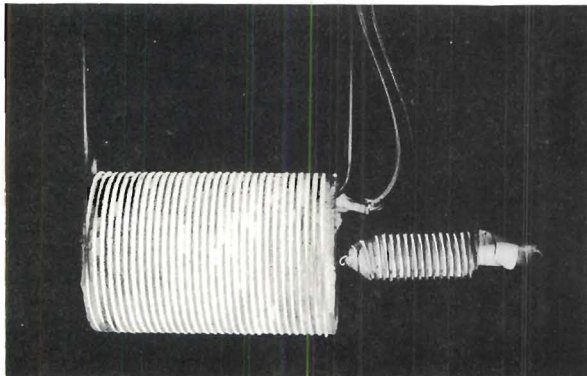
HYPERSONIC AIRCRAFT FOR OPERATION WITHIN  
FLIGHT CORRIDOR



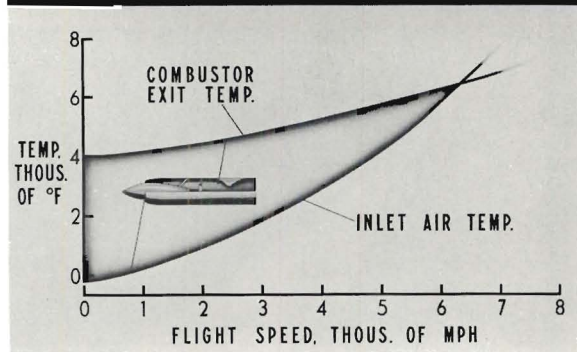
# HYPERSONIC AIRCRAFT FOR OPERATION ABOVE FLIGHT CORRIDOR



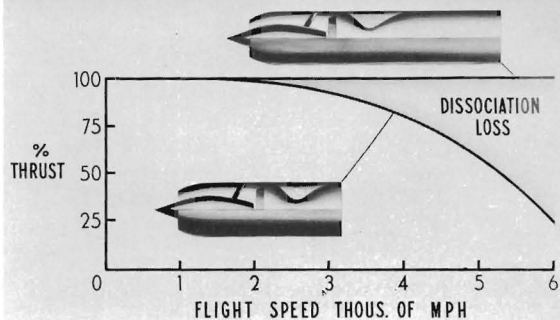
DEMONSTRATION OF RADIATION ON ENGINE  
SURFACE TEMPERATURES



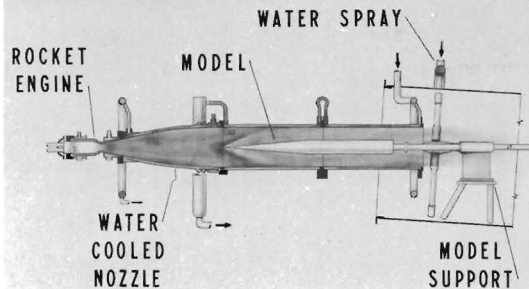
MAXIMUM COMBUSTION TEMPERATURE RISE



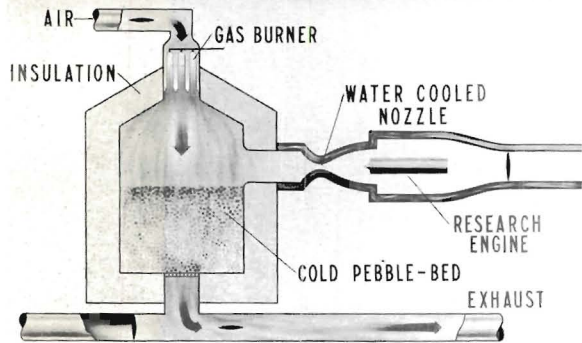
## EFFECT OF DISSOCIATION ON ENGINE THRUST



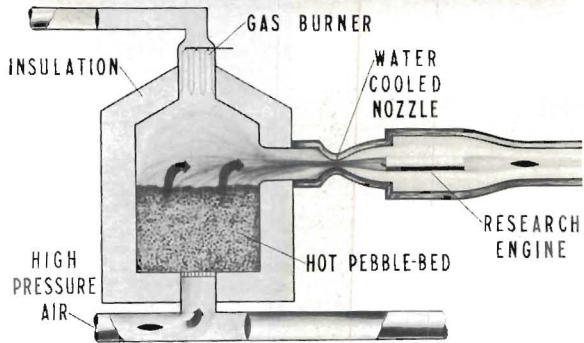
## ROCKET TUNNEL FACILITY



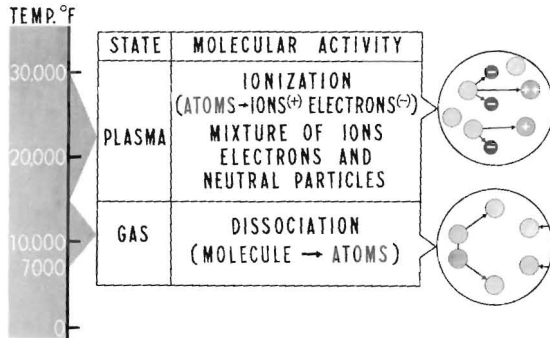
## PEBBLE-BED HEATER FACILITY HEATING CYCLE



