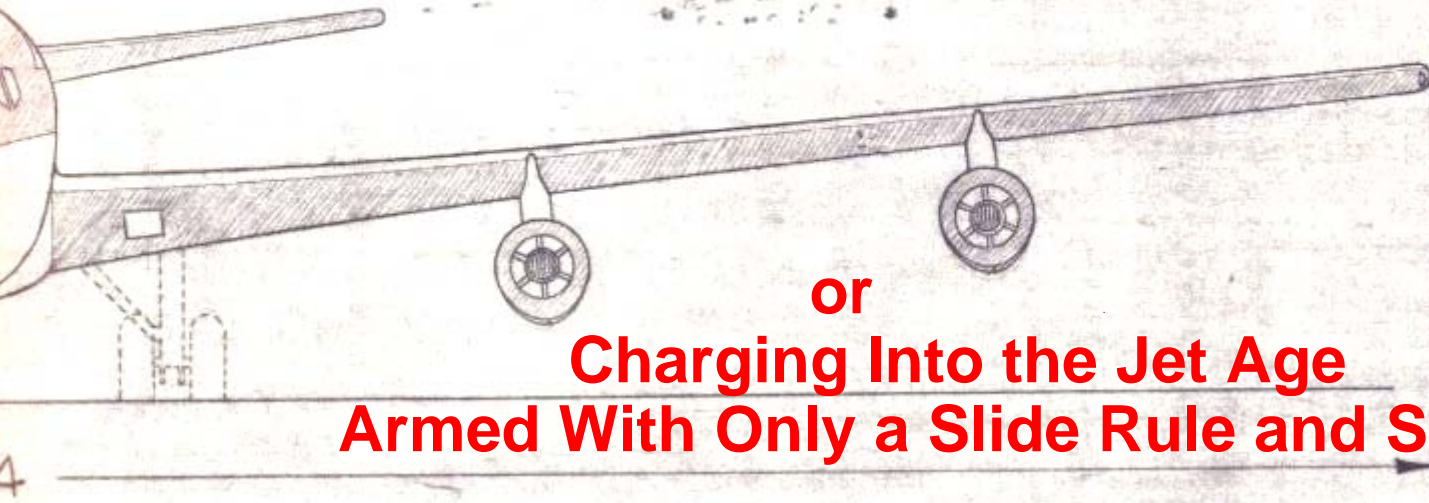


# The Development of Boeing's 367-80



or  
Charging Into the Jet Age  
Armed With Only a Slide Rule and Spline

FRONT VIEW

Ben Almojuela  
Boeing Commercial Airplanes  
Pacific Northwest AIAA Technical Symposium  
Nov. 7, 2009

MODEL	DRAWN	HARL BRACKIN	3-19-54	BOEING MODEL 707 PROTOTYPE MODEL DRAWING  5-72491
	CHECKED	LEB	12-26-52	
	STRESS CK			
	GROUP APPR	Rev. S. Ingersoll	12-16-54	
PROJ APPR	FINLAY	6-17-55		
BOEING AIRPLANE COMPANY SEATTLE 14, WASHINGTON				

ISSUE

5-72491

LATEST ATTACHMENTS

ADCN'S

DDA'S

# Background: USA 1946

- Wartime rationing of seats on airline flights is rescinded
- People were exposed to flying via passenger airplane during the war
- Many military transport airplanes are declared surplus and are converted to commercial transports
- Douglas emerges from the war known as *the transport company*; Boeing is known as *the bomber company*

