

CONCORDE



- BASIC WING DESIGN CONSIDERATION
- OFF DESIGN CAPABILITY
- SIMPLE HIGH-LIFT SYSTEM
- WING STRUCTURAL LOADS

STRATEGIC RECONNAISSANCE AIRCRAFT



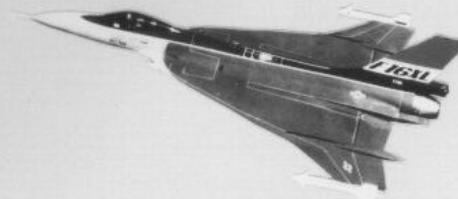
- LOW-SPEED HIGH LIFT
- A.C. CONTROL
- DIRECTIONAL STABILITY

TRANSONIC MANEUVERING FIGHTERS



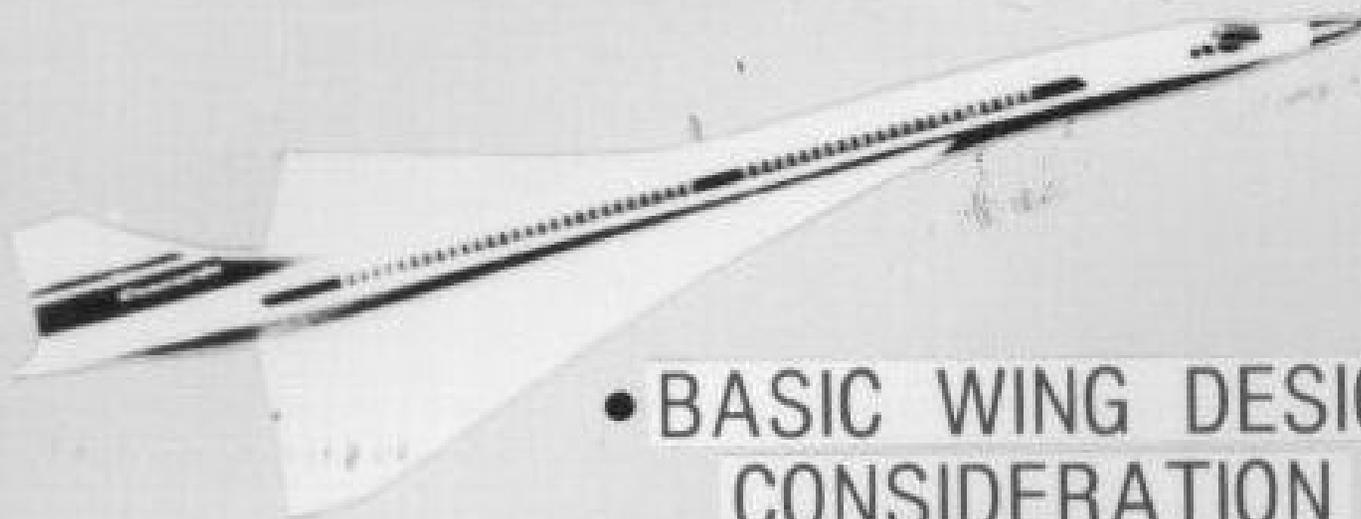
- MANEUVER LIFT STRAKES
- LOW-SPEED HIGH-LIFT
- LOW-GUST RESPONSE
- LOW STRUCTUAL WEIGHT

F-16XL



- LOW-SPEED HIGH LIFT
- TRANSONIC MANEUVER LIFT
- WING STRUCTURAL LOADS

CONCORDE



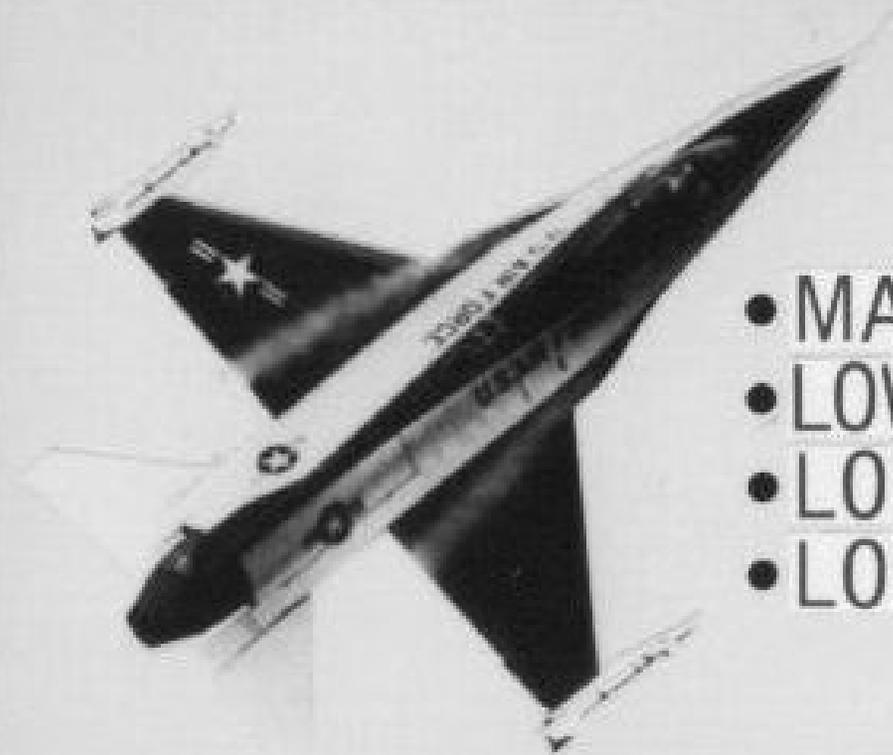
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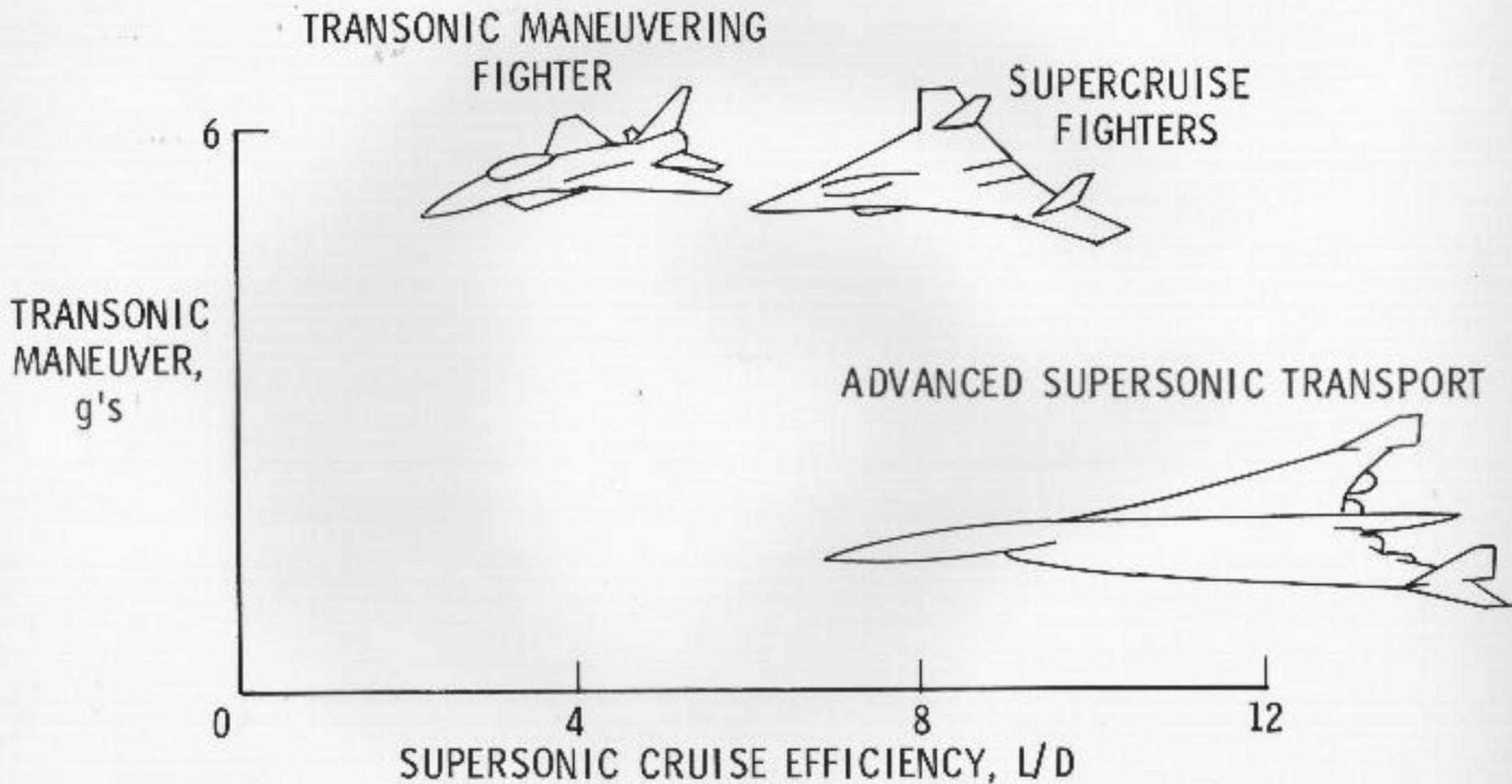