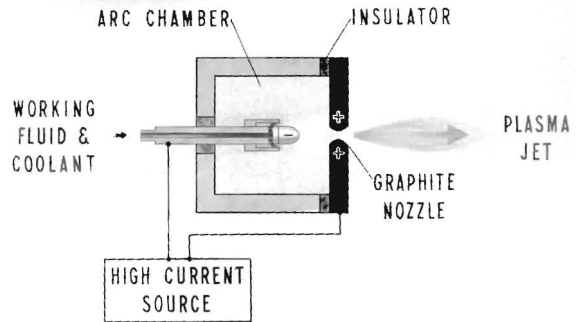
## PEBBLE-BED HEATER FACILITY RUN CYCLE



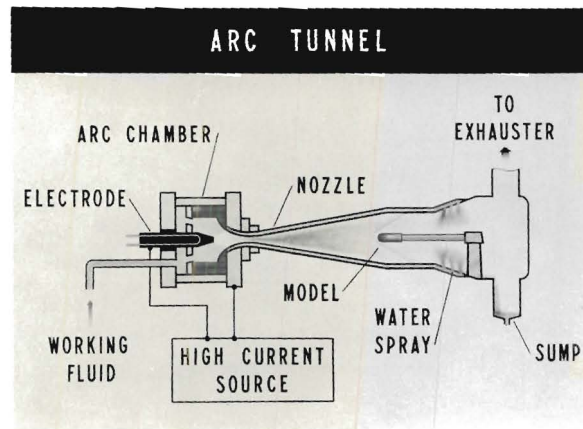
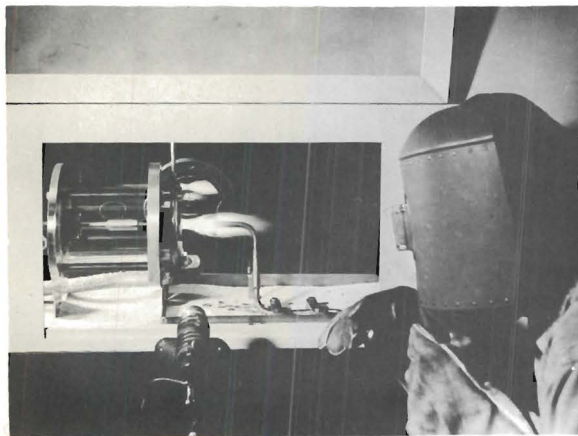
## EFFECT OF TEMPERATURE ON MOLECULAR STRUCTURE OF NITROGEN