# Commercial Airliner Competition 1946-52

Convair 240/340



Lockheed Constellation



Martin 404



Douglas DC-4



Boeing Stratocruiser

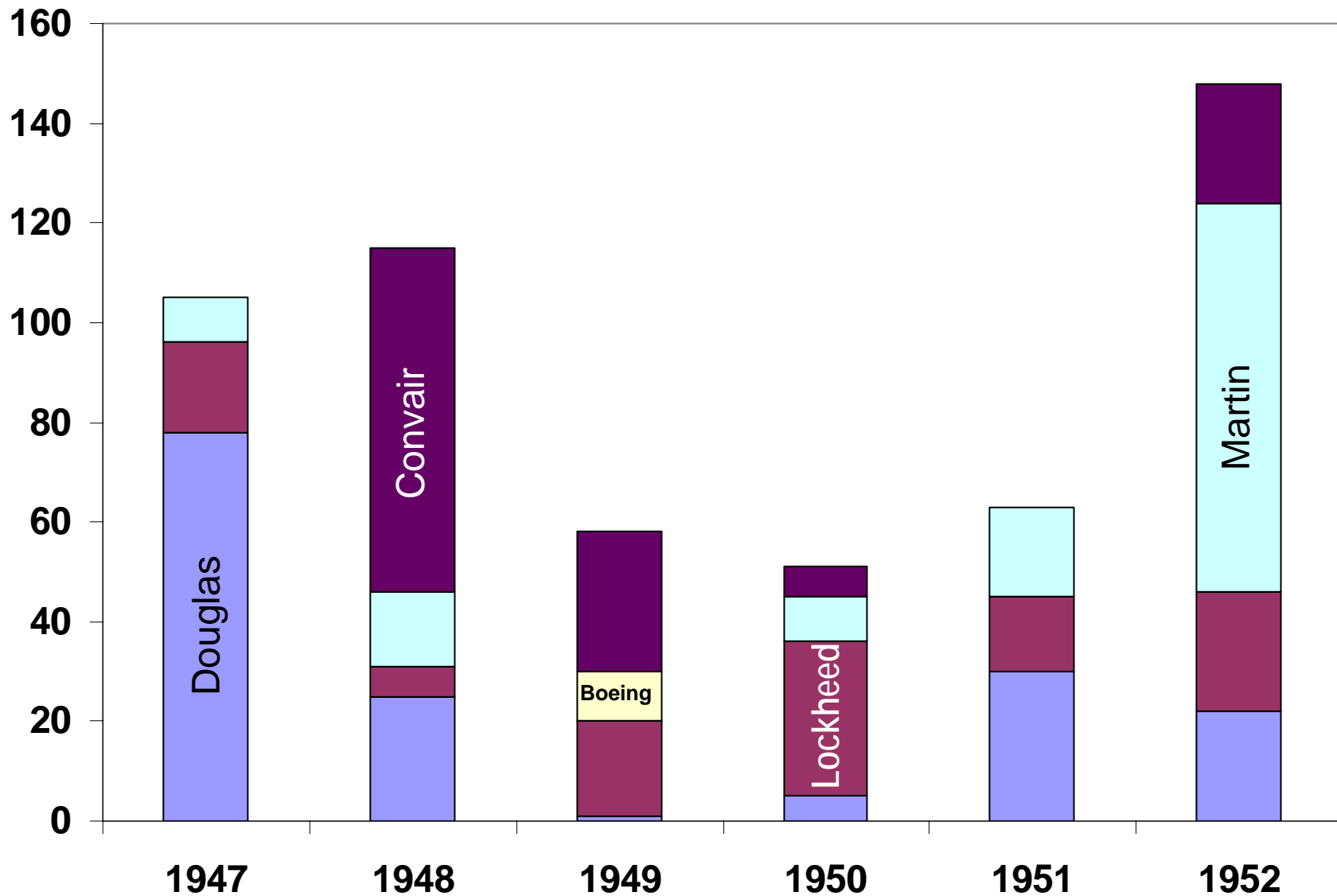


Martin 202



# US Commercial Airplane Deliveries

1947 - 1952





# Boeing is a *bomber* company that “dabbles” in commercial transports



**12  
Built**



**10  
Built**



**56  
Built**

# Reducing Development Risk

## New Transonic Jet Transport



B-47



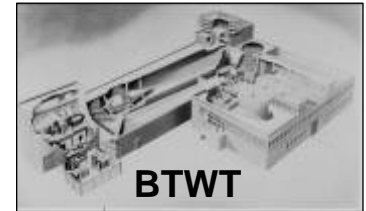
B-52



Stratoliner



Stratocruiser



BTWT

**Aggressively swept wing  
Podded engines**

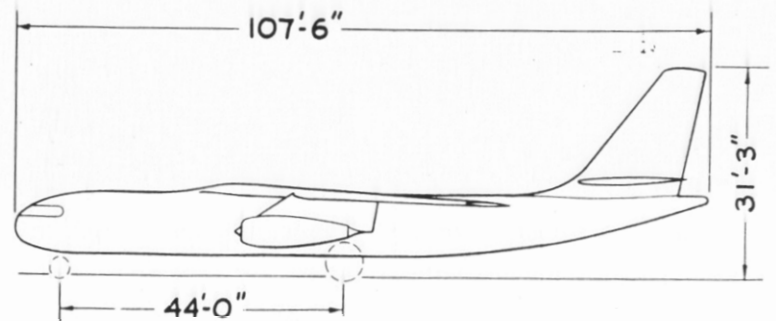
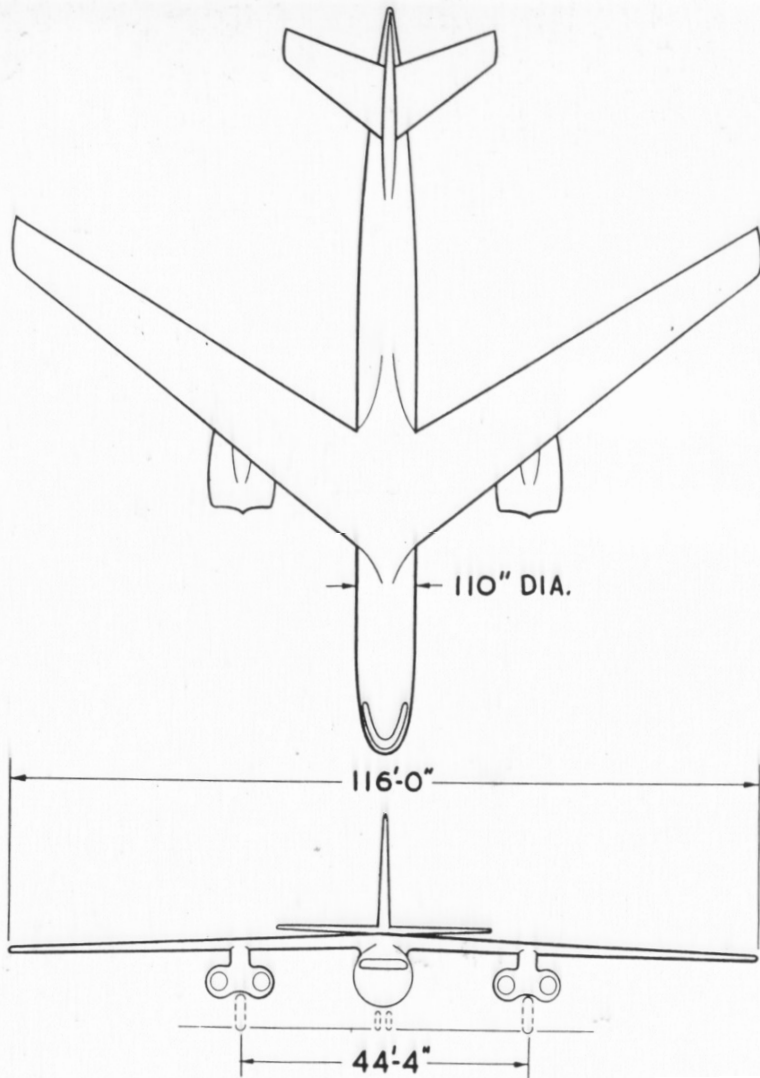
**Passenger fuselage  
Landing gear**

**Transonic  
Knowledge**

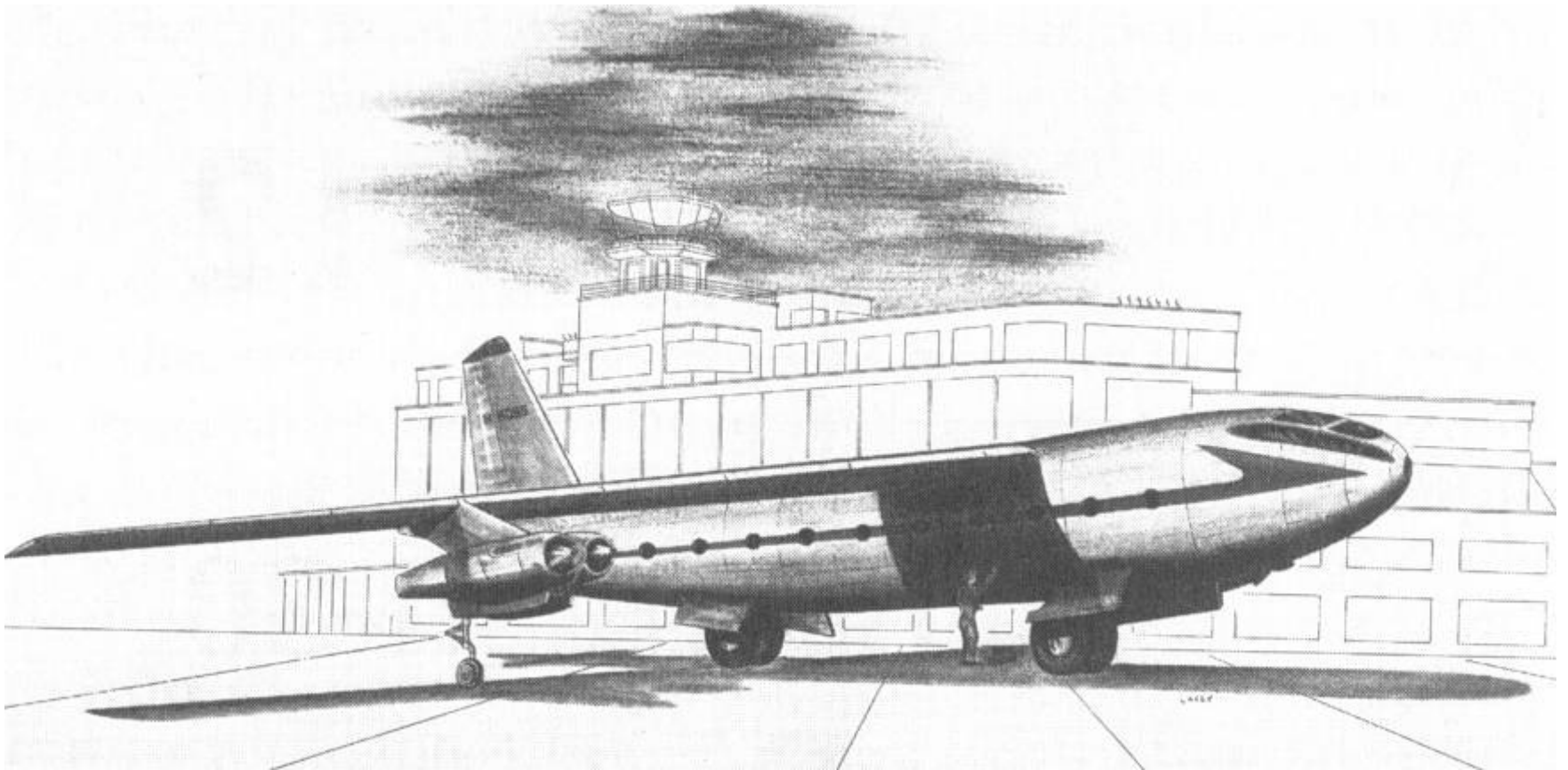
The Foundation

# 1946 Concept

W.L. Kellerman Dated December 9



# 1949 Concept (B-47 Derived)





# Configuration Evolution from 367/377-

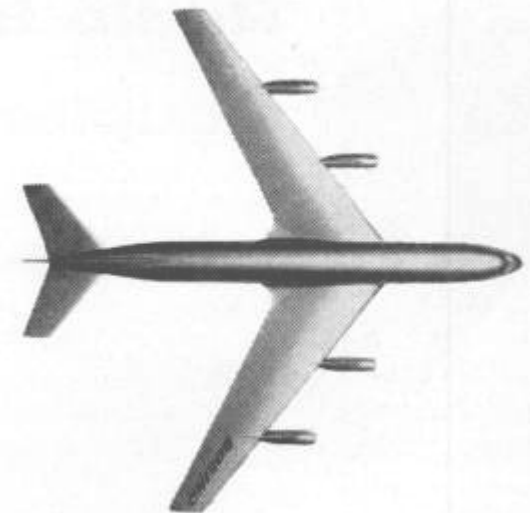
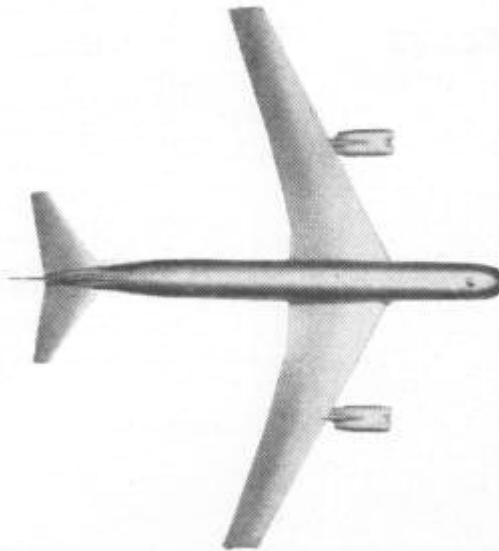
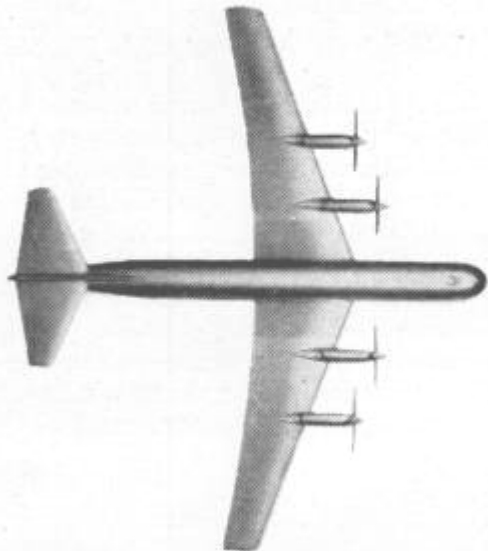
**MODEL 367-60**  
Turboprop Tanker-Transport  
Design - 1950