- LOW-SPEED HIGH LIFT
- TRANSONIC MANEUVER LIFT
- WING STRUCTURAL LOADS

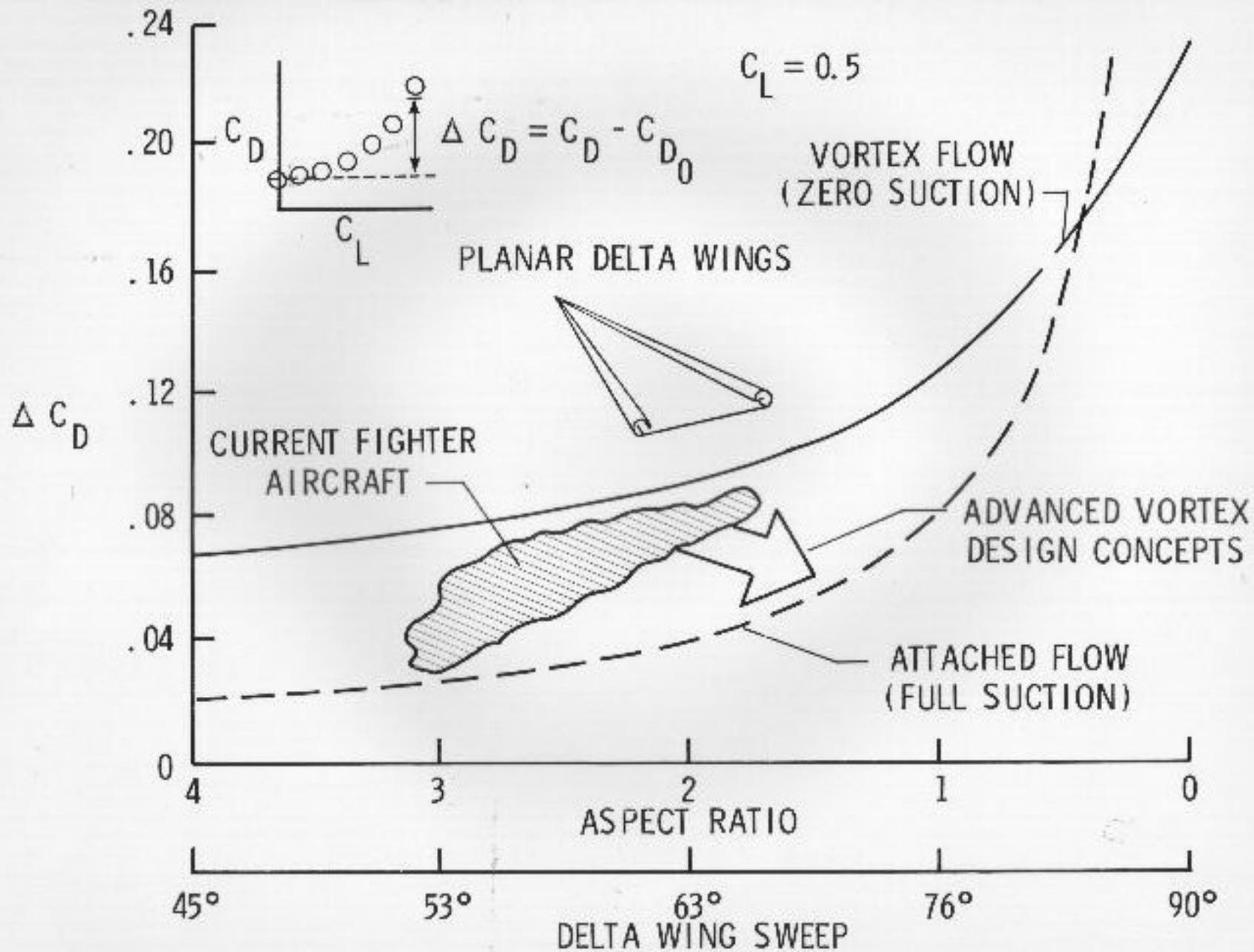




SUPERSONIC-CRUISE FIGHTER TECHNOLOGY

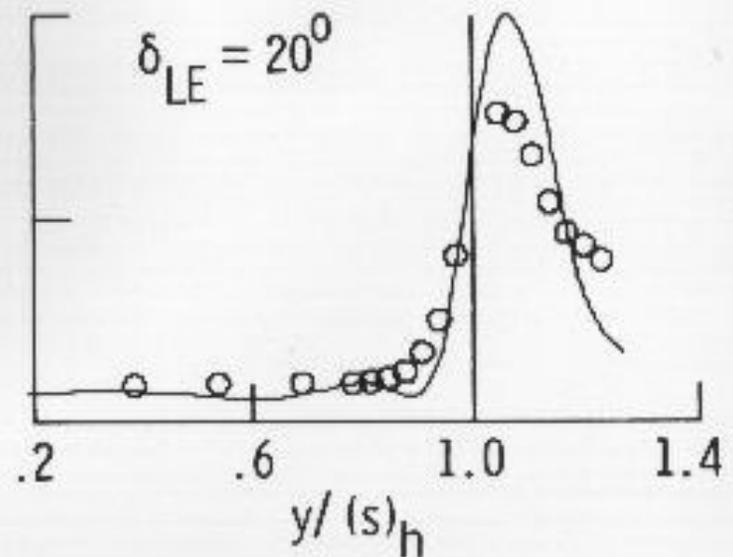
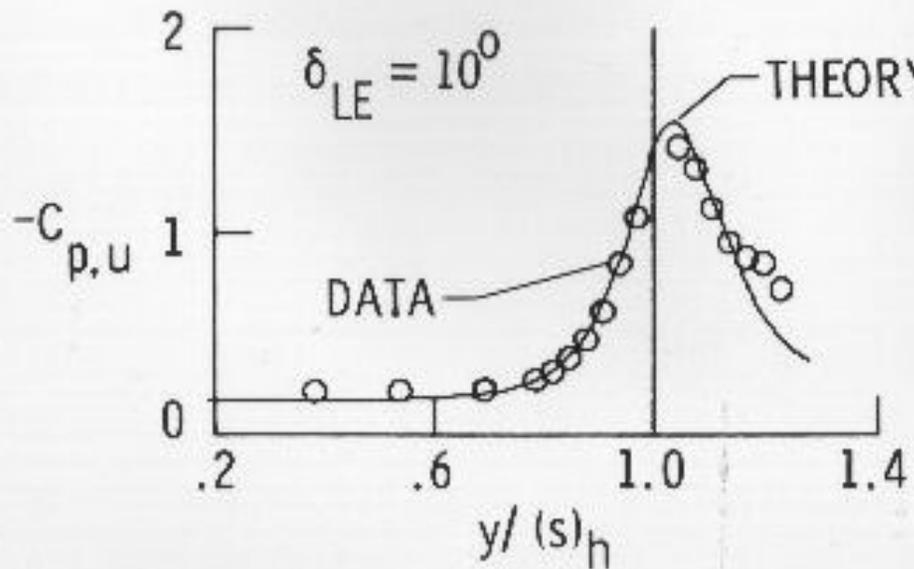
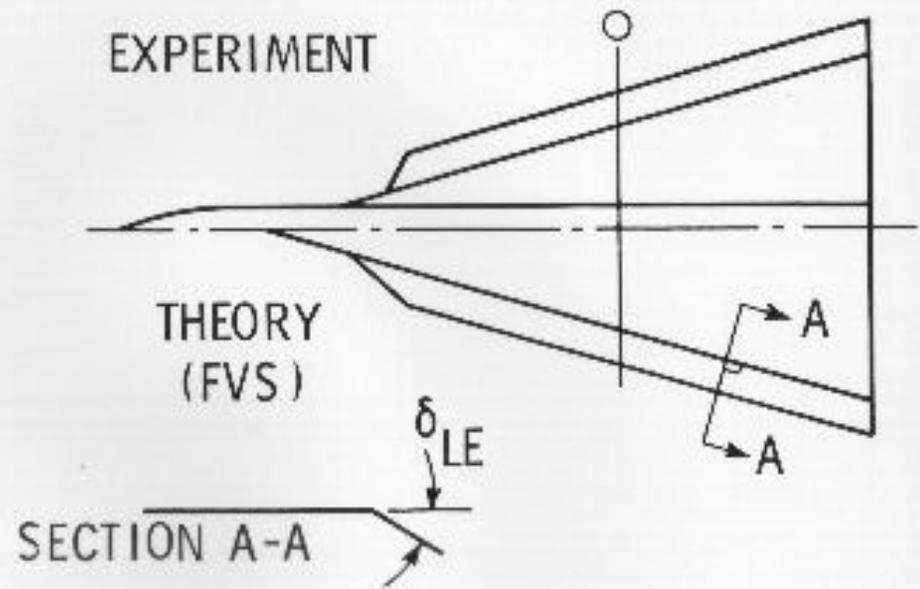
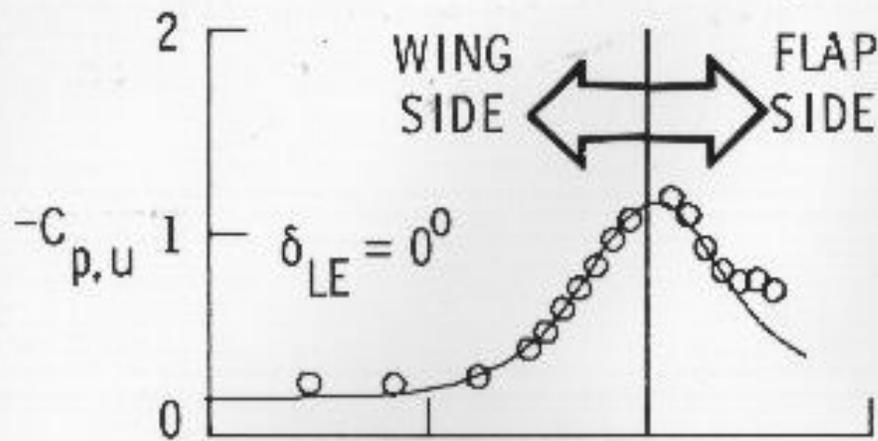