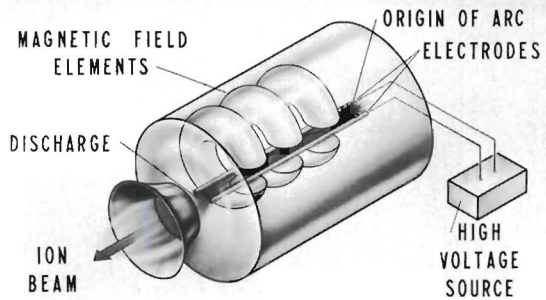
## PLASMA JET



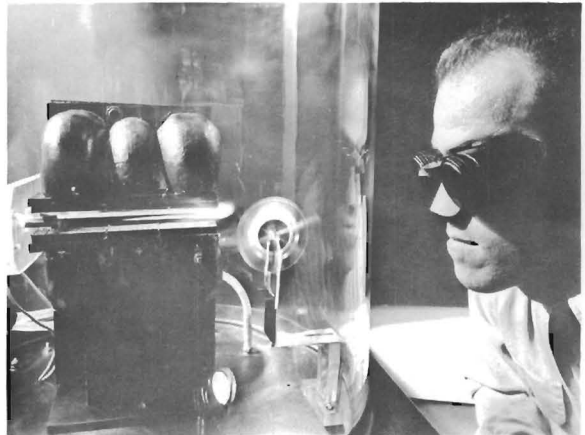
## PLASMA JET PRODUCED BY ARC CHAMBER



## ION-PROPULSION UNIT (AT EXTREME ALTITUDES)



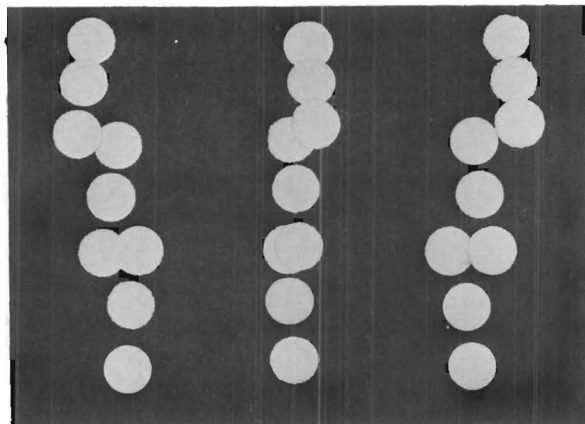
## ION ROCKET IN OPERATION



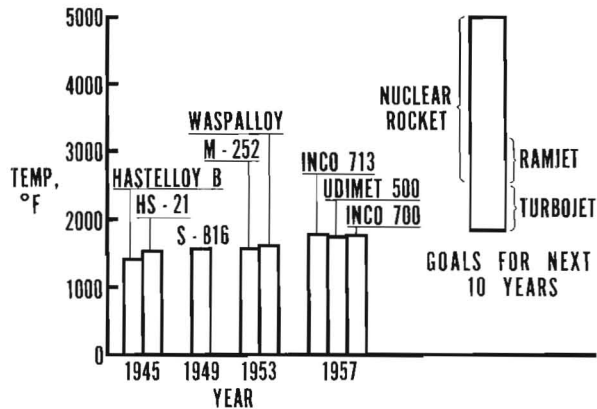


# High Temperature Materials

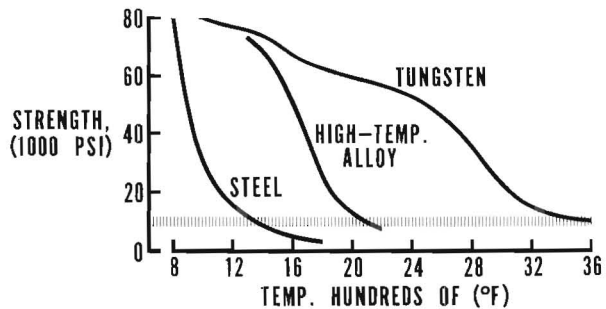
## ATOMIC STRUCTURE



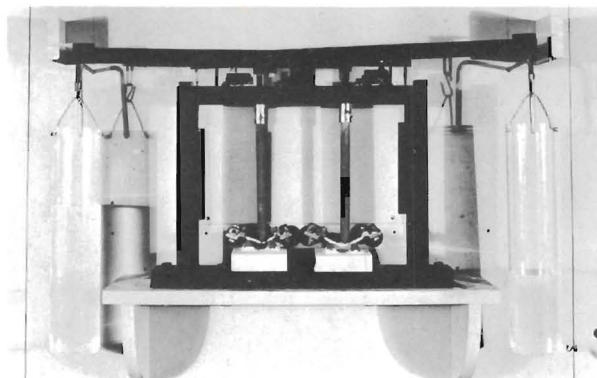
## OPERATING TEMP. OF MATERIALS



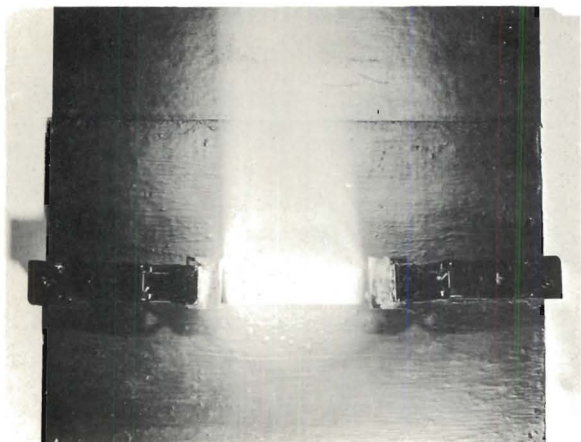
## COMPARATIVE STRENGTHS OF SEVERAL MATERIALS