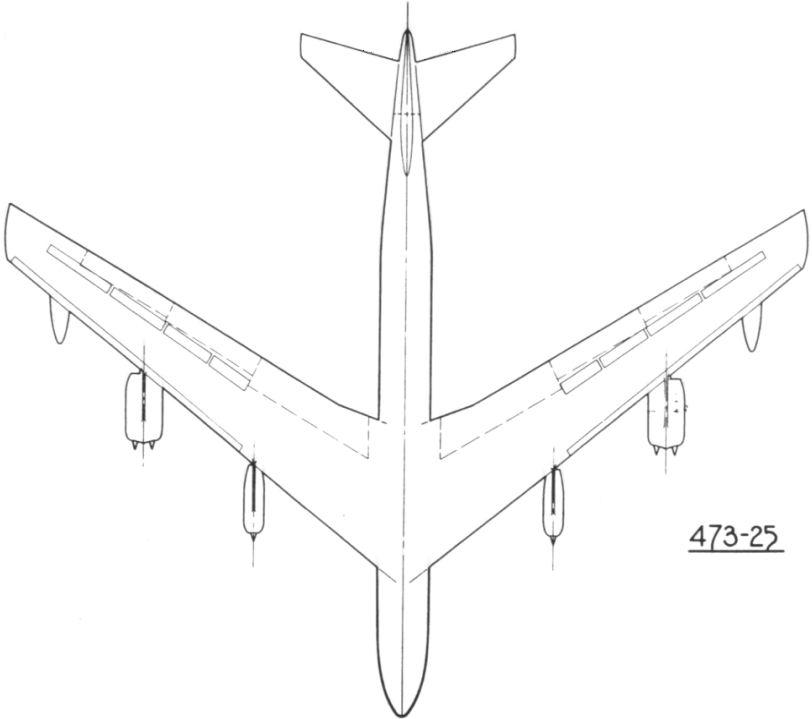
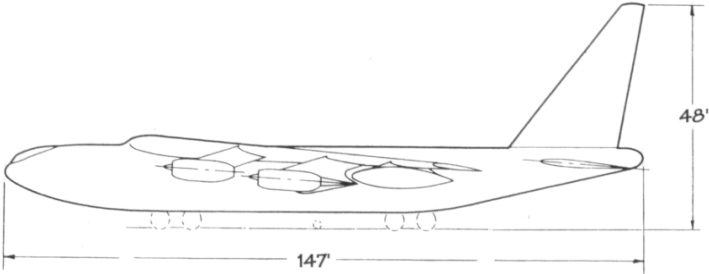
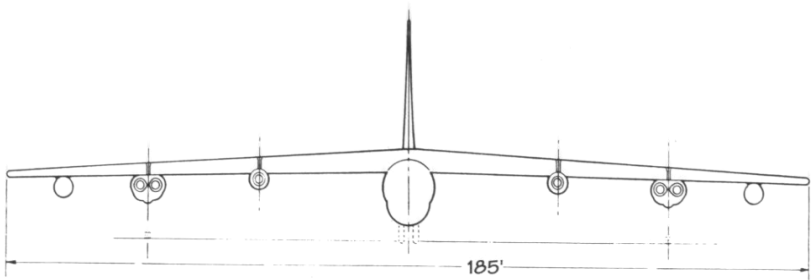
**MODEL 367-64**  
Turbojet Tanker-Transport  
Design - 1951



**PROTOTYPE**  
Turbojet Tanker-Transport  
Design - 1952



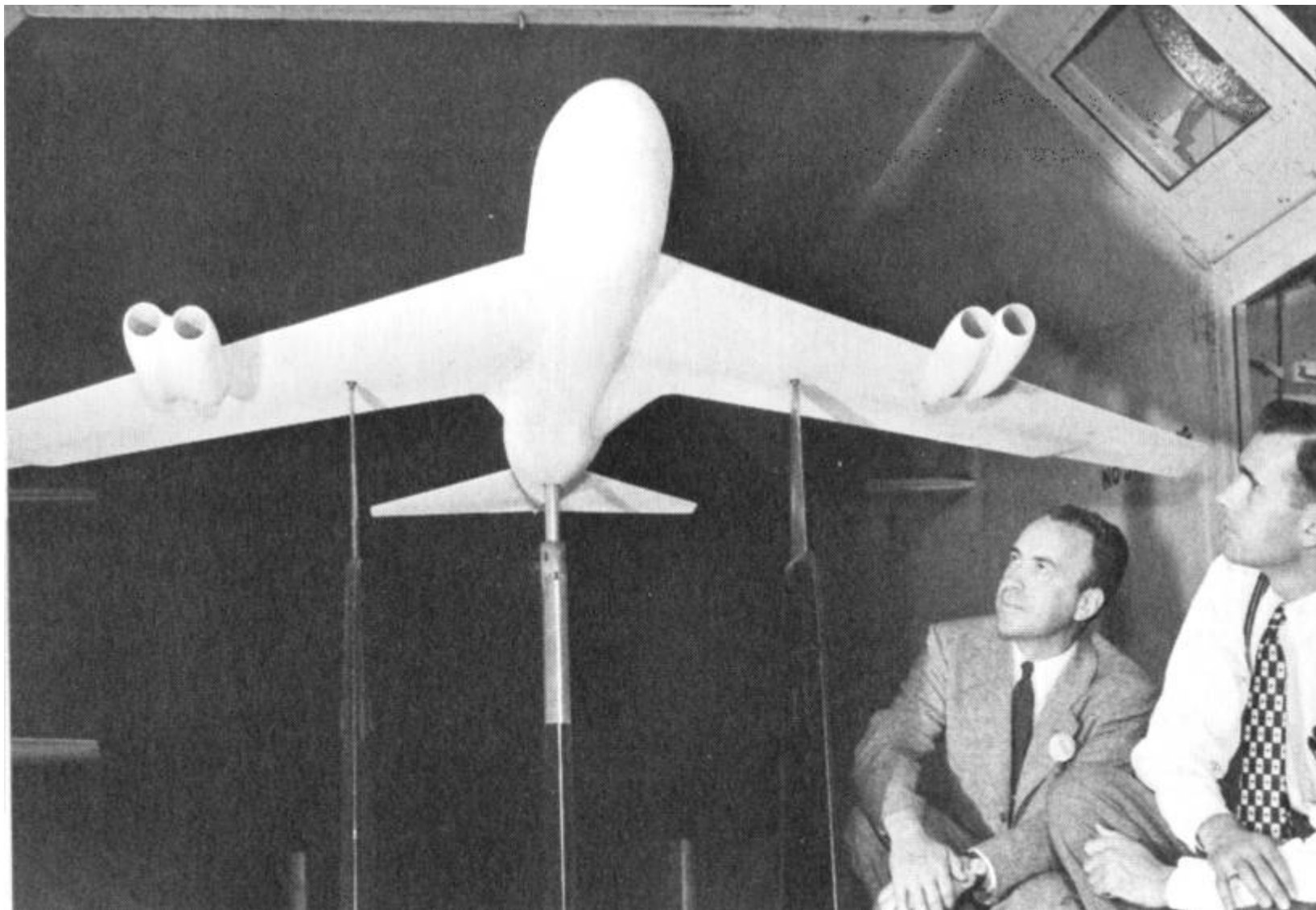
# Configuration Evolution from 473-



# 473-60C Wind Tunnel Model



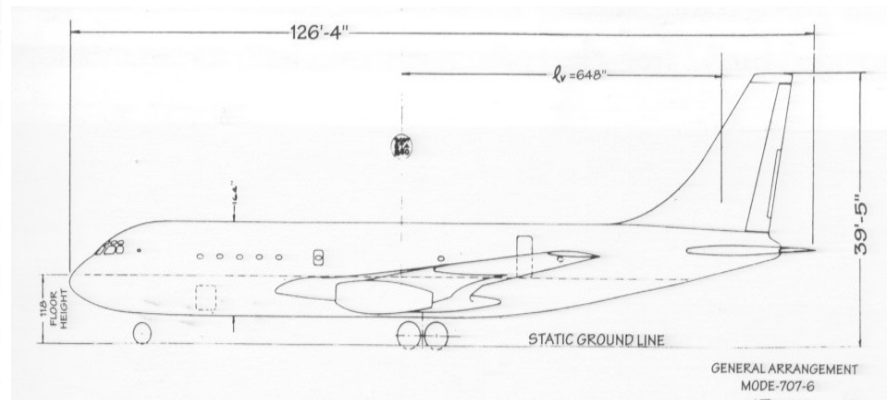
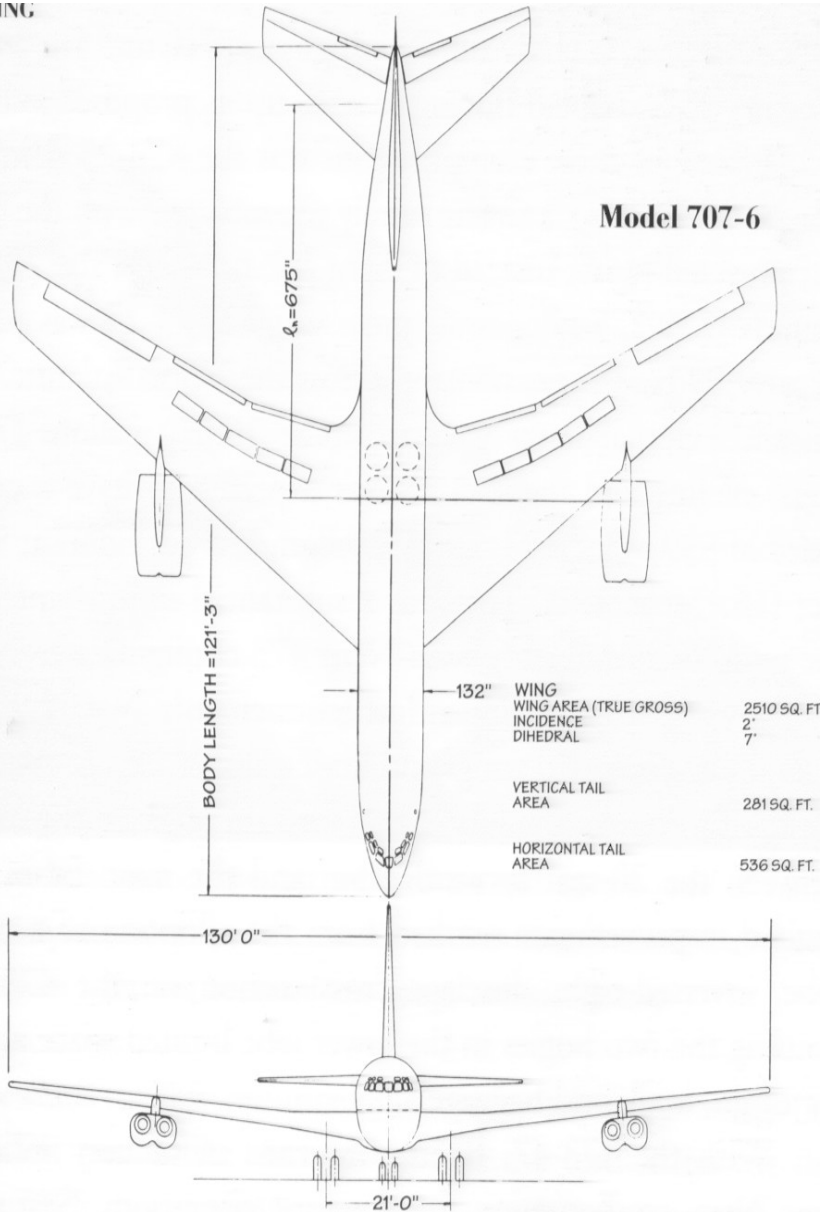
# 473-60C Wind Tunnel Model