SUBSONIC DRAG DUE-TO-LIFT



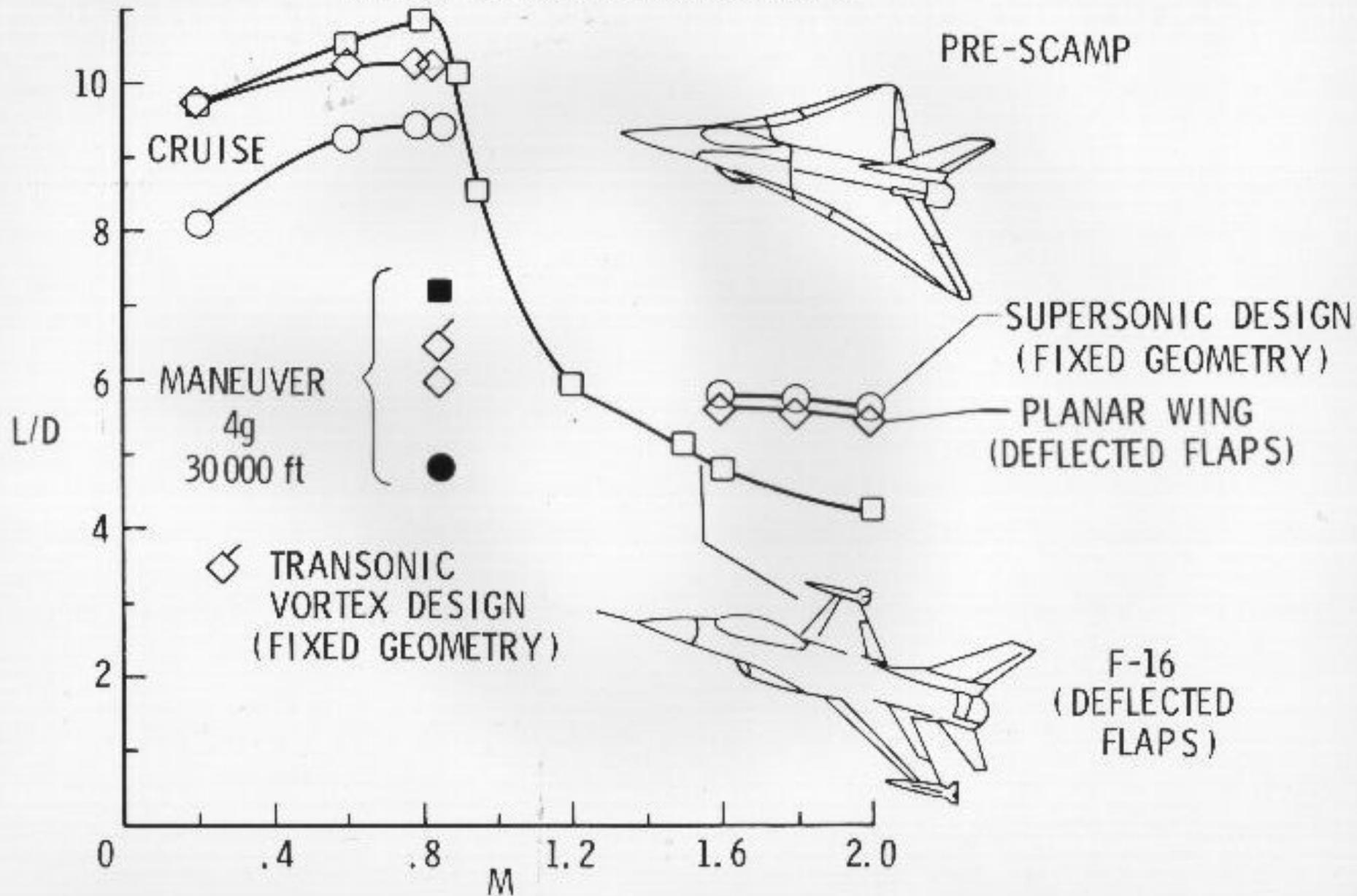
EFFECT OF FLAP DEFLECTION ON SPANWISE PRESSURE DISTRIBUTION

74° DELTA WING AT $M = 0.3$ AND $\alpha = 14^\circ$



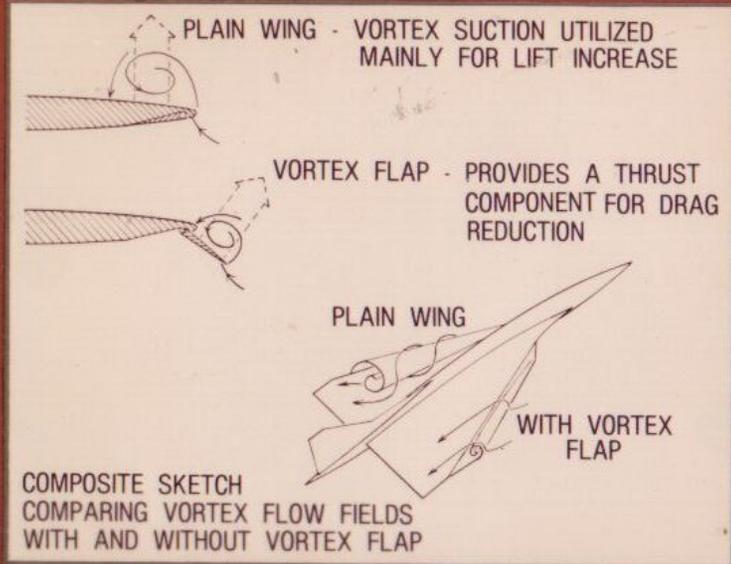
CRUISE AND MANEUVER AERODYNAMIC EFFICIENCY