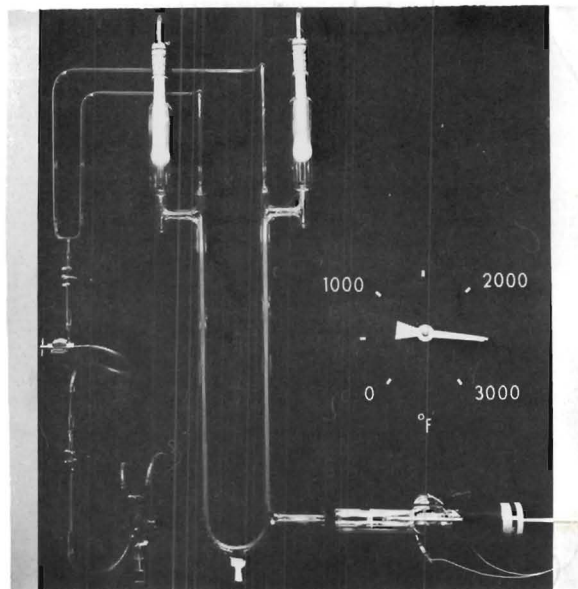
HARD PARTICLES DISPERSED IN MATRIX  
INCREASE STRENGTH



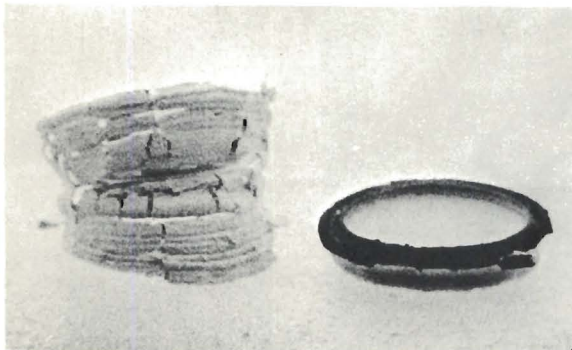
TUNGSTEN OXIDIZES RAPIDLY IN AIR



ATOM RECOMBINATION RAISES SURFACE TEMPERATURE



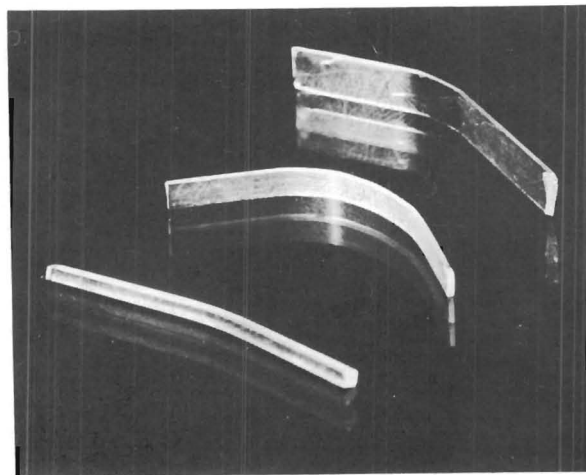
COMPARISON OF PURE & ALLOYED COLUMBIUM  
OXIDATION AT 1500 F IN AIR



DEMONSTRATION OF THERMAL STRESS FAILURE

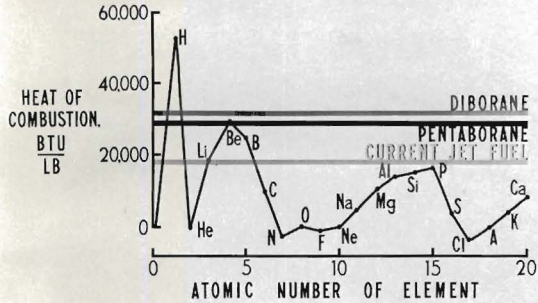


DUCTILITY OF MAGNESIUM OXIDE CRYSTALS

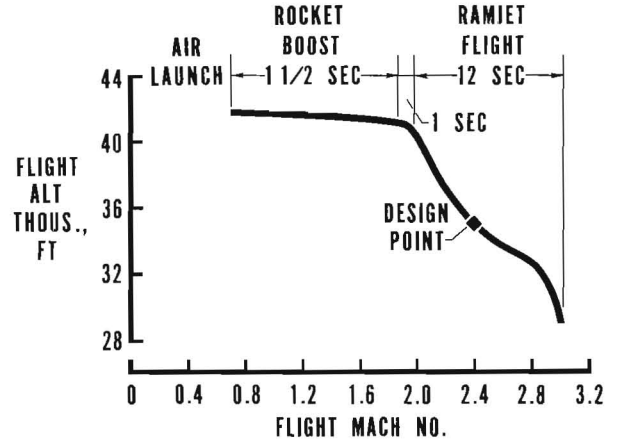