# 707-6 (1952)

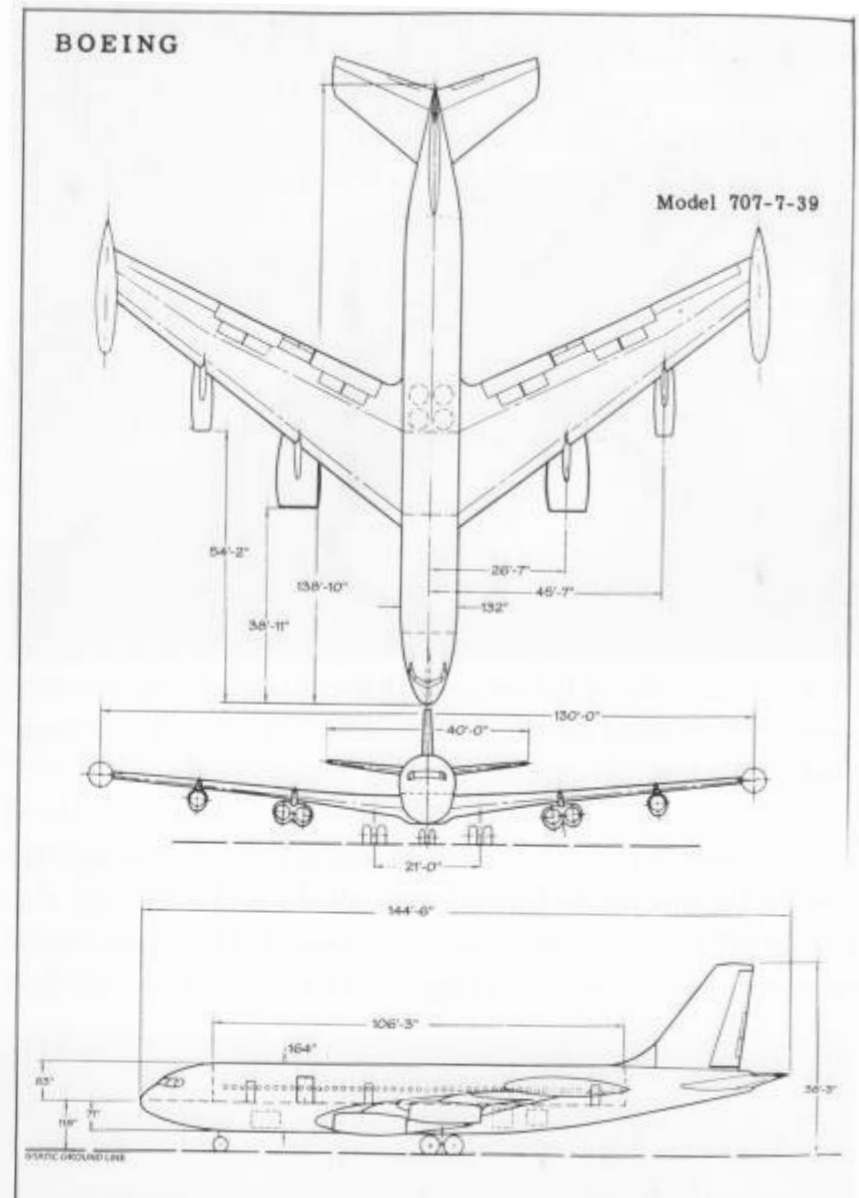
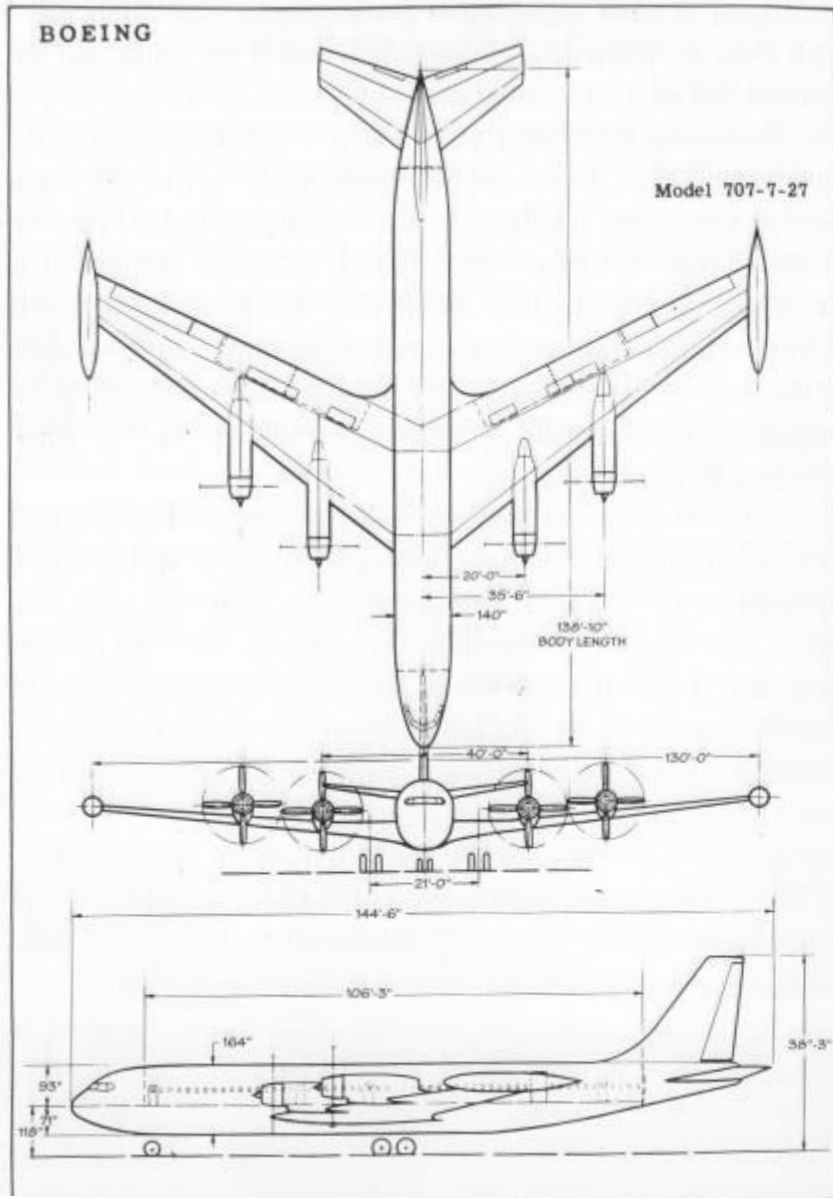
BOEING

Model 707-6

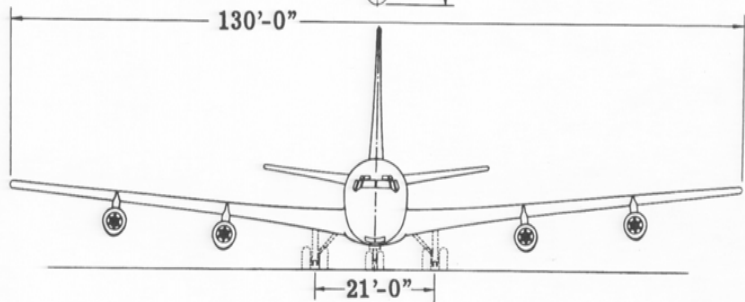
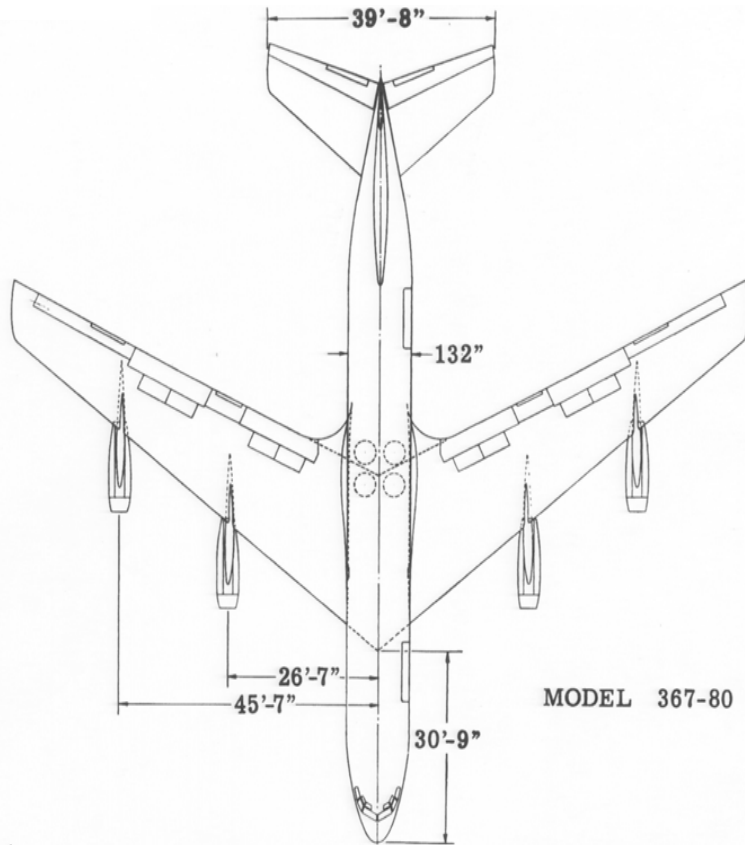




