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This booklet contains reproductions of charts used to illustrate the presentations at the 1953 Inspection of the NACA's Langley Aeronautical Laboratory. They have been prepared for your use following suggestions that such a device might be helpful to those who attend the Inspection. Space has been provided for those who may wish to take notes.
SPECIAL RECORDER DEPICTS HELICOPTER OPERATING CONDITIONS

NORMAL ACCELERATION
AIRSPEED
ALTITUDE

NORMAL ACCELERATION
AIRSPEED
ALTITUDE

1 MINUTE
AIRMAIL

1 MINUTE
MILITARY TRAINING

MANEUVER LOAD FACTOR

○ HELICOPTER "A"
○ HELICOPTER "B"
ALL BLADE SECTIONS AT C_L MAX

TRIM MEAN LIFT COEFFICIENT, C_l

0 0.2 0.4 0.6 0.8 1.0 1.2

1.0 1.5 2.0 2.5 3.0 3.5

NOTES
HYDRODYNAMICS

TAKE-OFF RESISTANCE

RESISTANCE

WATER

THRUST

L.AND

SPEED

TAKE-OFF RESISTANCE
HYDRO-SKIS

RESISTANCE

SPEED

NOTES
LIFT OF SKI SHAPES

RESISTANCE OF SKI SHAPES

NOTES
RELATIVE SIZE FOR SAME LIFT-RESISTANCE RATIO

RELATIVE RESISTANCE FOR SAME SIZE

NOTES
TRANSONIC RESEARCH

TRANSONIC TUNNELS

8-FT. TRANSONIC TUNNEL

8-FT. TRANSONIC PRESSURE TUNNEL

16-FT. TRANSONIC TUNNEL

VIEW OF FLOW AND SHOCK PATTERNS

VORTEX

SEPARATED FLOW

SUBSONIC

SHOCKS

TRANSONIC

NOTES
FLOW VISUALIZATION BY LIQUID FILM

\[ \alpha = 0 \quad \alpha = 5 \quad \alpha = 9 \quad \alpha = 13 \]

NOTES
# Pilotless Aircraft Research

## Rocket Models

<table>
<thead>
<tr>
<th>Type of Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
</tr>
<tr>
<td>Lift and drag</td>
</tr>
<tr>
<td>Boundary layer inlets</td>
</tr>
<tr>
<td>Stability and control</td>
</tr>
<tr>
<td>Control effectiveness</td>
</tr>
<tr>
<td>Hinge moments</td>
</tr>
<tr>
<td>Damping</td>
</tr>
<tr>
<td>Flying qualities</td>
</tr>
<tr>
<td>Automatic stabilization</td>
</tr>
<tr>
<td>Dynamic behavior</td>
</tr>
<tr>
<td>Flutter</td>
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<tr>
<td>Buffeting</td>
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</tbody>
</table>

## Coupled Yaw and Pitch

<table>
<thead>
<tr>
<th>Measured Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yaw</td>
</tr>
<tr>
<td>Pitch</td>
</tr>
</tbody>
</table>

## Notes

- Time
- Desired response
- Yaw
- Pitch
PITCH UP
DYNAMIC CHARACTERISTICS

90~
ANGLE OF ATTACK

-90~

ROLL

TIME. SECONDS

DAMPING RECORD

WING ANGLE OF ATTACK

WING BENDING

TIME. SEC. 0 1 2
FLIGHT FLUTTER STUDY

BUFFETING
EXTERNAL STORES

NOTES
GAS DYNAMICS

GAS DYNAMICS LABORATORY

TEST JETS

-20°F TO 140°F
100°F TO 400°F
65°F TO 500°F

650°F TO 1040°F

NOTES
HEAT-TRANSFER JET

- M = 0
- TIP
- T.F.
- AMB. AT ALT.
- LIQ. AIR

0.4

SMOOTH

SUBSONIC EFFECTS OF SURFACE ROUGHNESS

SKIN FRICTION COEF.

REYNOLDS NUMBER

DENSITY PROPORTIONAL TO LENGTH

VISCOSITY

NOTES
SUPERSOONIC EFFECTS OF SURFACE ROUGHNESS
4 FOOT SUPERSONIC TUNNEL

LATHE TOOL MARKS

SKIN FRICTION COEF.

ROUGH

SMOOTH

REYNOLDS NUMBER

DRAG BREAKDOWN
M = 1.8

ROUGHNESS

FRICT.

PRESS.

SMOOTH BODY

NOTES
ALLOWABLE ROUGHNESS FOR A LONG RANGE MISSILE

ALTITUDE - 50,000 FT - M = 2.5

LOW DENSITY JET

NOTES
B.L. SER. AHEAD OF CONTROL

Theory

Actual

B.L. SEPARATION CRITERIA

\[ \frac{\Delta P}{Q_{\text{crit}}} \]

Strength of Shock

Separation

No Separation

Turb.

\[ 10^2 \quad 10^5 \quad 10^8 \quad 10^9 \]

Reynolds Number
DYNAMIC LOADS

ROUGH AIR DEPENDS ON ALTITUDE

LOADS DEPEND ON OPERATION AND AIRPLANE

NOTES
LOADS DEPEND ON OPERATION AND AIRPLANE

NOTES
VARIATION OF FRICTION IN LANDING

NOTES
TROUBLESOME FLUTTER REGIONS

- Propellers, Rotor Blades
- Unswept Wings
  - High AR
  - Low AR
- Swept Wings
- Delta Wings
- Controls
- External Stores
- Thin Skins

EXPERIMENTS WITH DYNAMIC FLUTTER MODEL

NOTES
CREEP DEFLECTION AT ELEVATED TEMPERATURE

STRESS IN A DELTA WING DUE TO NONUNIFORM TEMPERATURE

NOTES
NOTES
EFFECT OF A SHARP NOTCH ON FATIGUE STRENGTH

![Graph of Fatigue Strength vs. Static Strength](image)

**Notes**
SINKING SPEEDS FOR TRANSPORT LANDINGS

FREQUENCY DISTRIBUTION

NOTES
SINKING SPEEDS FOR TRANSPORT LANDINGS

PROBABILITY

SINKING SPEED $V_s$ FT/SEC.

0 1 2 3 4 5

PROBABILITY OF EXCEEDING $V_s$

10 100 1000 10,000

F-86 STABILIZER STRAIN-GAGE INSTALLATION

BRIDGE

SHEAR-FRONT SPAR

SHEAR-REAR SPAR

MOMENT REAR SPAR

GAGE STATION

SECTION A-A

GAGE STATION

CHORD POSITION R
MODEL CONSTRUCTION

WING MILLING FIXTURE

- TOOL NORMALIZING TEMPLATE
- BALL SOCKET AT ORIGIN
- HIGH SPEED ROUTER
- ROLLER
- ROUGH BLANK
- TEMPLATE BENT TO ARC ABOUT ORIGIN
- FINISHED SURFACE

AIRFOIL CUTTING MACHINE

- TEMPLATE (6X SIZE)
- FOLLOWER WHEEL
- BARREL STOCK
- FINISHED AIRFOIL
- CUTTER
- TORQUE TUBE

NOTES