# High Energy Aircraft Fuels

## HEAT OF COMBUSTION OF THE ELEMENTS

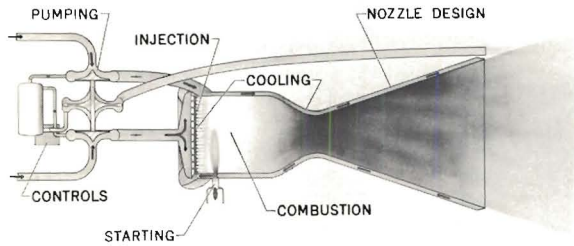


## FLIGHT DATA FOR A PENTABORANE POWERED RAMJET

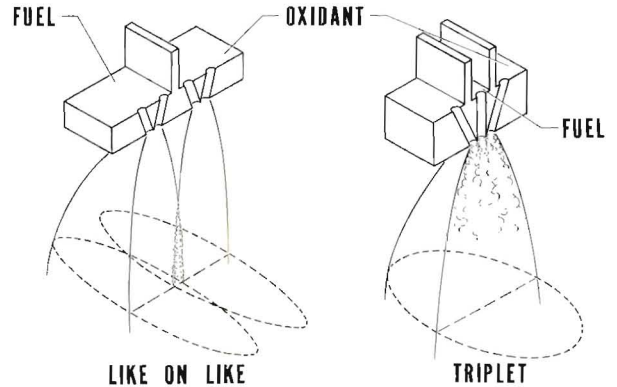


# High Energy Rocket Propellants

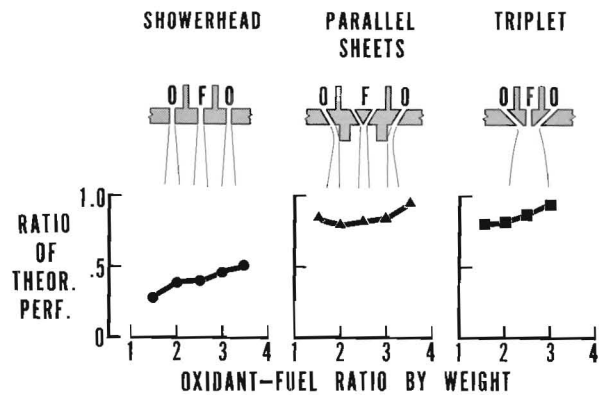
## ROCKET ENGINE PROBLEM AREAS



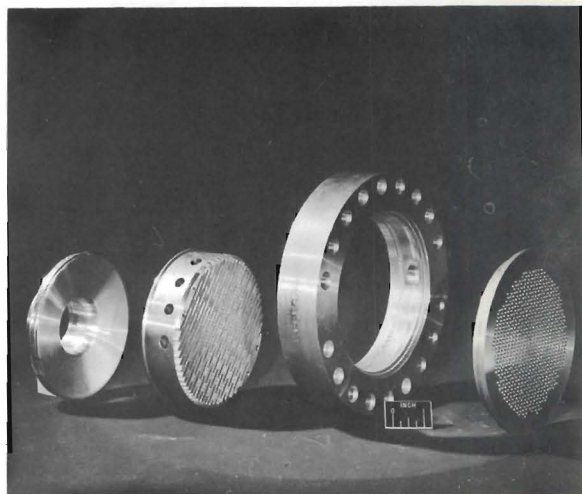
## INJECTOR ELEMENT SPRAY PATTERNS



### SINGLE ELEMENT INJECTOR PERFORMANCE

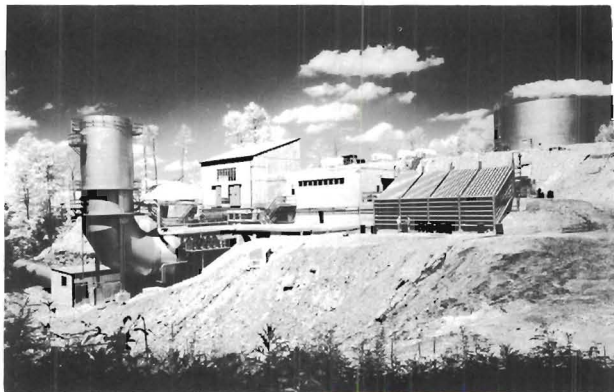


### MULTI UNIT ROCKET INJECTOR

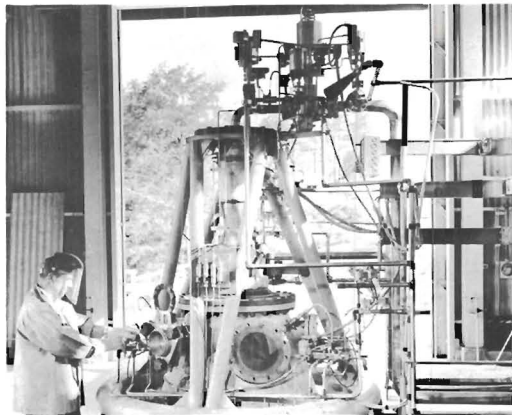