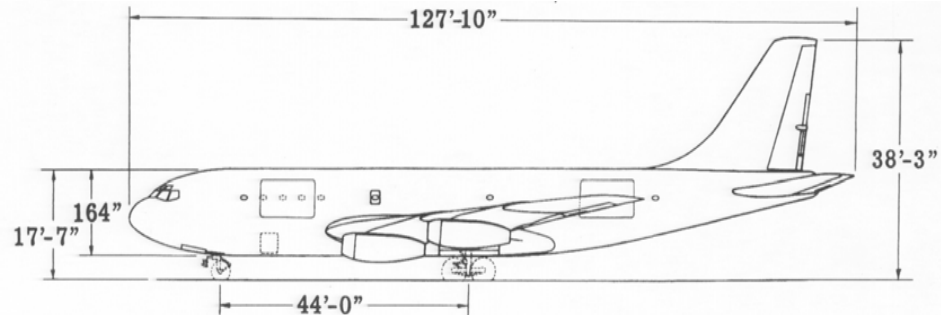
# 707-7 Alternatives



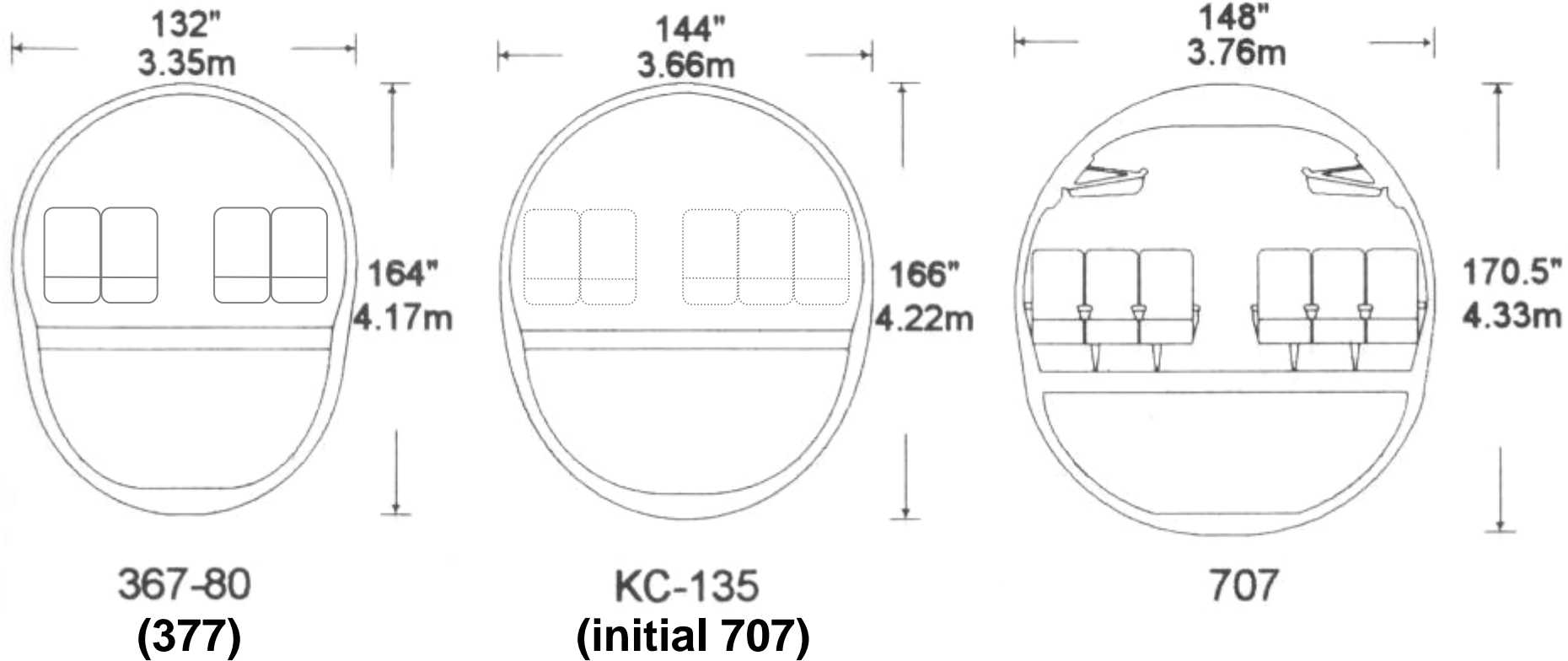
# 367-80 "Firm Configuration"



<b>Span</b>	<b>130 ft</b>
<b>Length Overall</b>	<b>127 ft 10 in</b>
<b>Height</b>	<b>38 ft 3 in</b>
<b>Fuselage Width</b>	<b>11 ft</b>
<b>Main Gear Track</b>	<b>21 ft</b>
<b>Max TO Weight</b>	<b>190,000 lb</b>
<b>Operating Empty Wt</b>	<b>88,890 lb</b>
<b>Engines</b>	<b>PW JT3P</b>
<b>SLST – ea</b>	<b>9500 lb</b>
<b>Max Passengers (if equip)</b>	<b>130</b>
<b>Max speed</b>	<b>478 kt @ 35000 ft</b>
<b>Cruise speed</b>	<b>435 kt</b>
<b>Service ceiling</b>	<b>40,000 ft</b>
<b>Max range (no payload)</b>	<b>2600 nmi</b>



