

# Orbiter Sub-System Design

Prof. Aaron Cohen

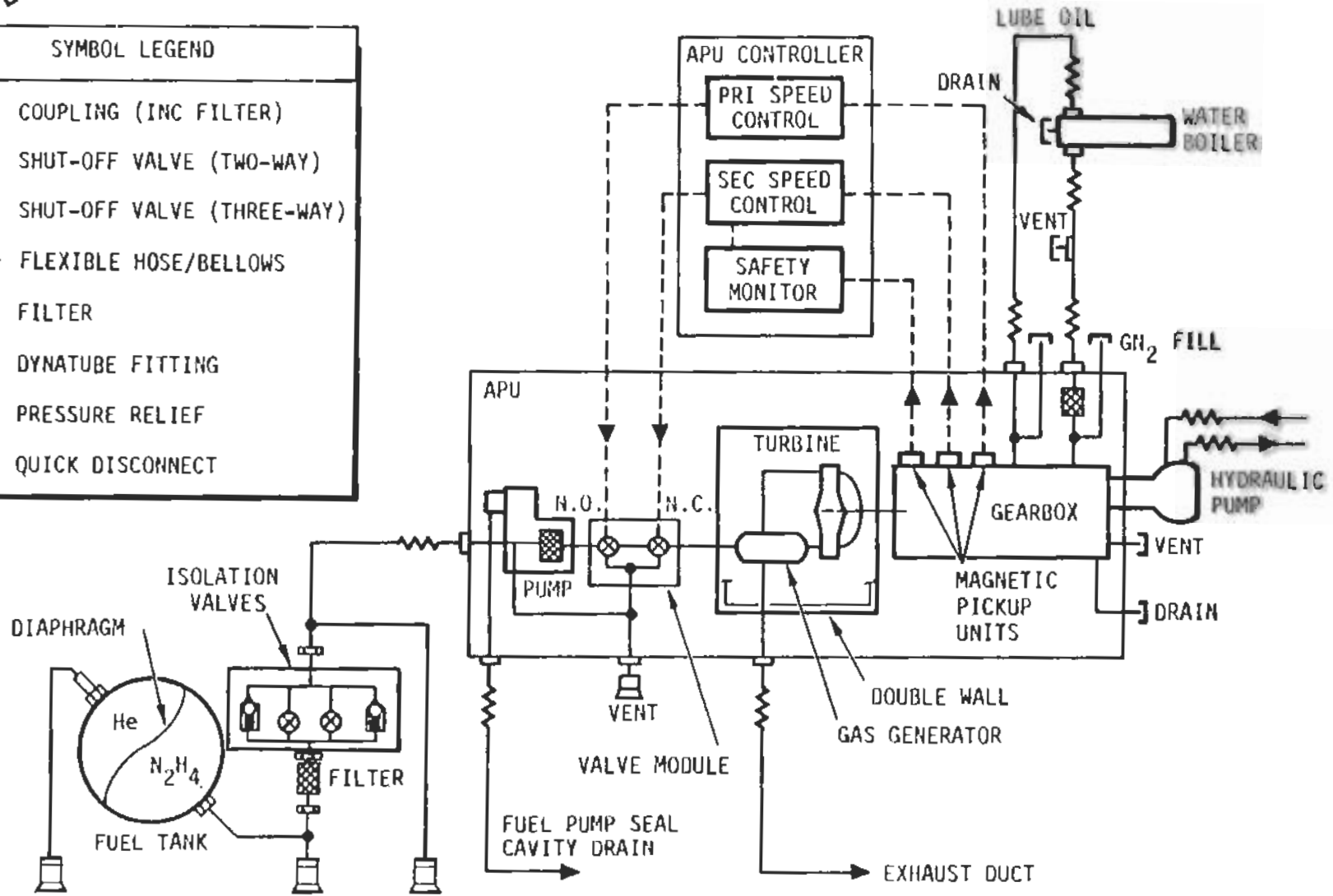
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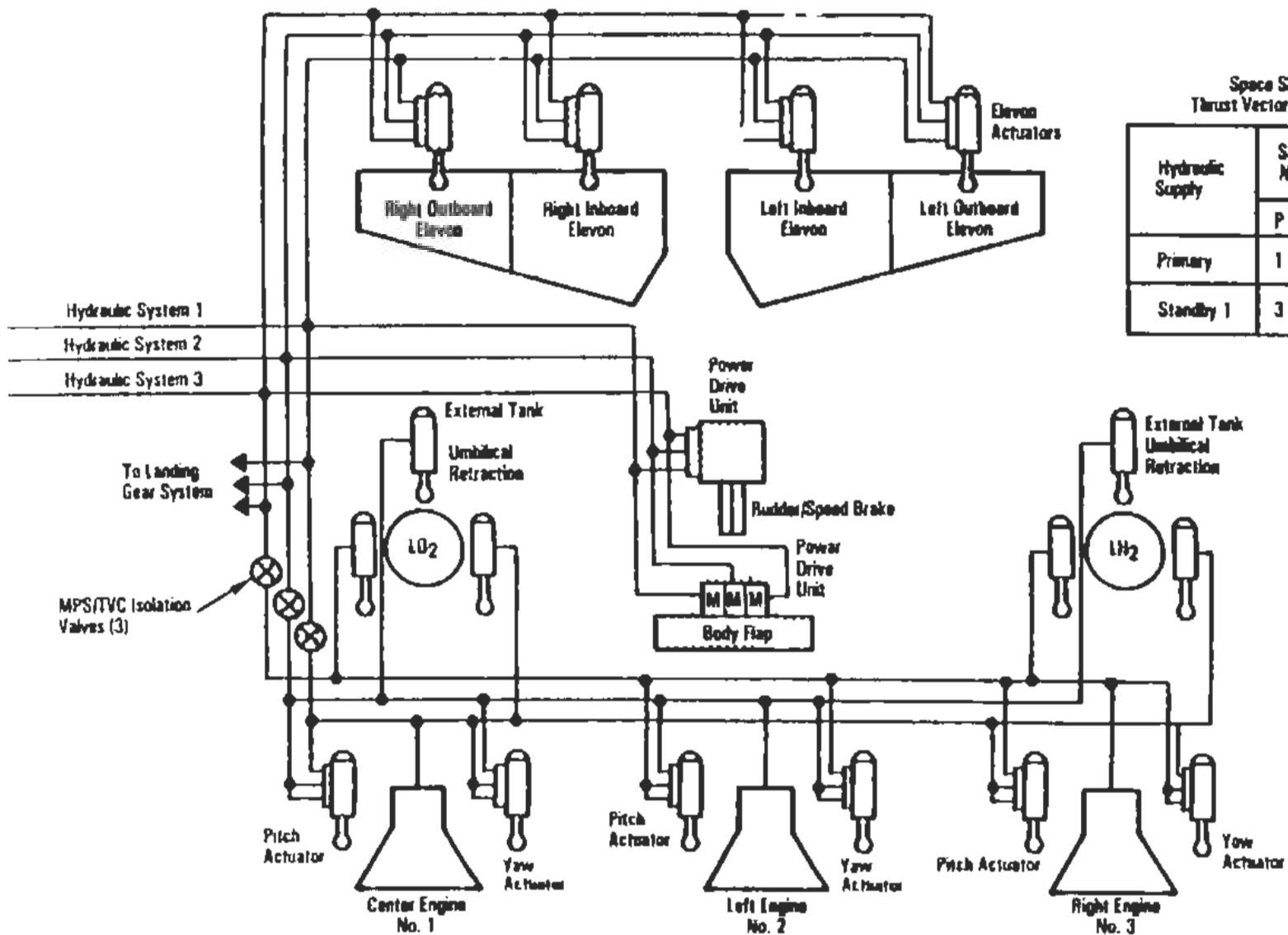