ROCKET ENGINE RESEARCH FACILITY



THRUST STAND, ROCKET ENGINE RESEARCH FACILITY

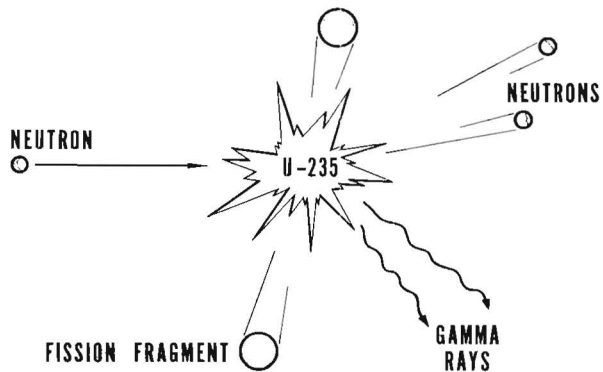


CONTROL ROOM, ROCKET ENGINE RESEARCH FACILITY

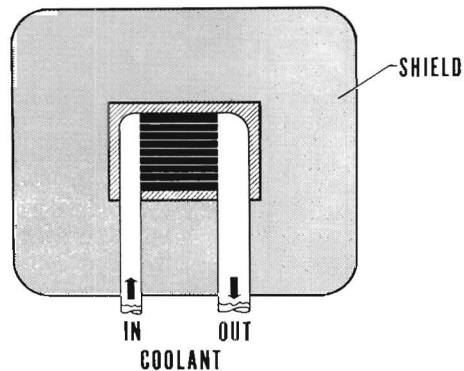


# *Aircraft Nuclear Propulsion*

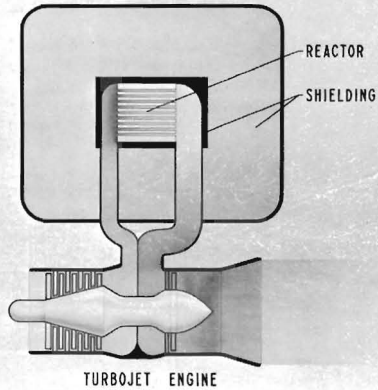
## FISSION PROCESS



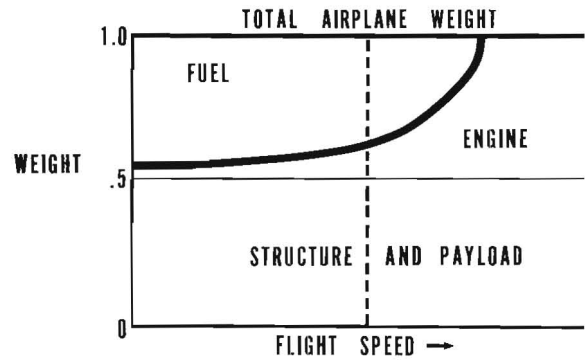
## REACTOR



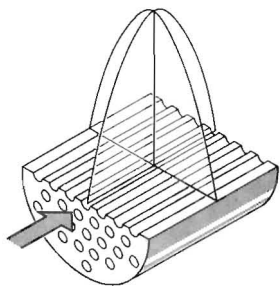
## DIRECT AIR SYSTEM



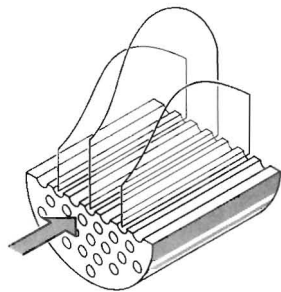
## WEIGHT BREAKDOWN OF CHEMICAL AIRPLANE