EFFECT OF ARTICULATED FLAPS



VORTEX FLAP ANALYSIS AND DESIGN CAPABILITY

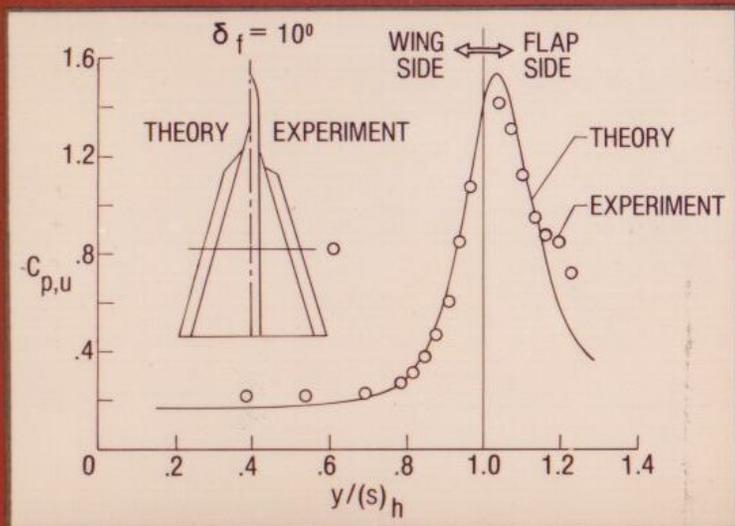
THE CONCEPT



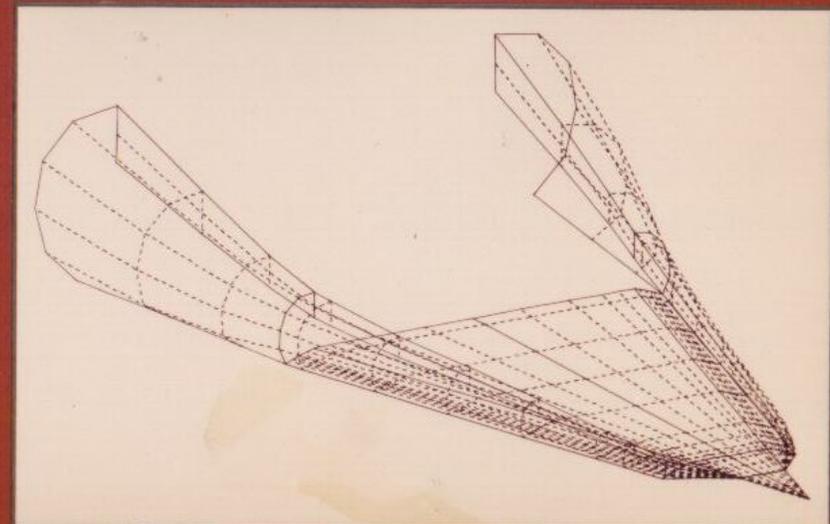
74° DELTA WING-BODY MODEL



THEORY-EXPERIMENT COMPARISON

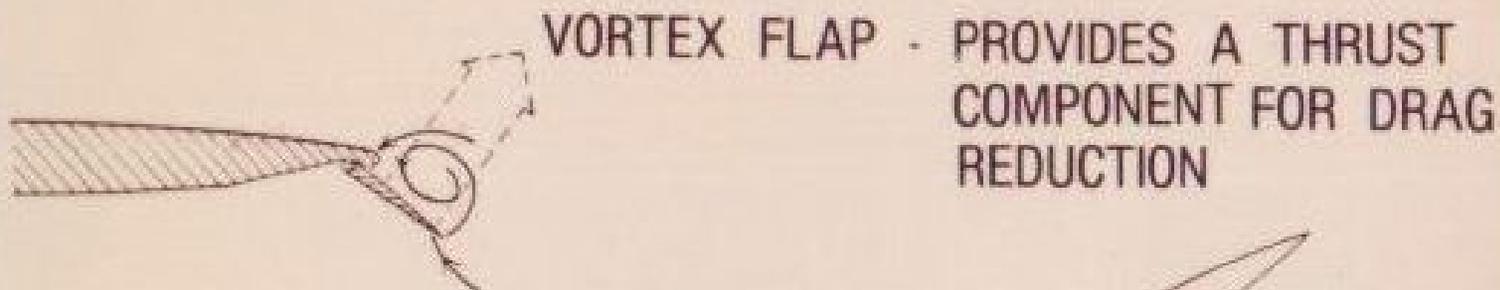
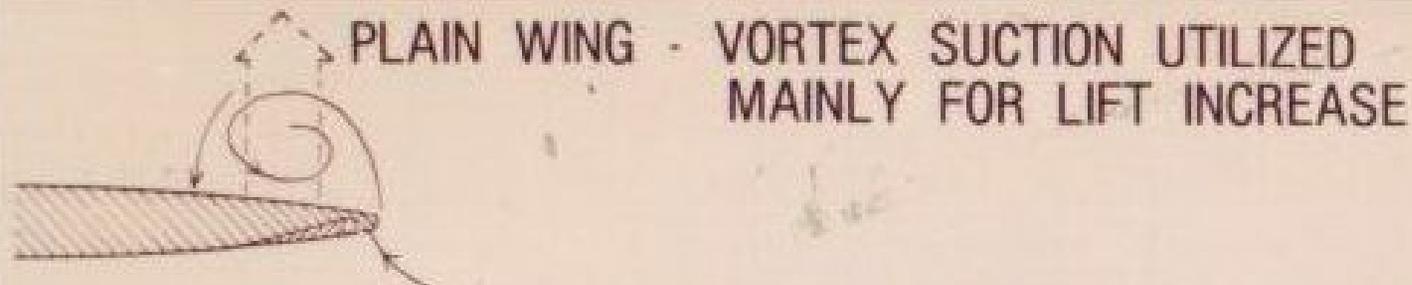