# Fuselage Cross-section Evolution



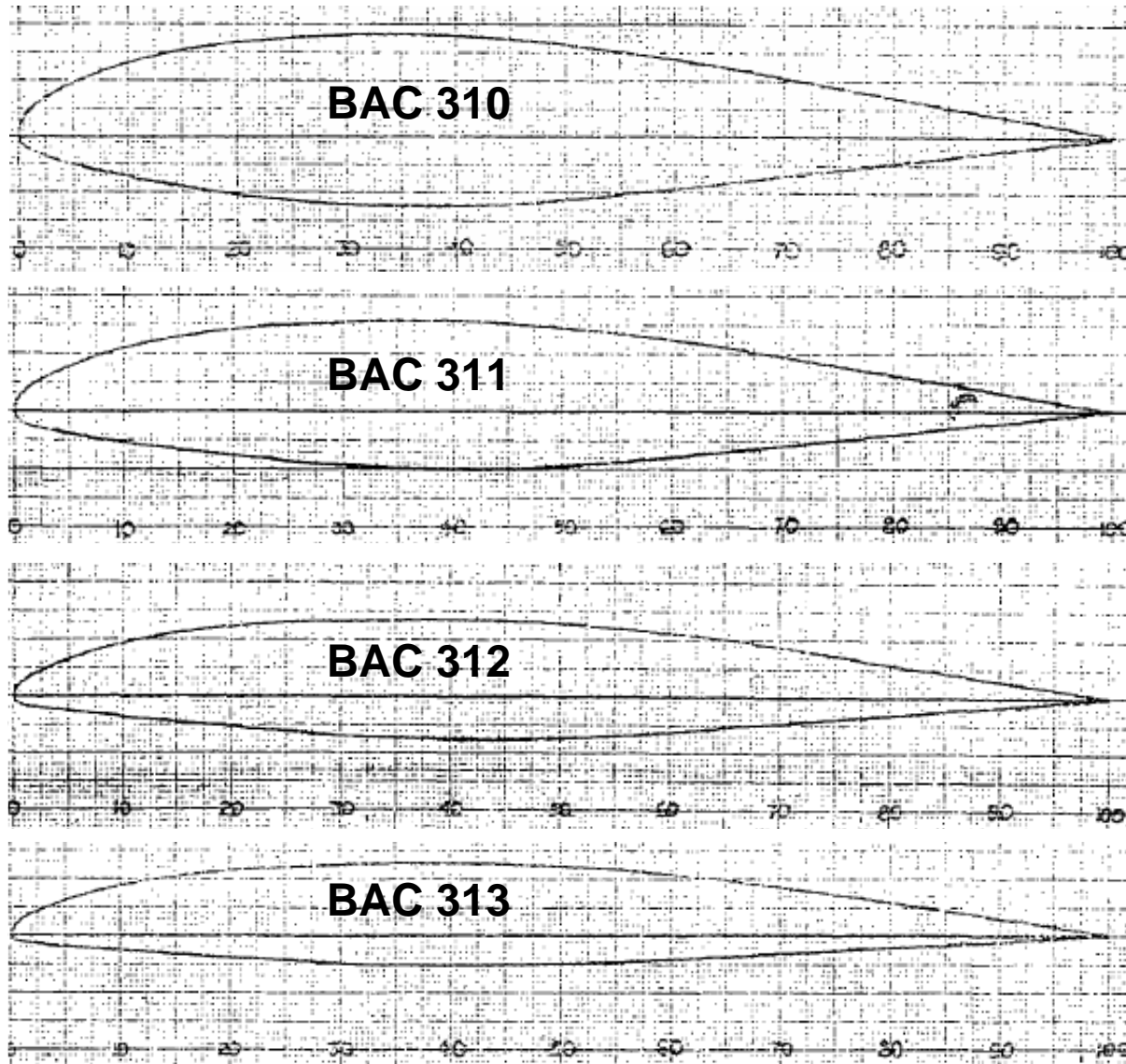
# Initial 144"-wide 707 fuselage



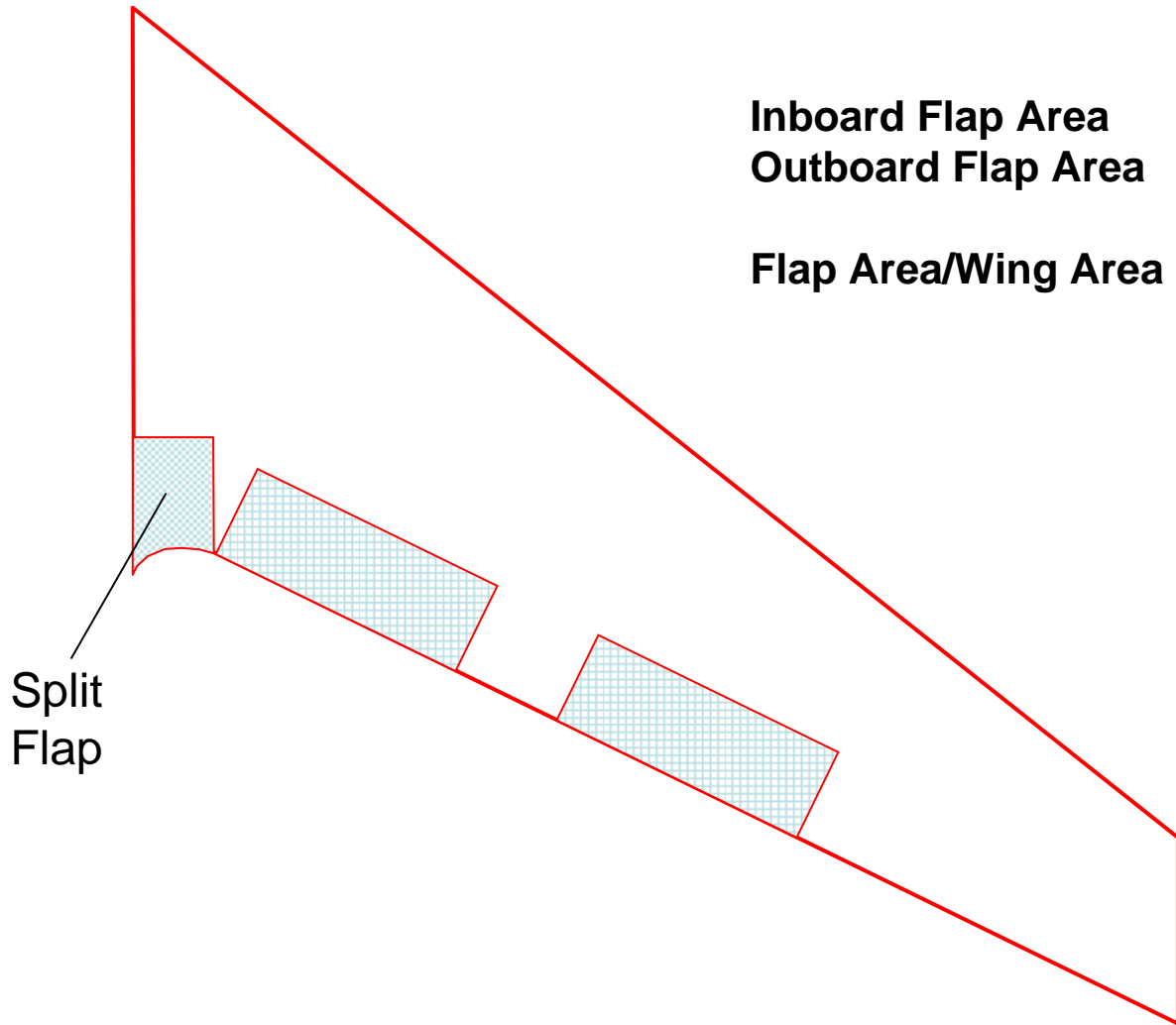




# Wing Airfoils



# 367-80 Wing Trailing Edge Flaps

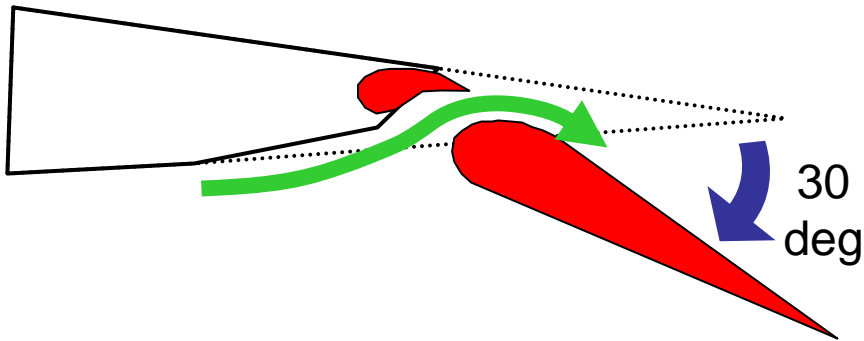


**Inboard Flap Area**            **159 sq ft**  
**Outboard Flap Area**        **161.5 sq ft**

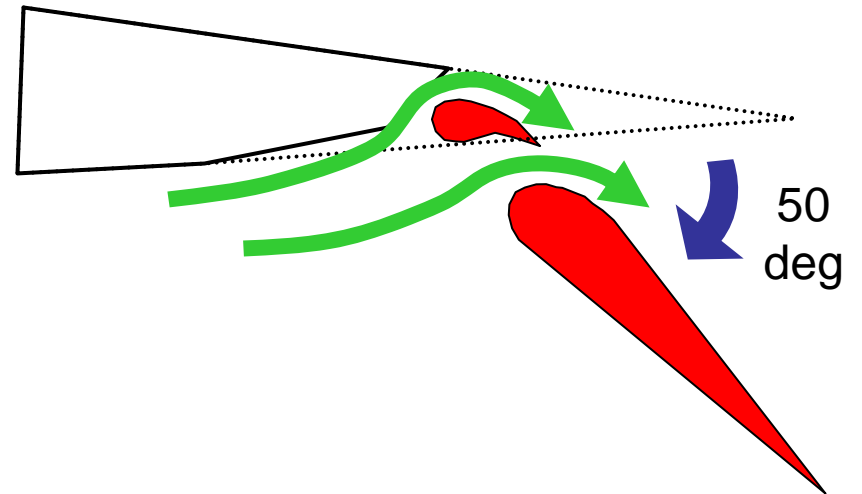
**Flap Area/Wing Area Ratio**   **0.134**