## POWER AND TEMP. DISTRIBUTION

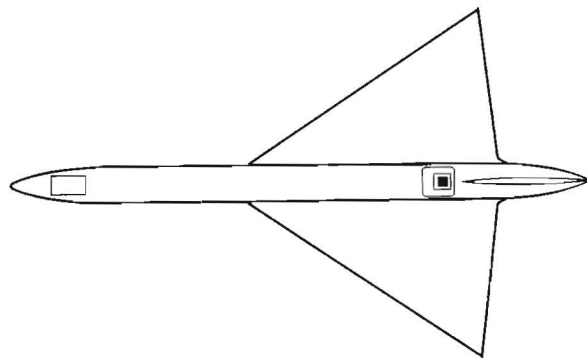


POWER



TEMPERATURE

## SHAPED SHIELD

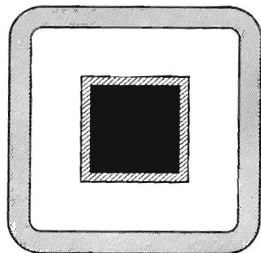


## DIVIDED SHIELD

CREW SHIELD



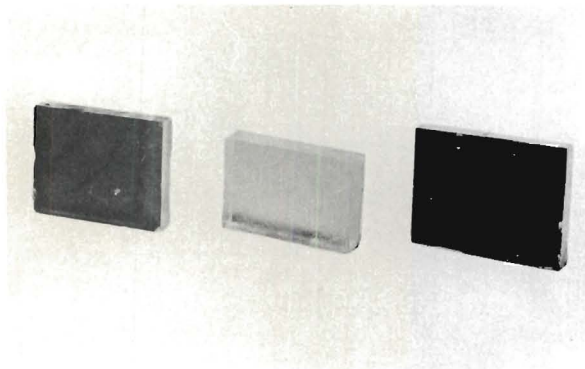
REACTOR SHIELD



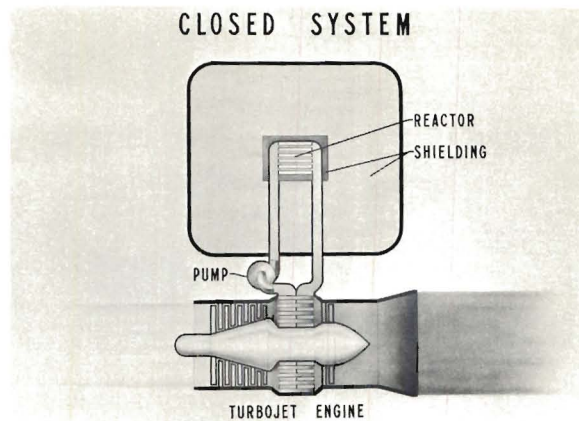
NACA 60" CYCLOTRON



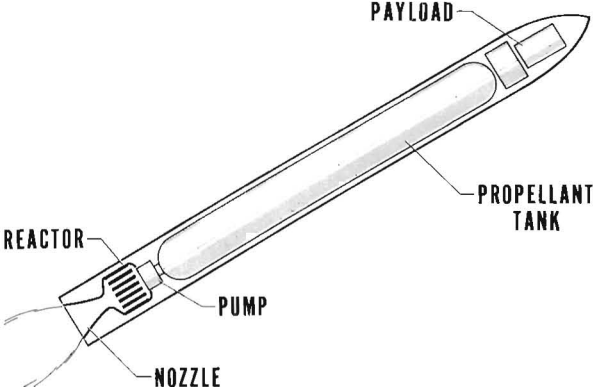
## RADIATION DAMAGE



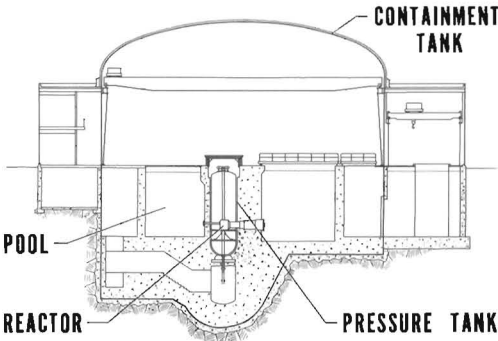
## CLOSED SYSTEM



# NUCLEAR ROCKET

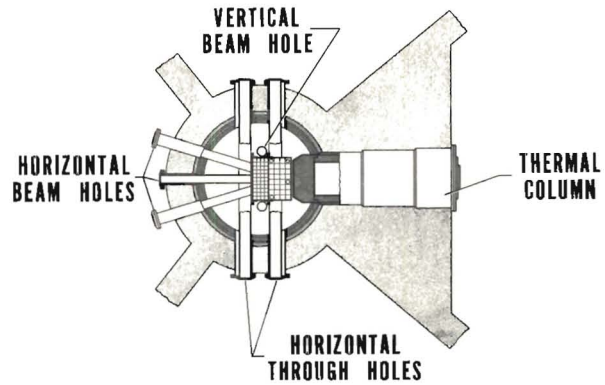


# REACTOR BUILDING



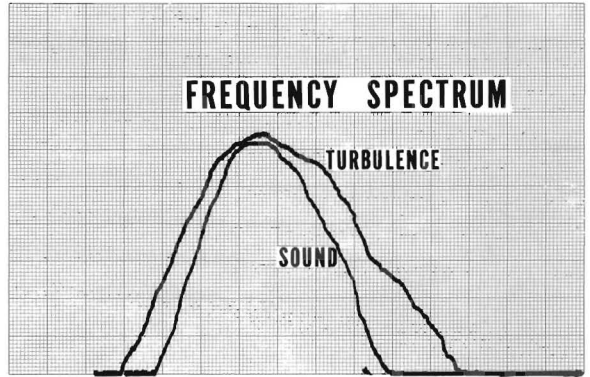
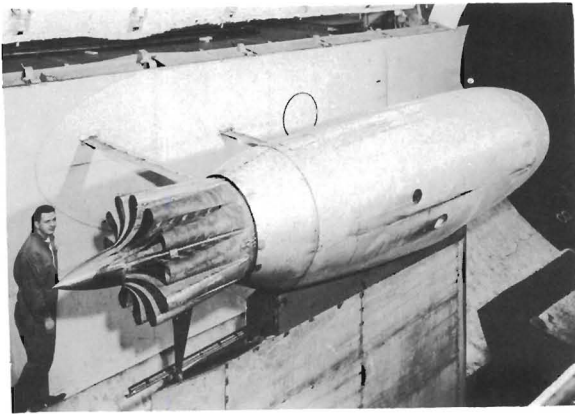