THEORETICAL MODEL

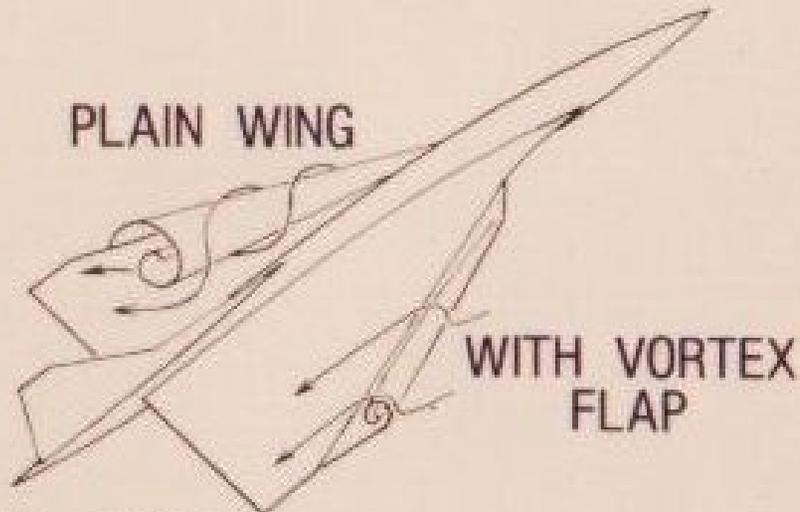


AK 60%

THE CONCEPT

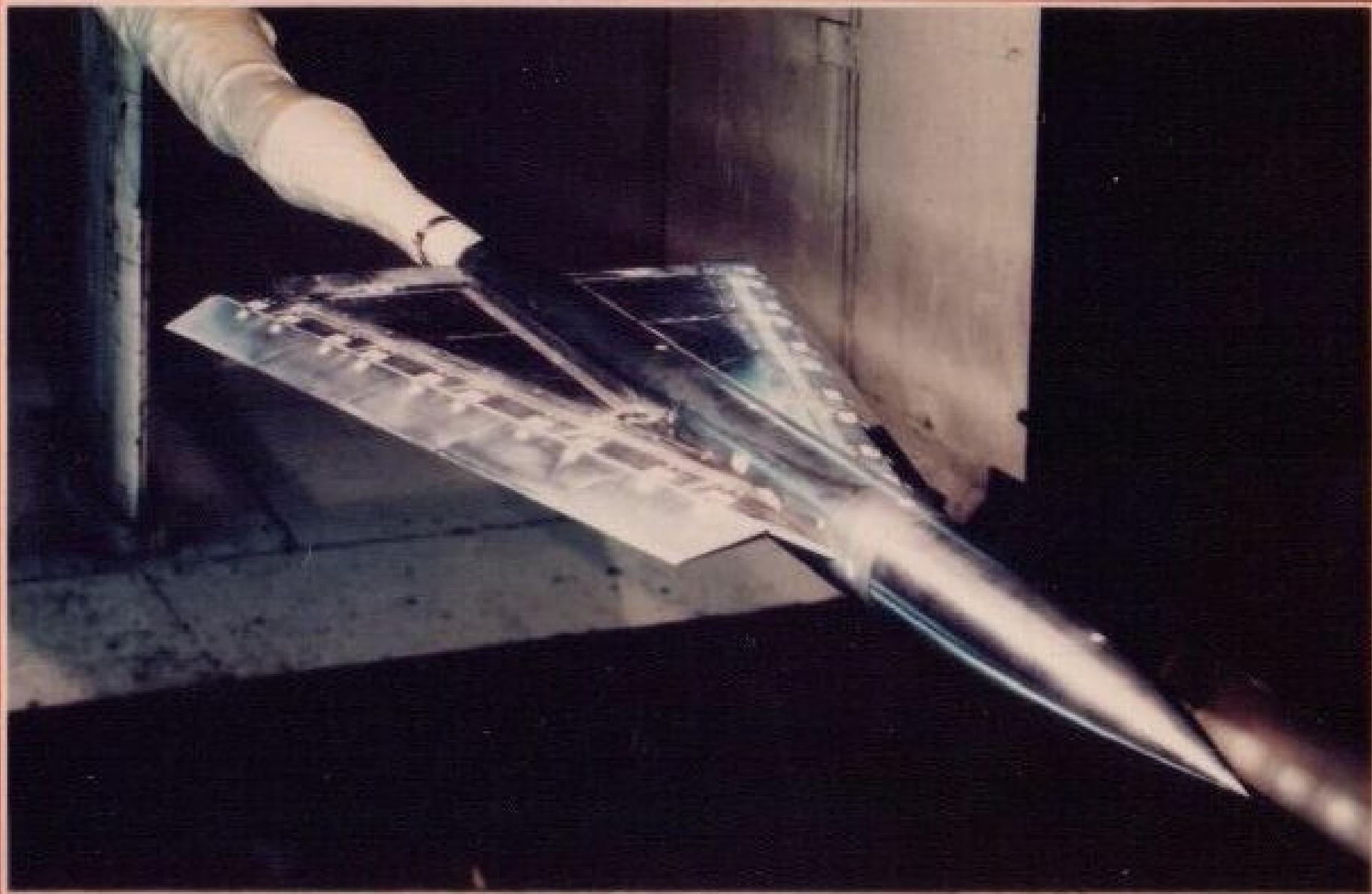


PLAIN WING

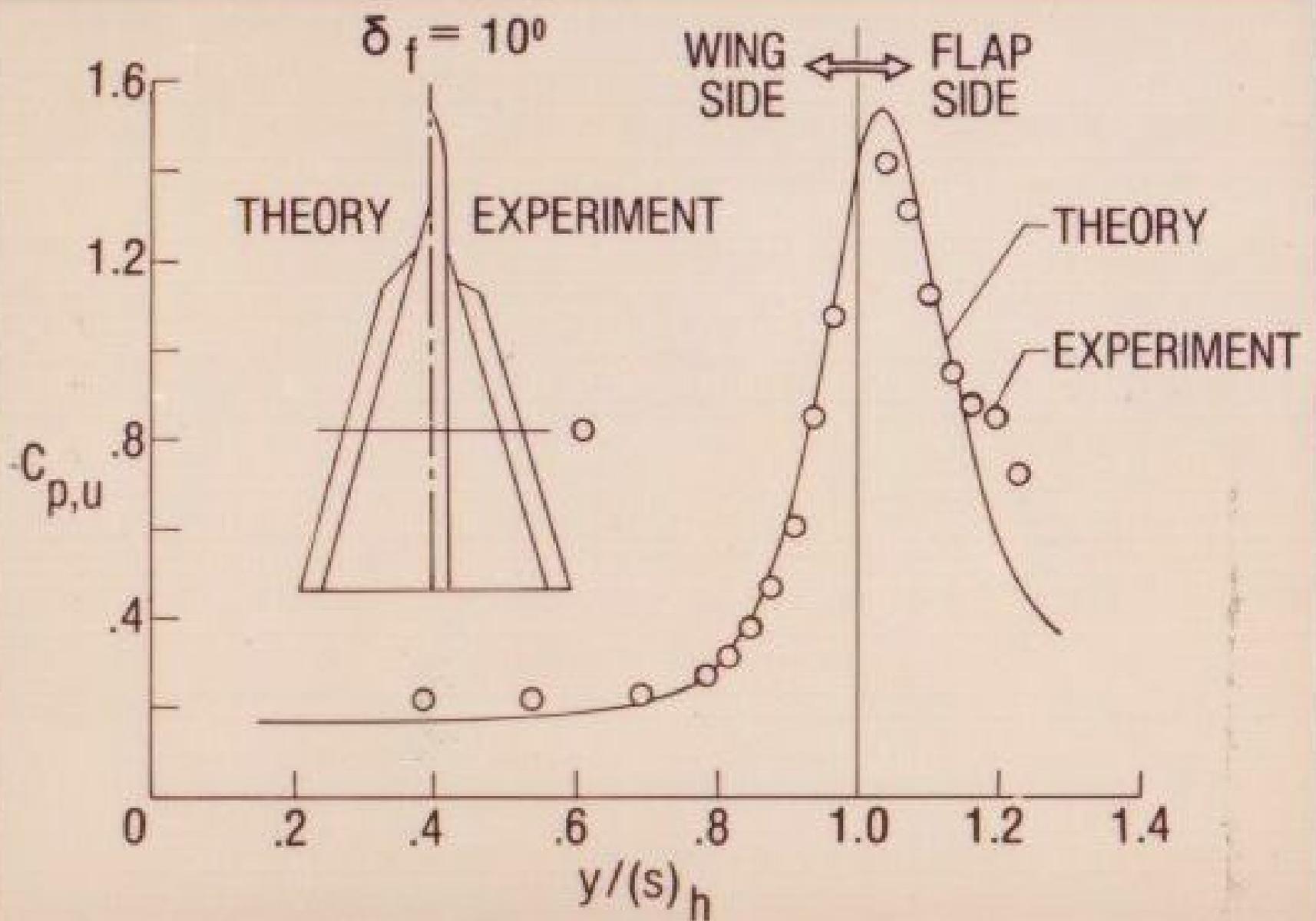


COMPOSITE SKETCH
COMPARING VORTEX FLOW FIELDS
WITH AND WITHOUT VORTEX FLAP

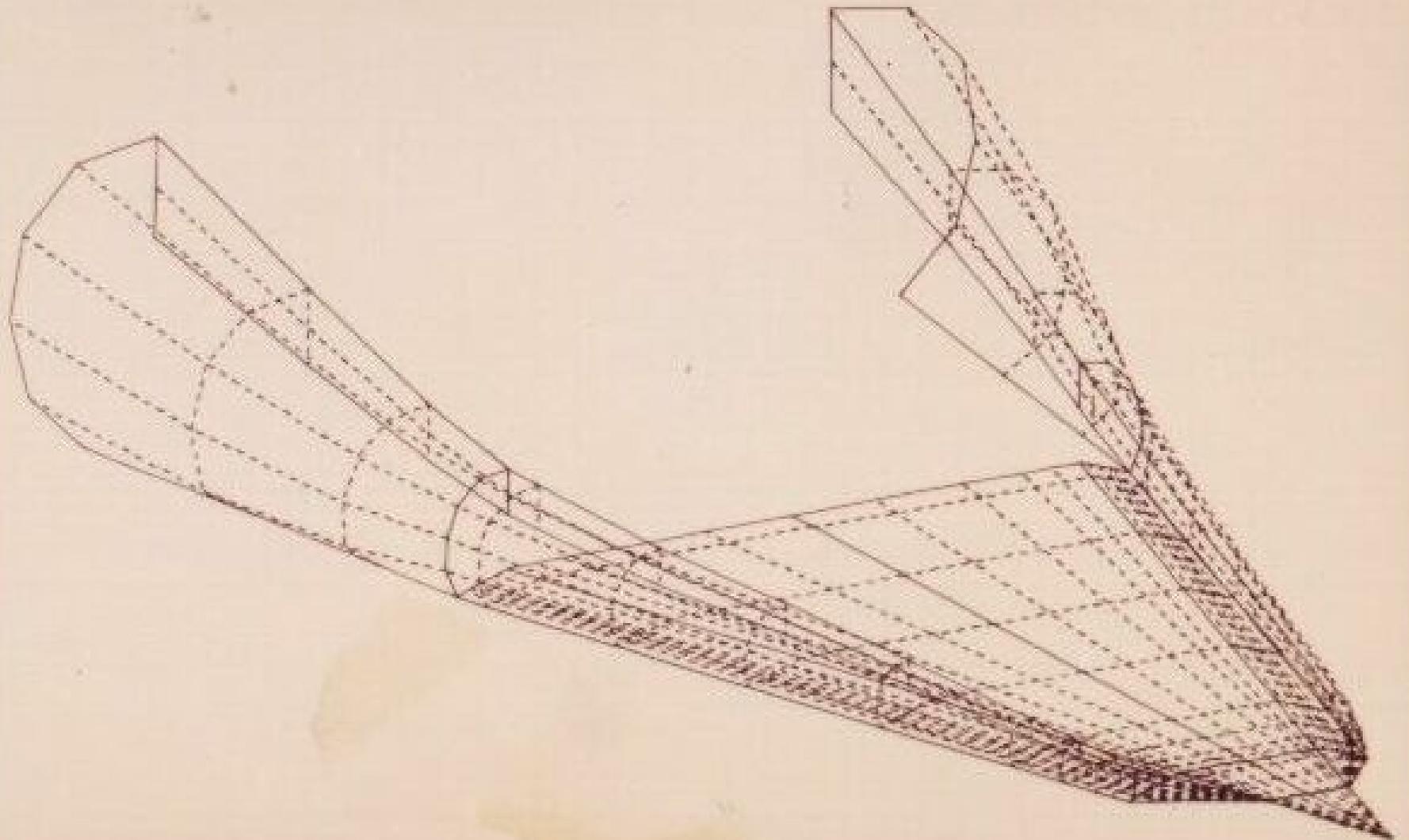
74° DELTA WING-BODY MODEL



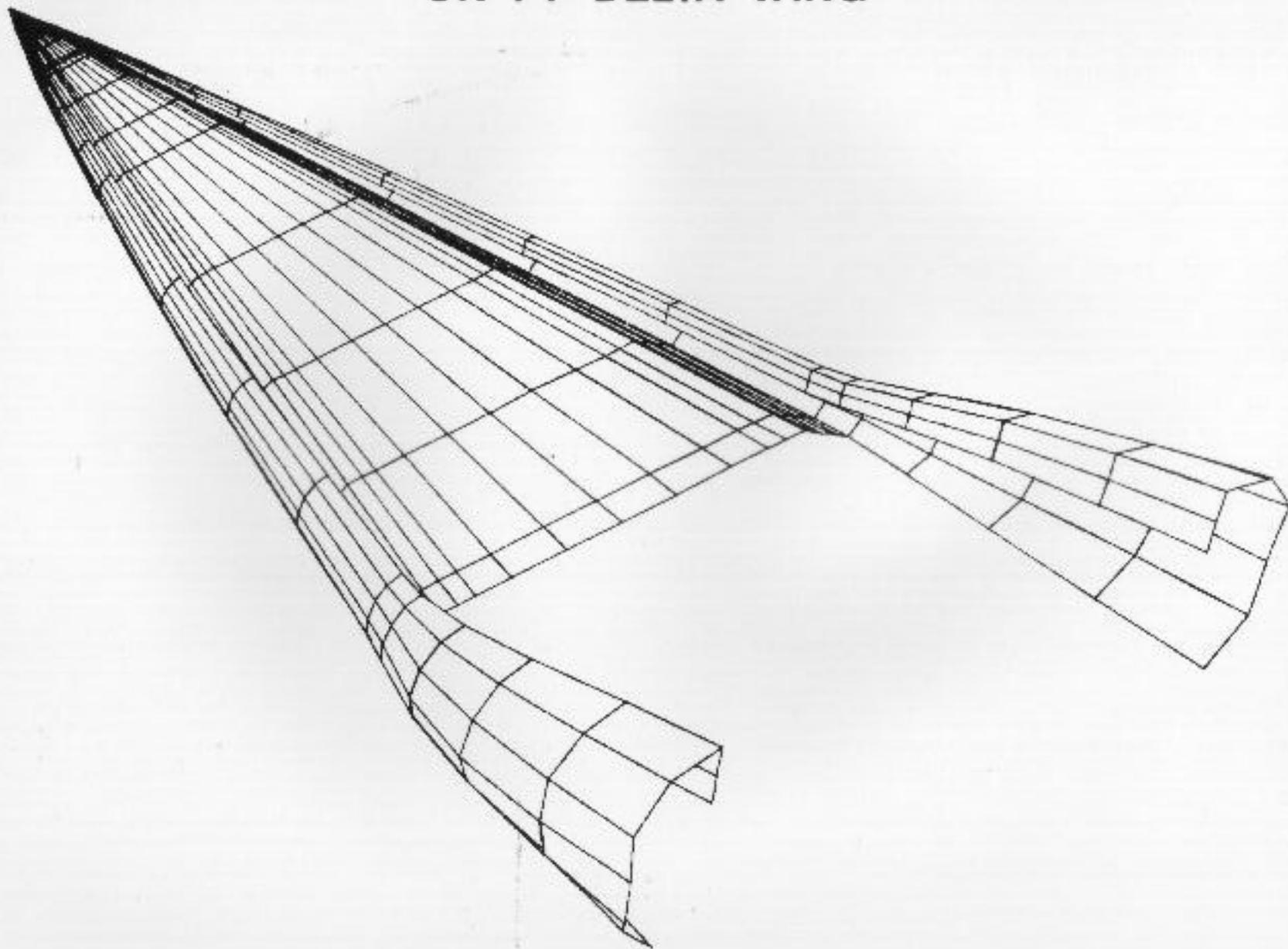
THEORY-EXPERIMENT COMPARISON

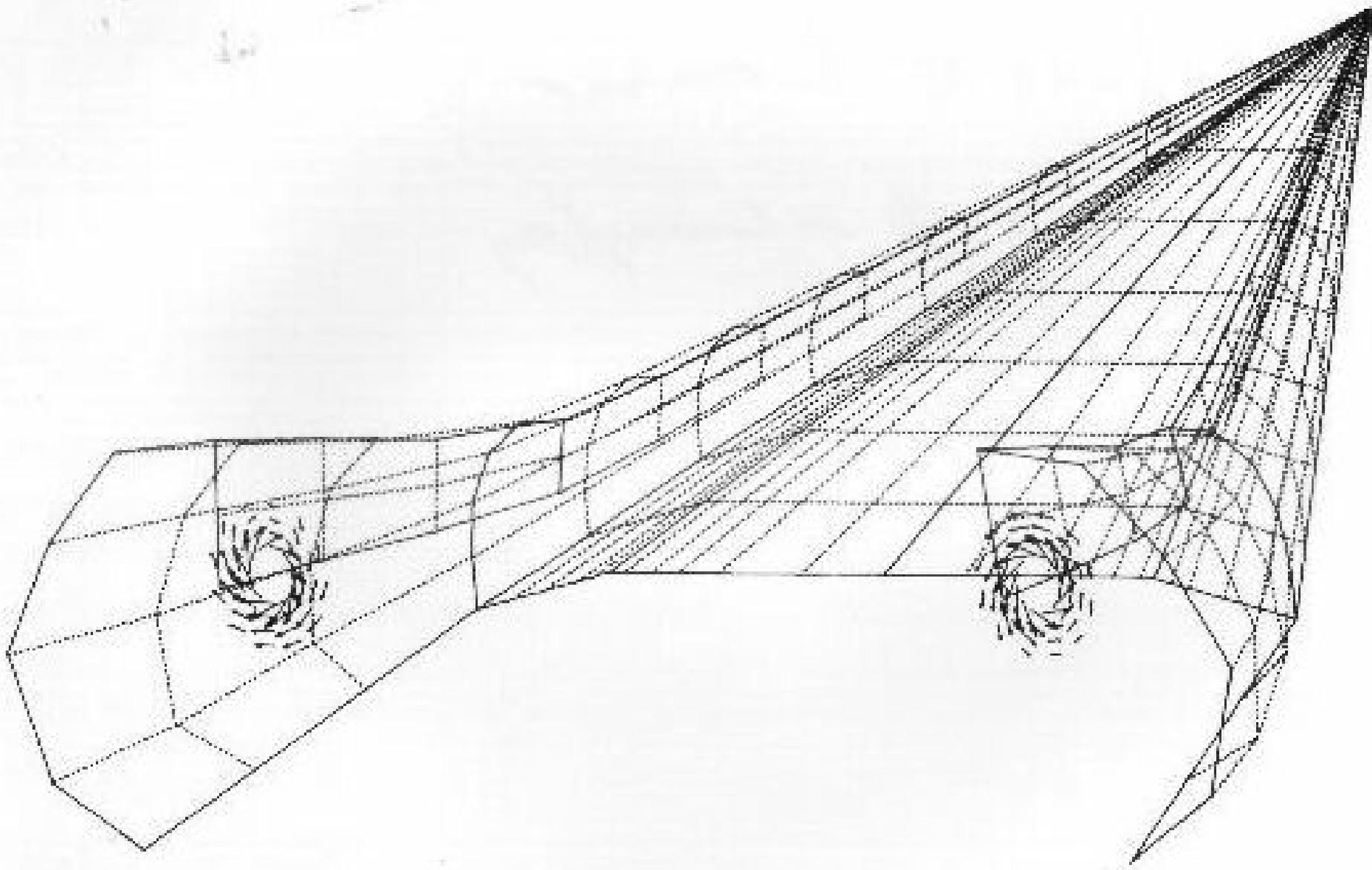


THEORETICAL MODEL



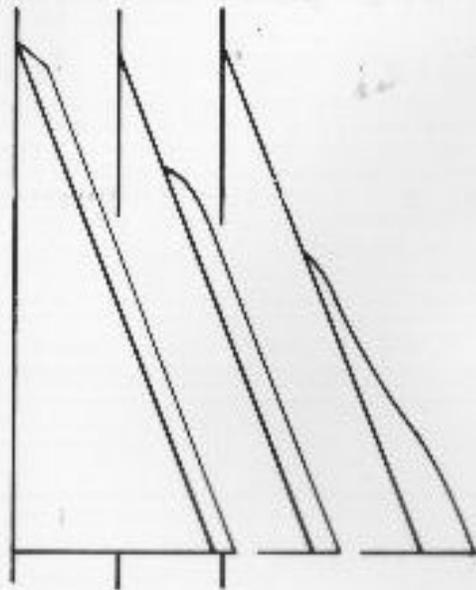
FREE VORTEX SHEET SOLUTION FOR GOTHIC VORTEX FLAP ON 74° DELTA WING





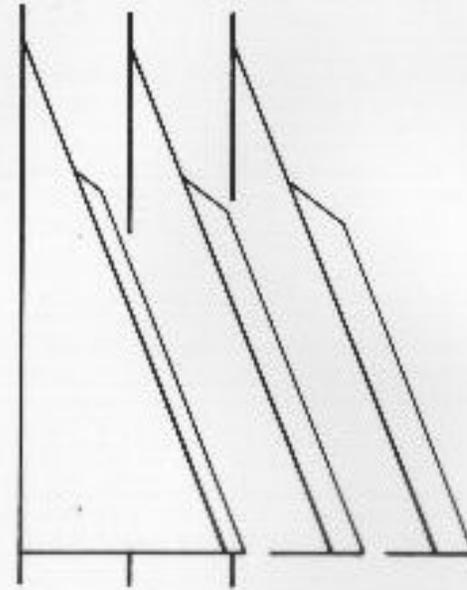
Vortex Flap