# 367-80 Wing Trailing Edge Flaps

Takeoff Configuration



Landing Configuration



# 367-80 Wing Trailing Edge

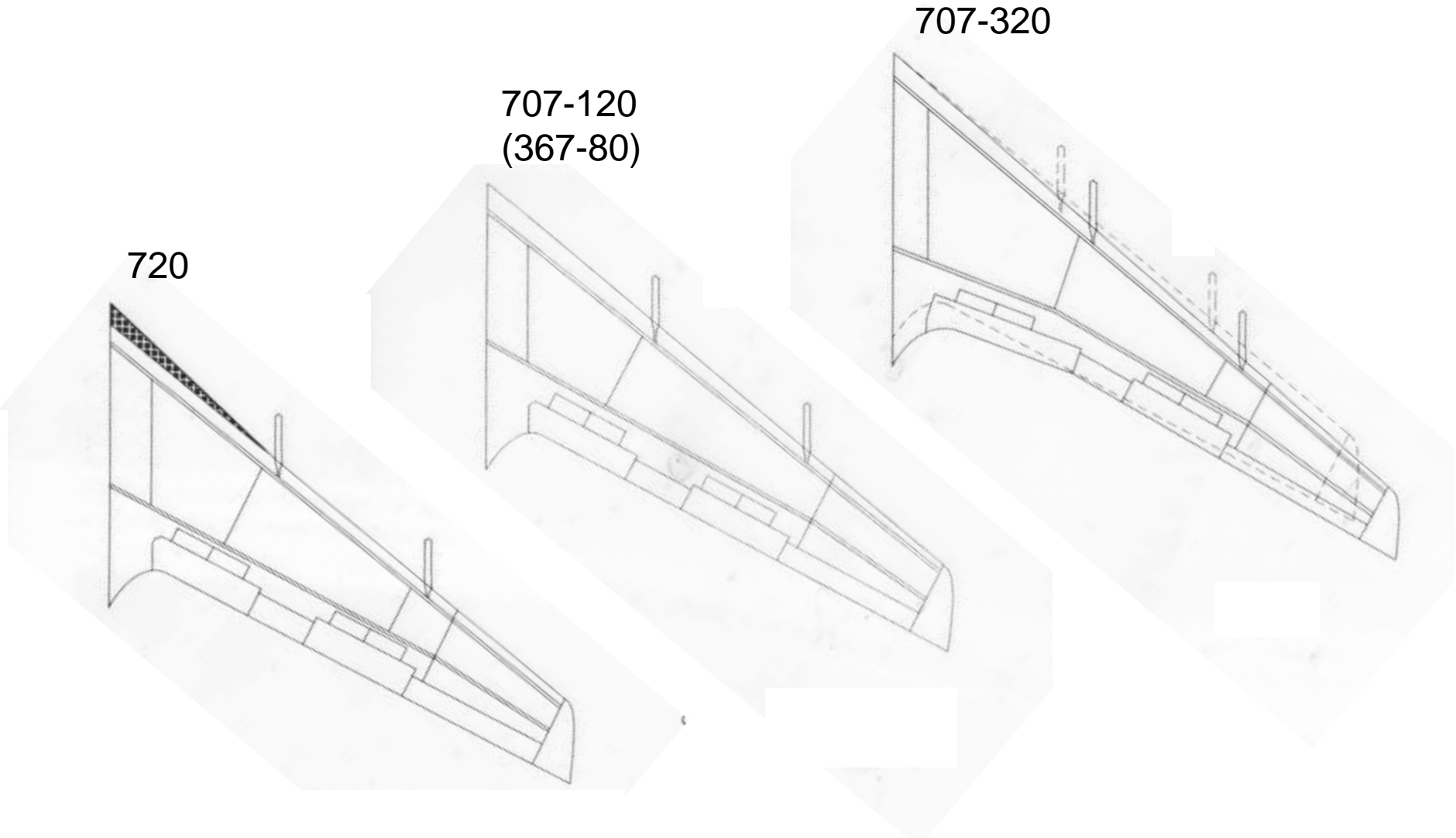


# Wing Evolution 367-80/707/720

707-320

707-120  
(367-80)