## TEST FACILITIES

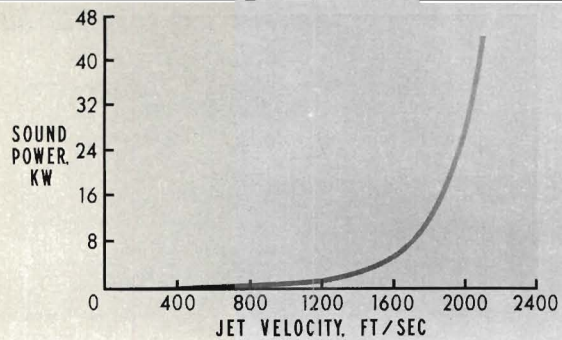


# *Aircraft Noise Reduction*

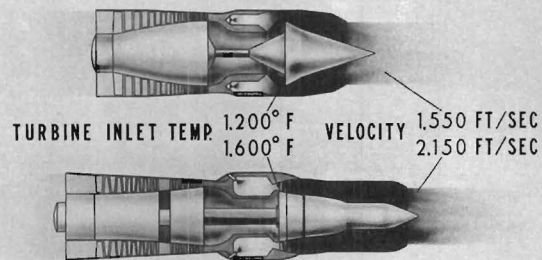
A NOISE SUPPRESSOR NOZZLE



## TURBOJET NOISE GENERATION

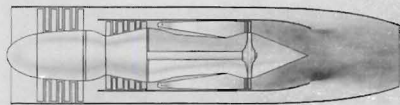


## LOW AND HIGH TEMPERATURE ENGINES

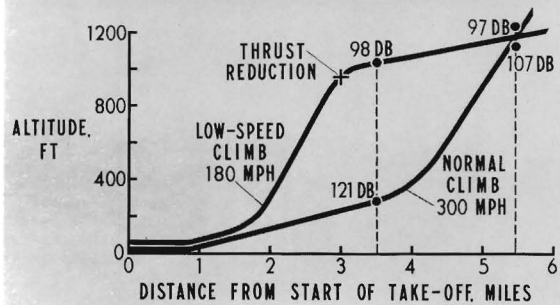


## BY-PASS ENGINE

VELOCITY 1.550 FT/SEC

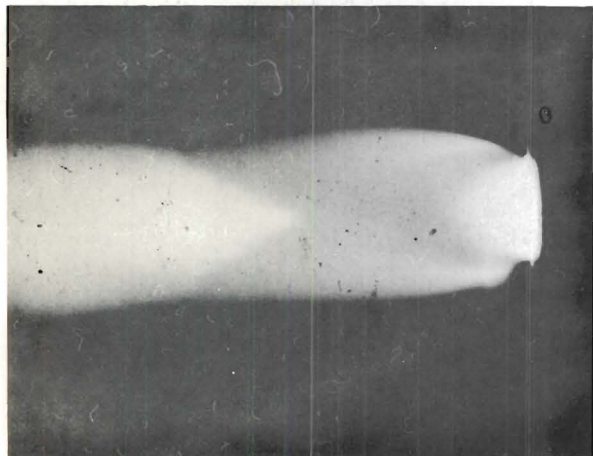


## EFFECT OF CLIMB PROCEDURE ON NOISE



# *Research Newsreel*

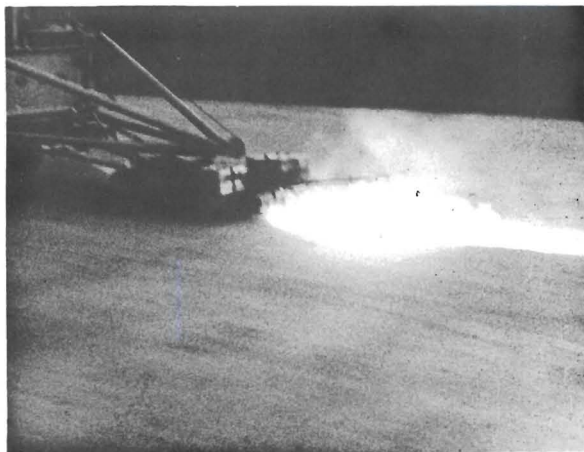
ROCKET BURNING IN SUPERSONIC TUNNEL



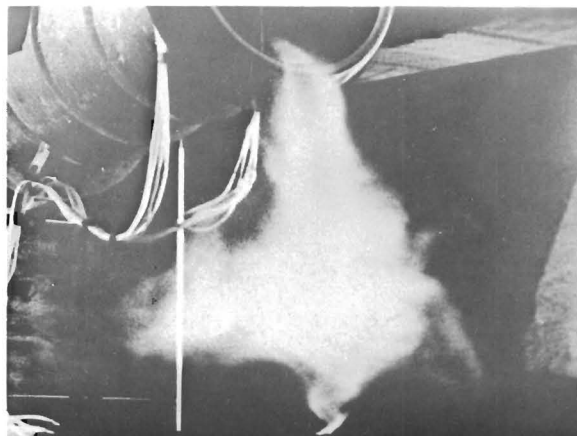
COOLED TURBINE BLADE FABRICATION



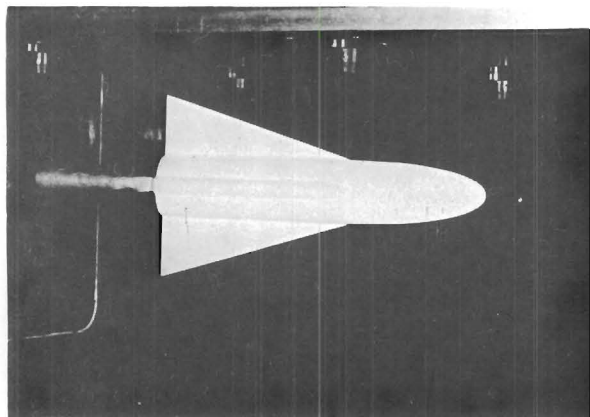
MAGNESIUM FRICTION SPARKS



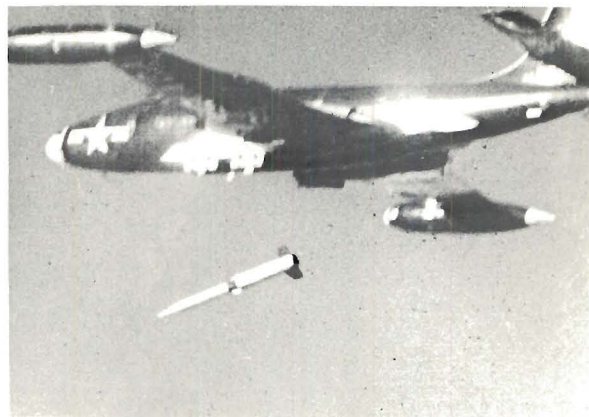
INLET VORTEX FORMATION



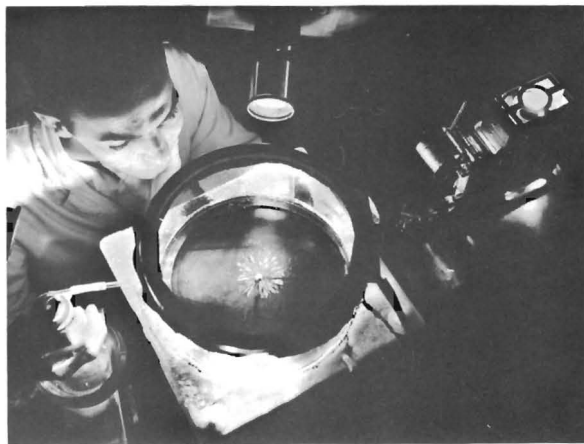
**BOUNDARY-LAYER STUDIES IN BLOCK TUNNEL**



**FREE FLIGHT HYPERSONIC RESEARCH**



ALPHA PARTICLES IN CLOUD CHAMBER





NACA-CLEVELAND



CLEVELAND, OHIO