CHARACTERISTICS OF VARIOUS VORTEX FLAP GEOMETRIES



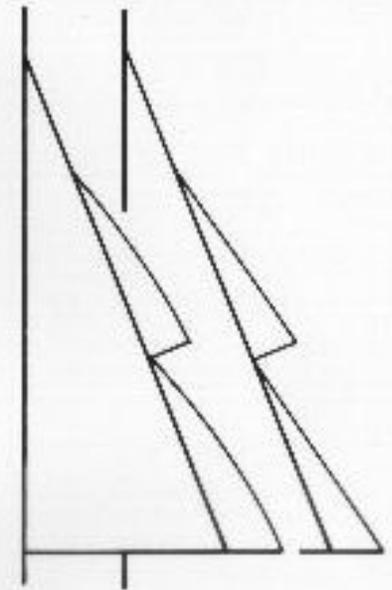
SHAPING/LENGTH

- REDUCING LENGTH INBOARD IMPROVES FLAP EFFICIENCY
- SHAPING FLAP INBOARD IMPROVES VORTEX FORMATION; AND OUTBOARD, PROMOTES VORTEX FLOW REATTACHMENT, REDUCING DRAG AND PITCH-UP



SIZE

- INCREASING SIZE DELAYS INBOARD MOVEMENT OF VORTEX, PROMOTES VORTEX FLOW REATTACHMENT
- INCREASING SIZE INCREASES FRONTAL AREA, REDUCES DRAG



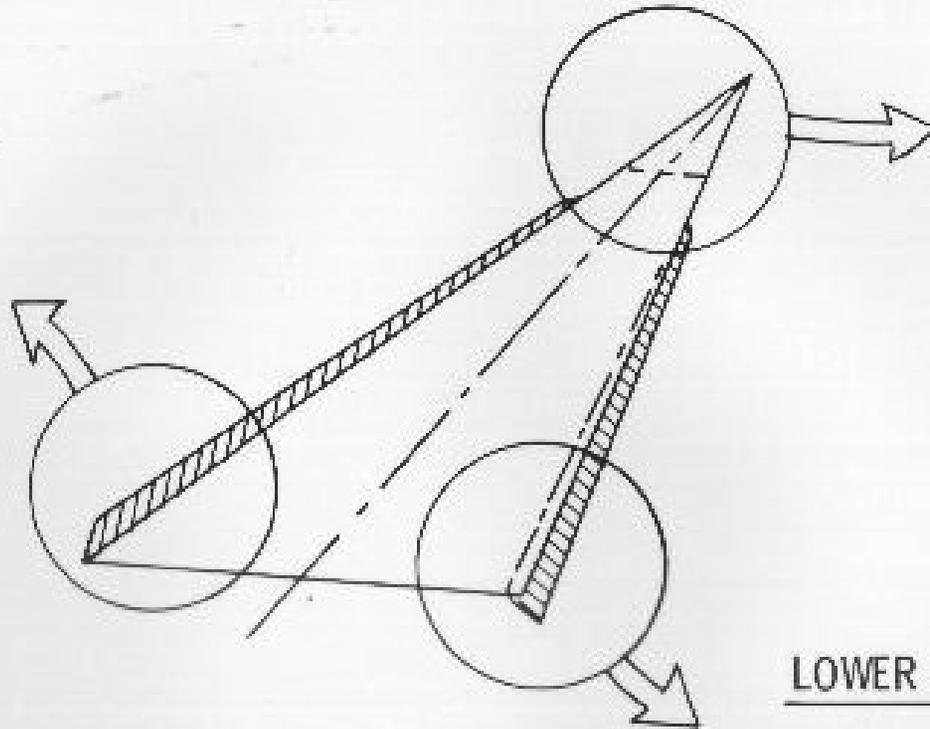
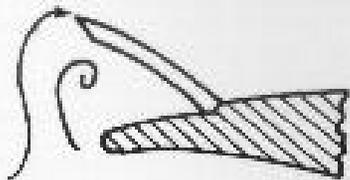
SEGMENTATION

- DELAYS INBOARD MOVEMENT OF VORTICES AND IMPROVES FLAP EFFICIENCY IN TIP REGION
- CONTROLS LONGITUDINAL STABILITY CHARACTERISTICS