720



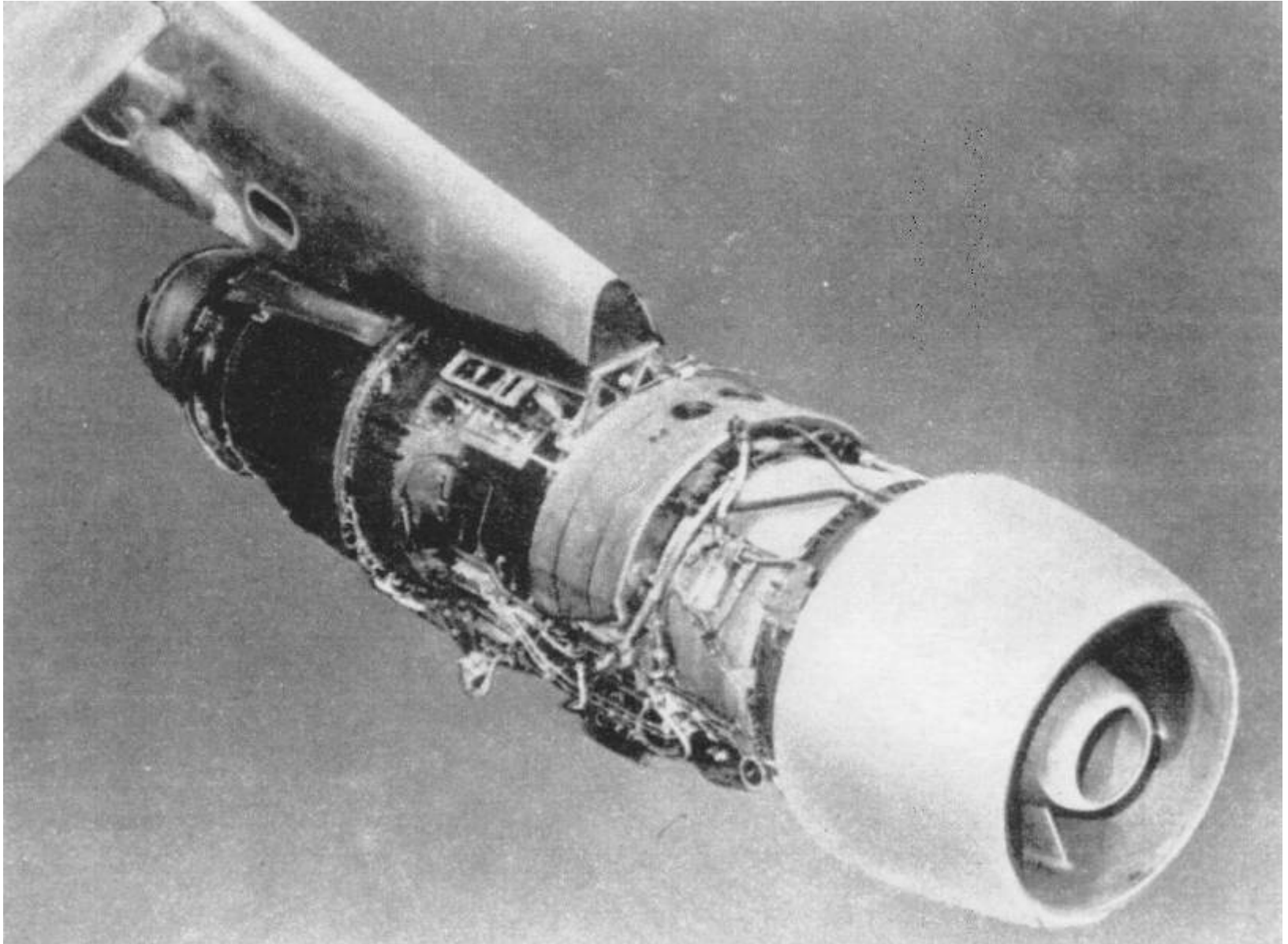


# Landing Gear



# Engines – PW-JT3L

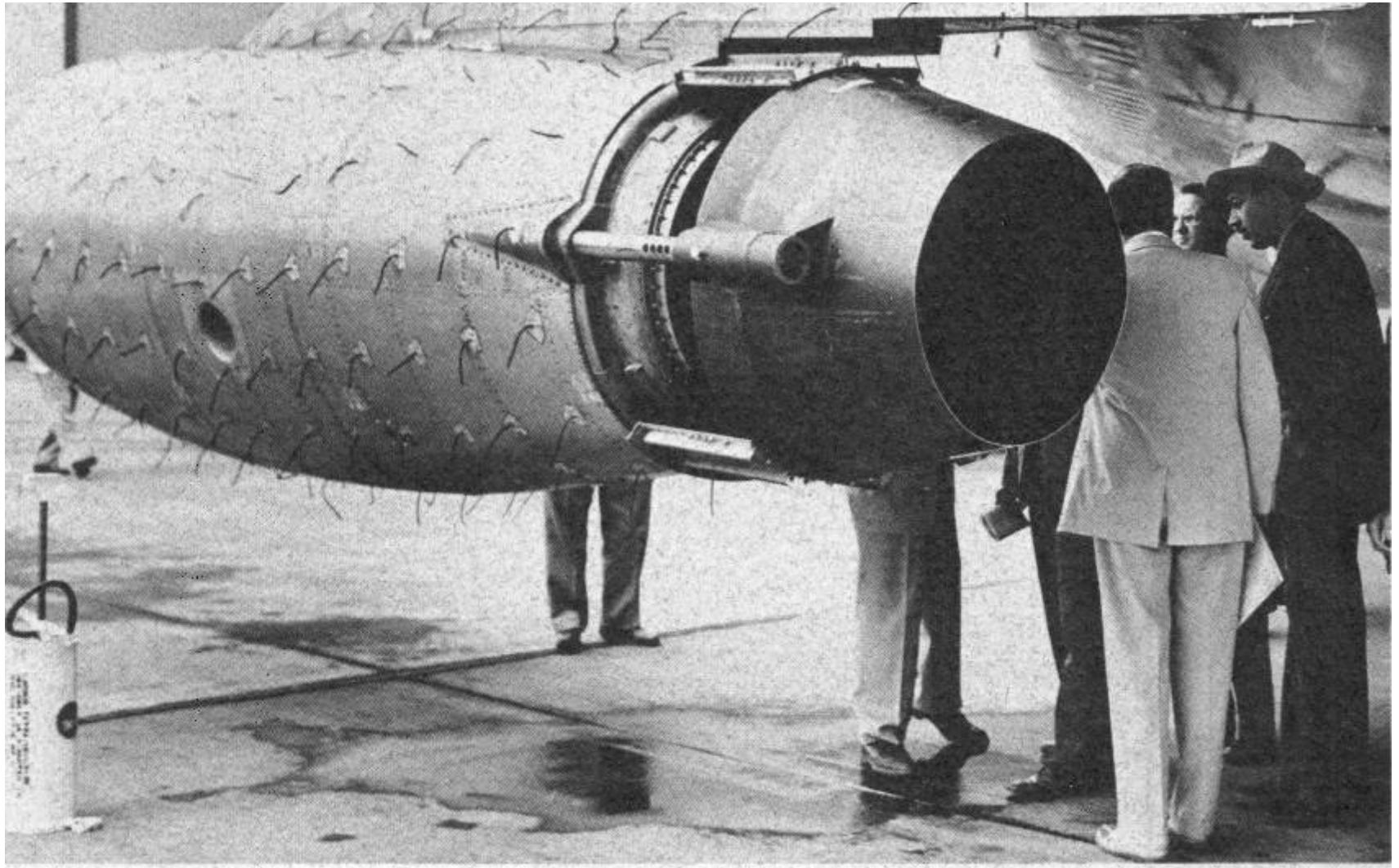
*Derivative of Military J-57*



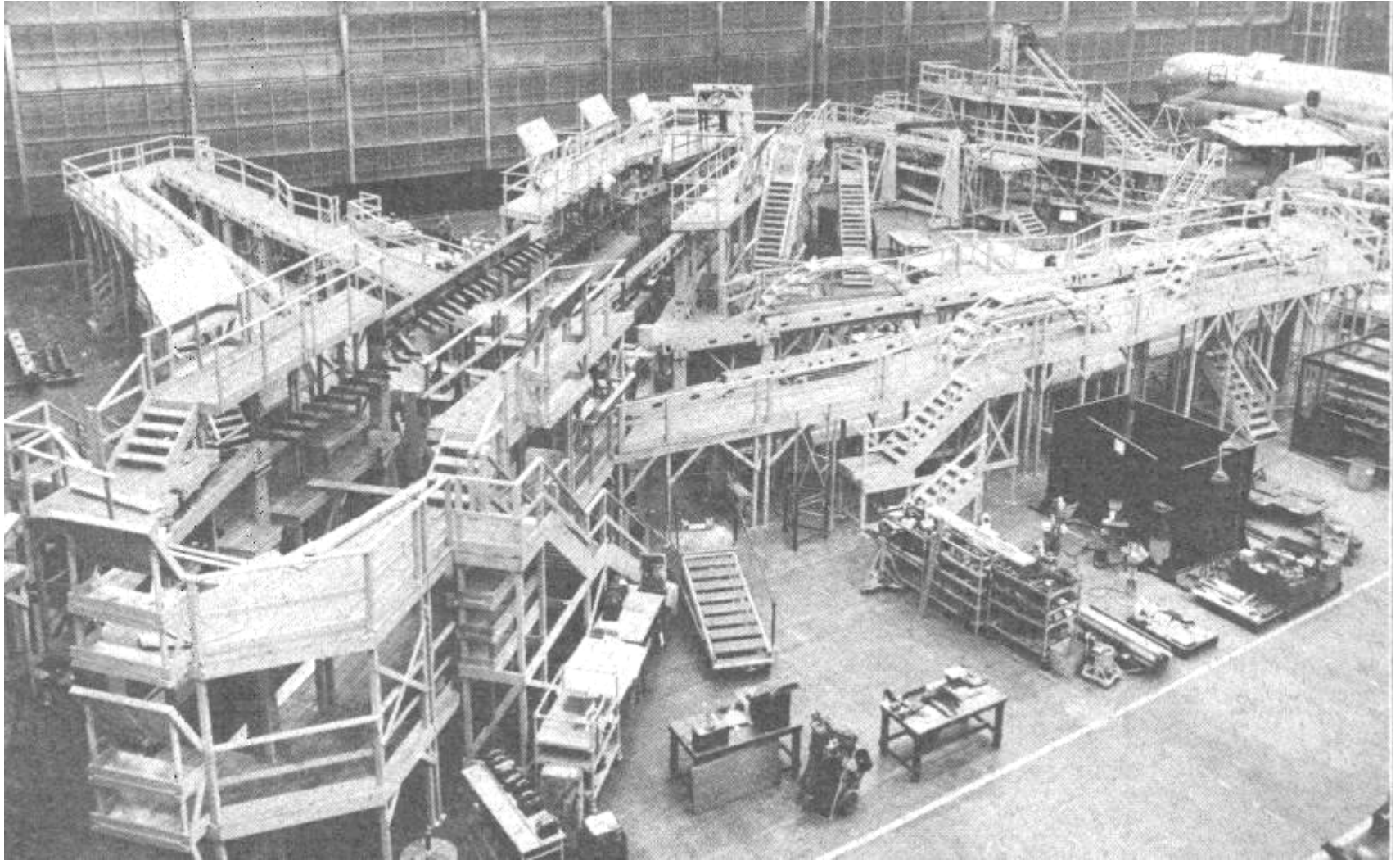
# In-flight view of engine



# Thrust Reverser

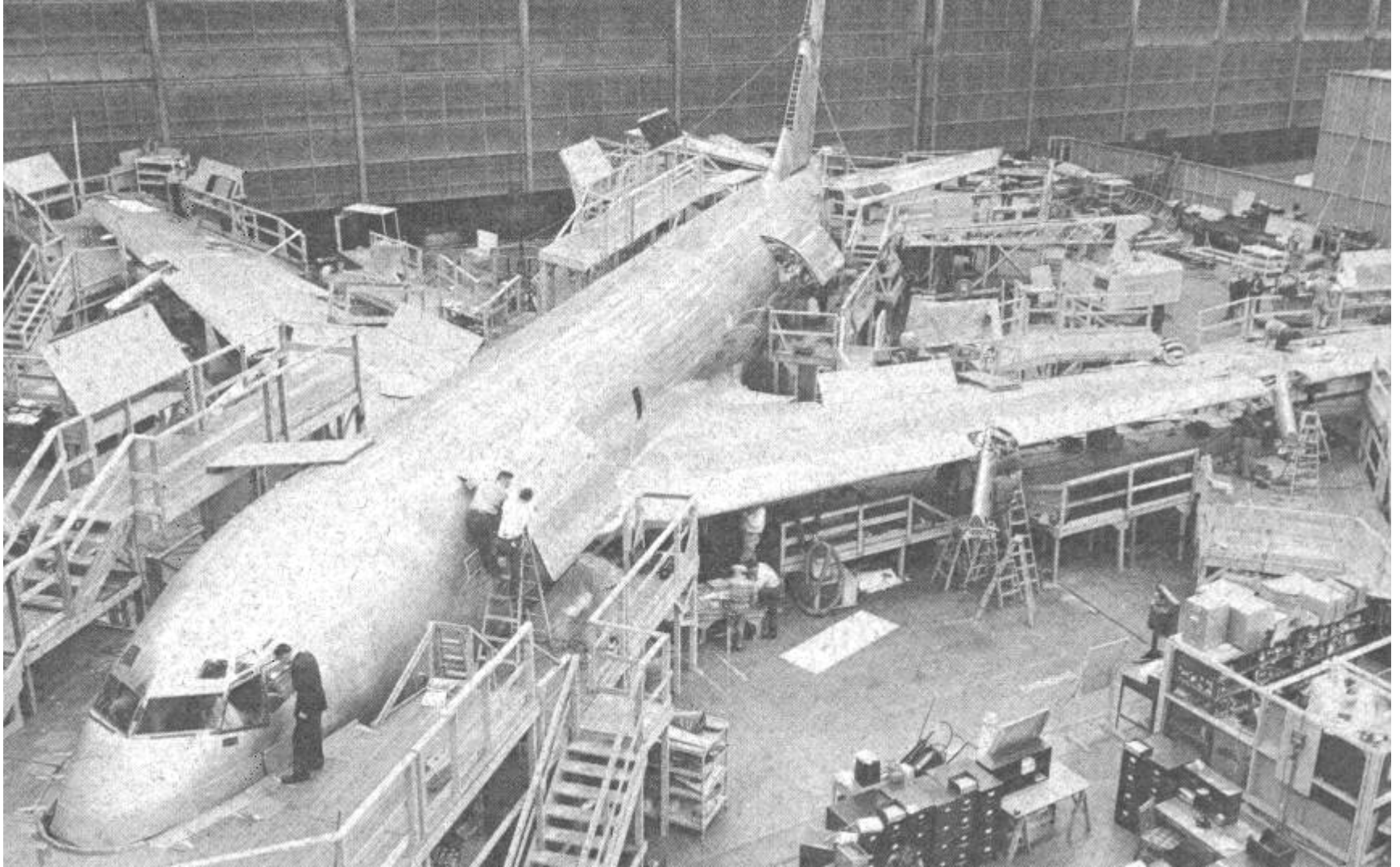


# Built from the Bottom Up





# Not Moving, No Line





# 367-80 Rollout

*Renton WA May 14, 1954*



# Oops

**Landing Gear Attachment Fitting Fails During Taxi Test  
May 21, 1954**



# 367-80 First Flight

*Renton WA July 15, 1954*



# KC-135 Rollout

1956





# First Production 707

*late 1957*



# From Prototype to Testbed

*Highlights of 367-80 Tests*

1954-60	KC-135 & 707 Development, field length performance
1961-64	727 Development, including triple-slotted flaps and fuselage-mounted engine
1965-66	Variable Stability, SST and C-5 Development
1967-70	Boundary Layer Control, Automatic Landing



# Destination: History

2003



# The Last Landing

*IAD (Dulles) 2003*





# National Air & Space Museum Dulles Center



# **The Development of Boeing's 367-80:**

## *Charging Into the Jet Age Armed With Only a Slide Rule and Spline*

### Abstract

Boeing has dominated the commercial aircraft industry for so long it is hard to remember when it wasn't so. Yet, at the end of WWII, Douglas Aircraft was dominant in the field, and Boeing was in a distant fifth place behind Lockheed, Martin, and Convair.

When Bill Allen committed Boeing to building a prototype of a commercial jet transport in 1952, he hedged the bet by developing the 367-80 as a badly needed high-speed tanker for the B-47 and B-52. Success of the aircraft as a passenger transport would be "pure gravy".

Development histories of the Boeing 707 draw a picture of boldness and courage in the face of long odds...but it can be argued that the Boeing of 1950 actually had most of what it needed to take on the task. What it took was the "can-do" attitude of the Boeing employees of the time.

In this presentation, Mr. Almojuela presents a brief summary of the period leading up to the design, build, and flight of the 367-80 prototype, and some of the trials and tribulations of the airplane that vaulted Boeing to prominence in the commercial aircraft field.