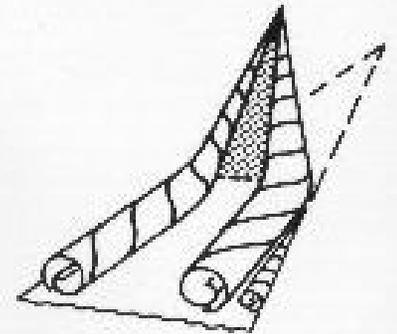
TYPES OF VORTEX FLAPS

FLOW PATTERNS

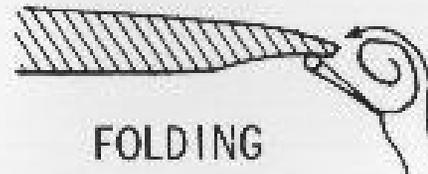
UPPER SURFACE



APEX



LOWER SURFACE



FOLDING



HINGED



TABBED

USES OF A VORTEX FLAP

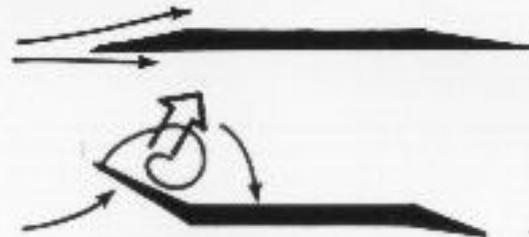
CONTROLLED VORTEX FORCE

POTENTIAL BENEFITS*



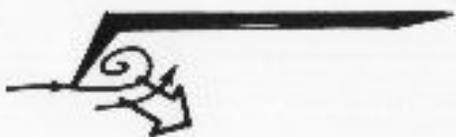
- APPROACH TRANSONIC SUSTAINED MANEUVER L/D; INCREASE AT LOW SUPERSONIC

- INCREASE TAKEOFF AND INSTANTANEOUS MANEUVER LIFT



- MAINTAIN SUBSONIC CRUISE EFFICIENCY; INCREASE SUPERSONIC CAPABILITY

- INCREASE LIFT AND DRAG FOR LANDING

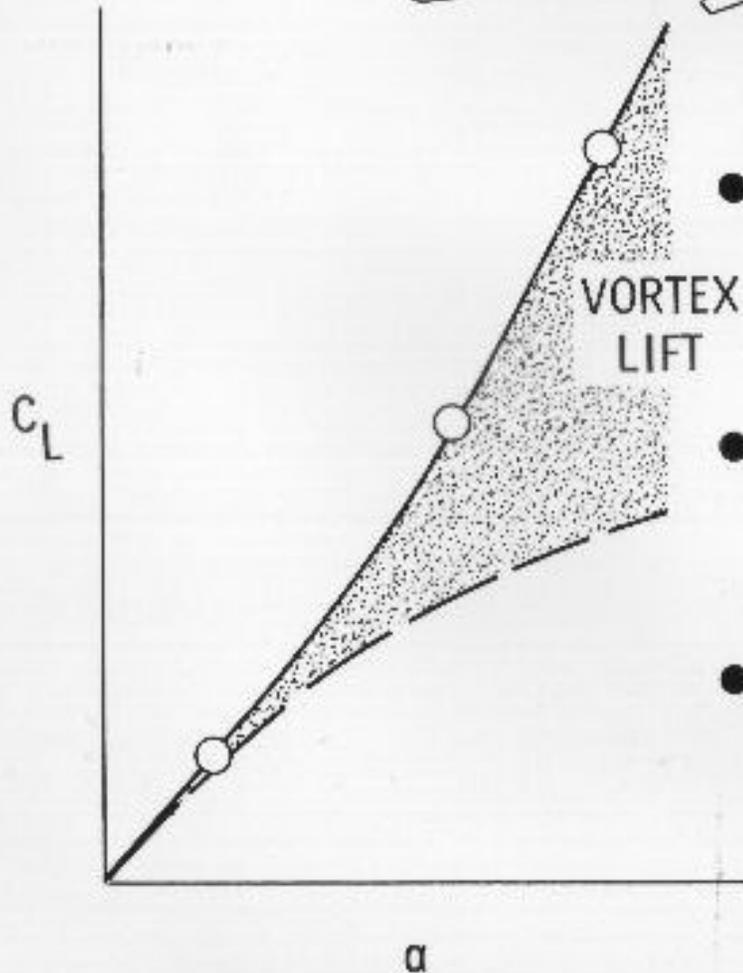
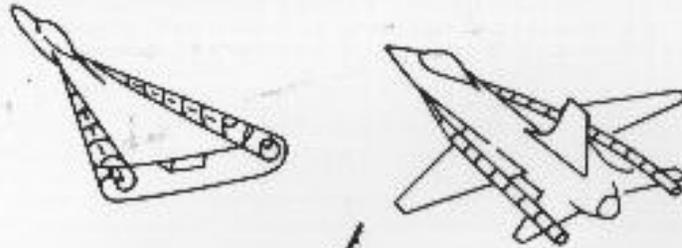


- PROVIDE SPOILER EFFECT (HIGH DRAG) FOR ROLLOUT

- PROVIDE SIMPLE VARIABLE GEOMETRY

* ● COMPARED TO CURRENT PRODUCTION FIGHTERS

SOME ADVANTAGES OF VORTEX FLOW



- INCREASED MANEUVER LIFT

- INCREASED LANDING & T.O. LIFT

- LITTLE INCREASE IN GUST RESPONSE

- LIGHT WEIGHT

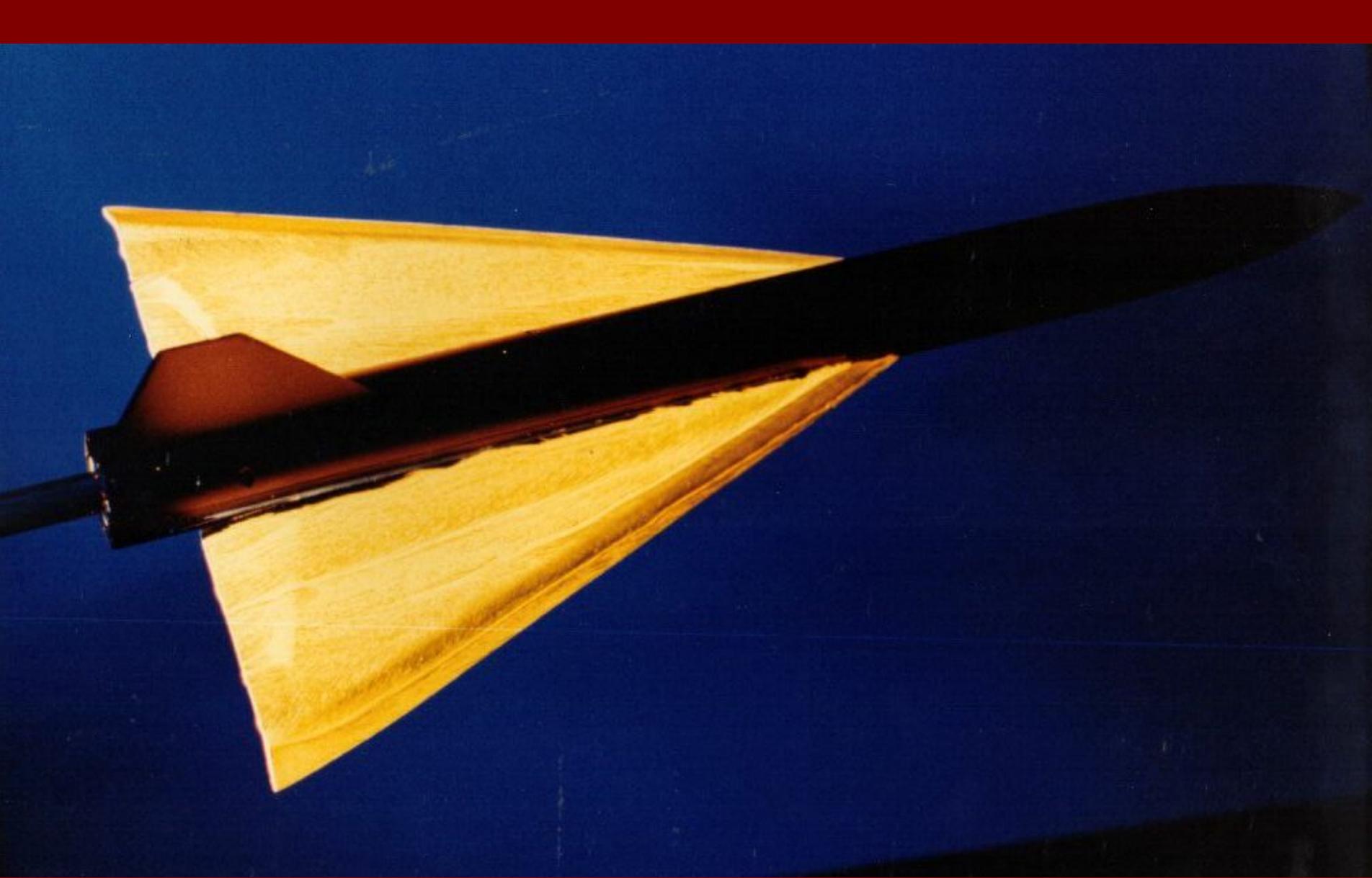
- AERO. CENTER CONTROL

- SIMILAR FLOW OVER WIDE α & M RANGE

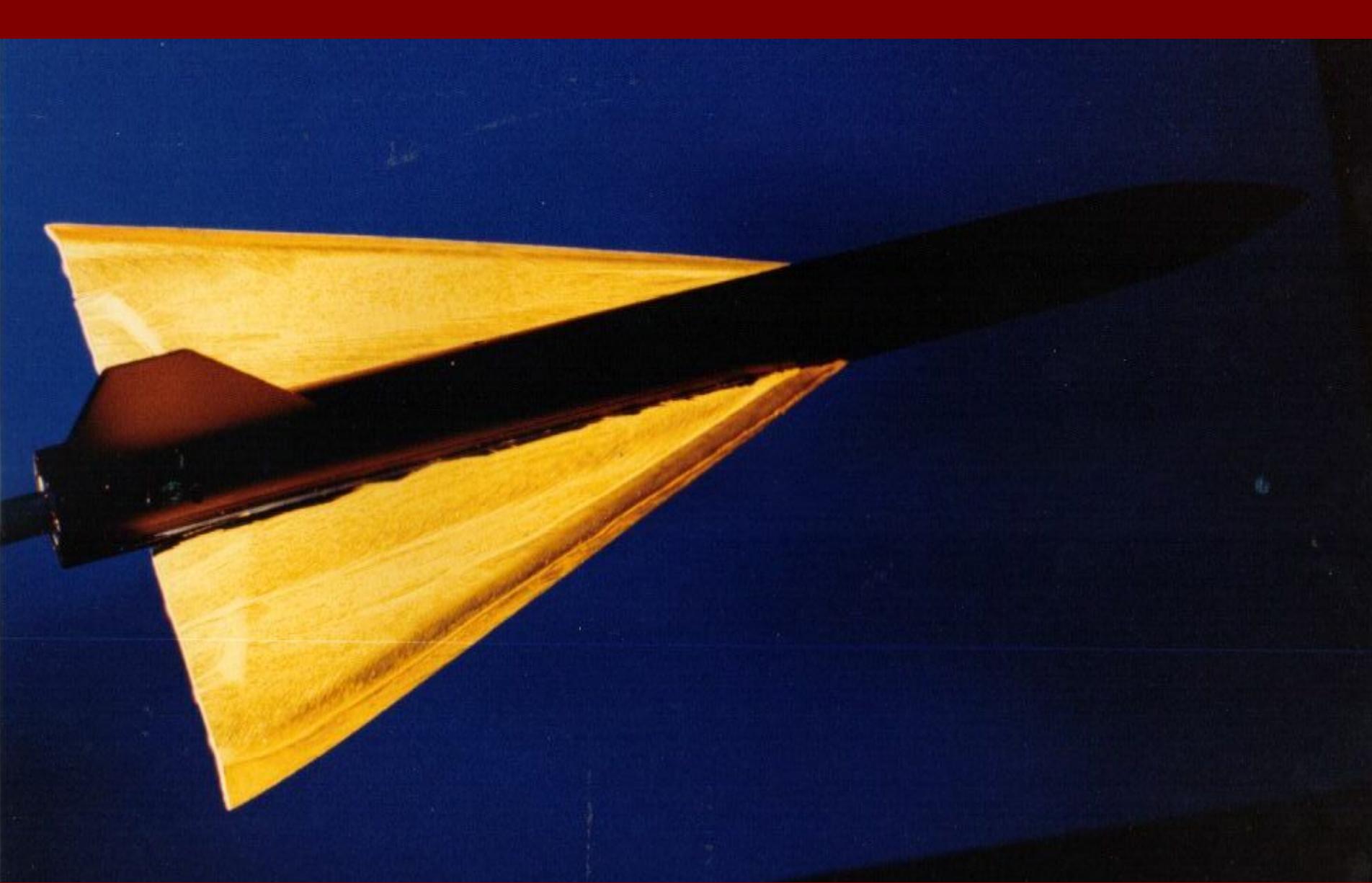
- REDUCED BUFFET INTENSITY

RESEARCH OPPORTUNITY

- RECOVER L. E. THRUST



Model 830487202



Model 830487204