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# AUXILIARY POWER UNIT SUBSYSTEM SCHEMATIC

SYMBOL LEGEND	
	COUPLING (INC FILTER)
	SHUT-OFF VALVE (TWO-WAY)
	SHUT-OFF VALVE (THREE-WAY)
	FLEXIBLE HOSE/BELLOWS
	FILTER
	DYNATUBE FITTING
	PRESSURE RELIEF
	QUICK DISCONNECT





Space Shuttle Main Engine  
Thrust Vector Control Hydraulic Logic

Hydraulic Supply	SSME No. 1		SSME No. 2		SSME No. 3	
	P	Y	P	Y	P	Y
Primary	1	3	2	1	3	2
Standby 1	3	1	1	2	2	3

*Hydraulic Actuator System—Aerosurfaces, Umbilical Retraction and Space Shuttle Main Engine Thrust Vector Control Actuator*

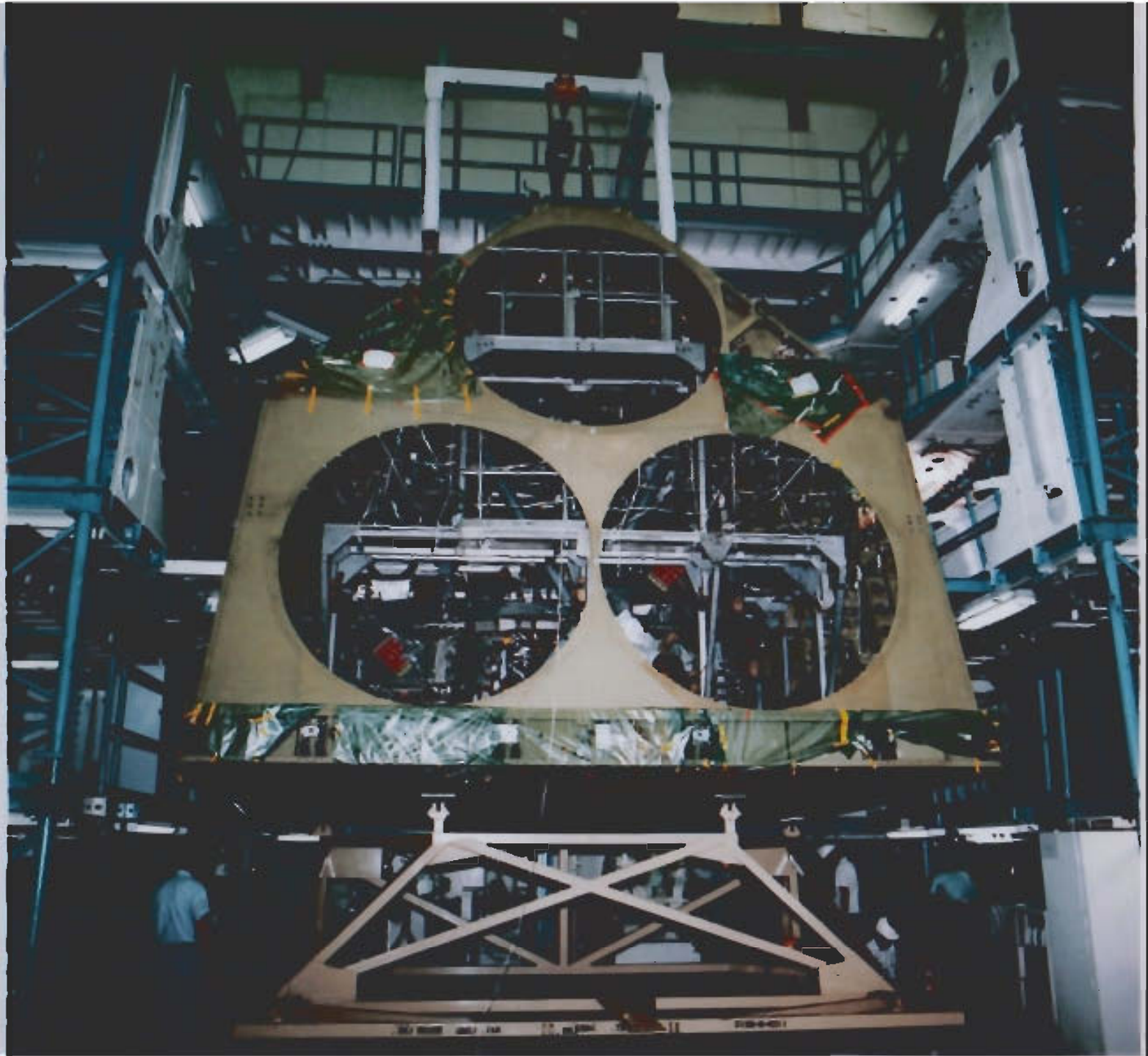
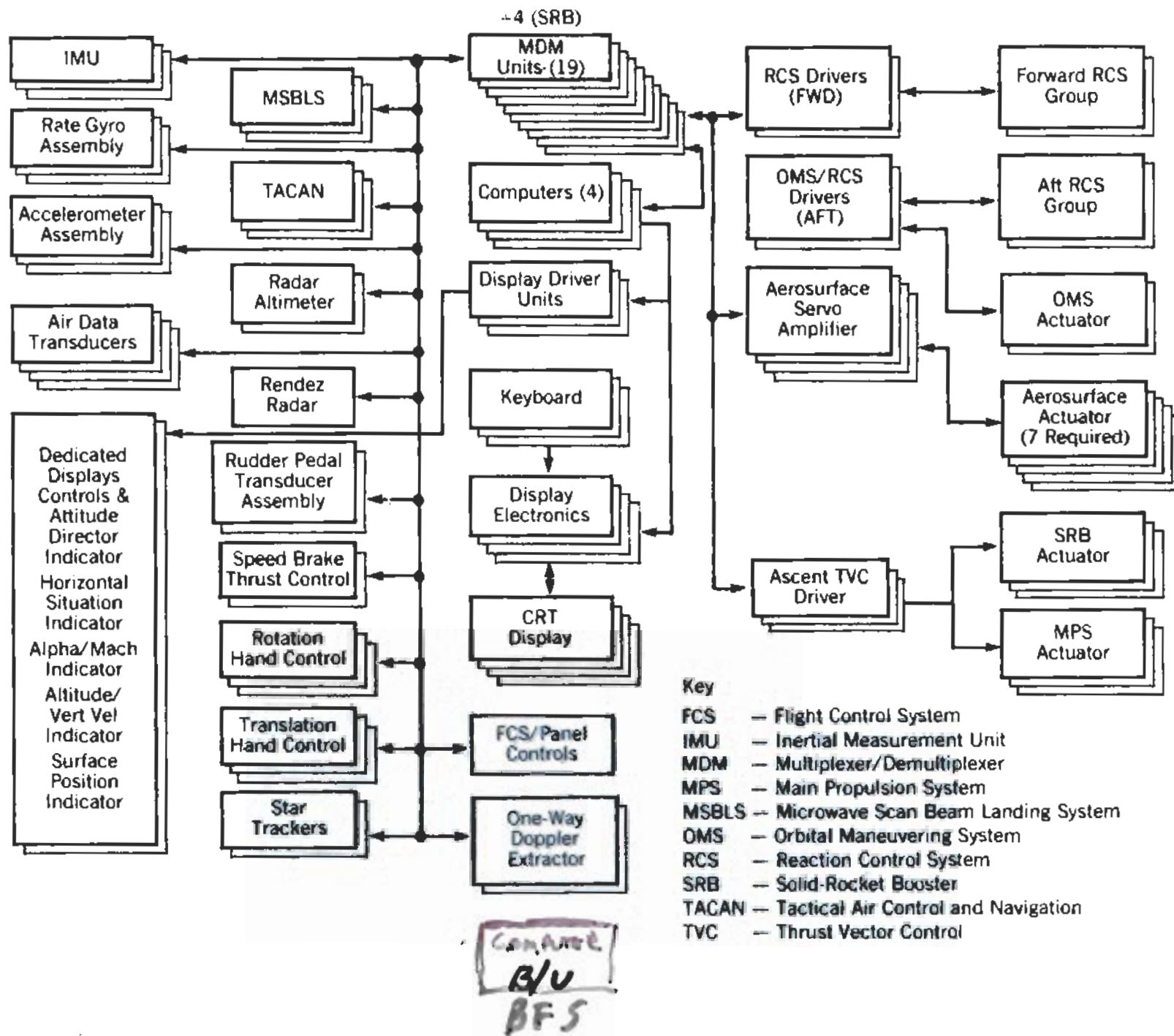
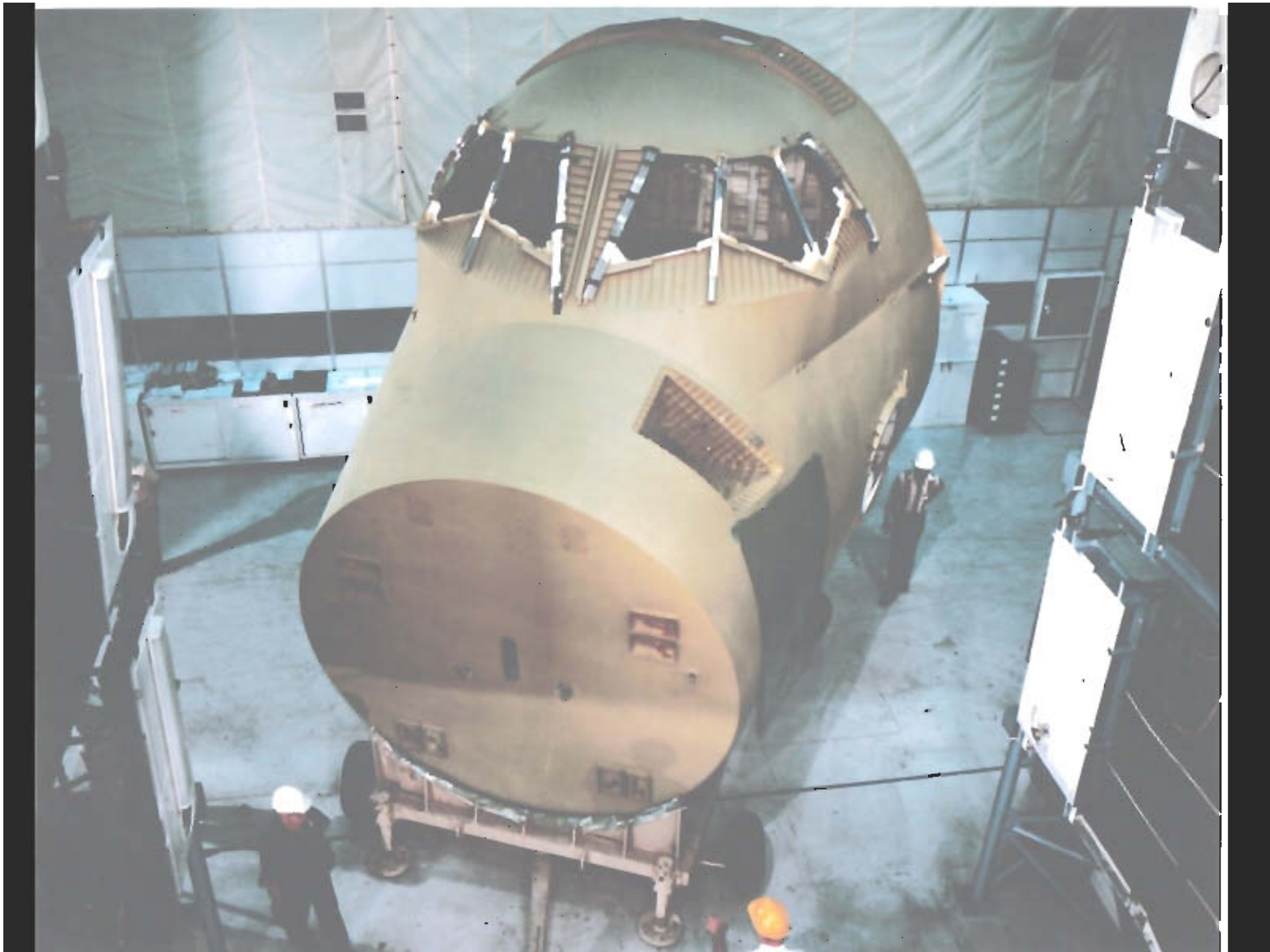
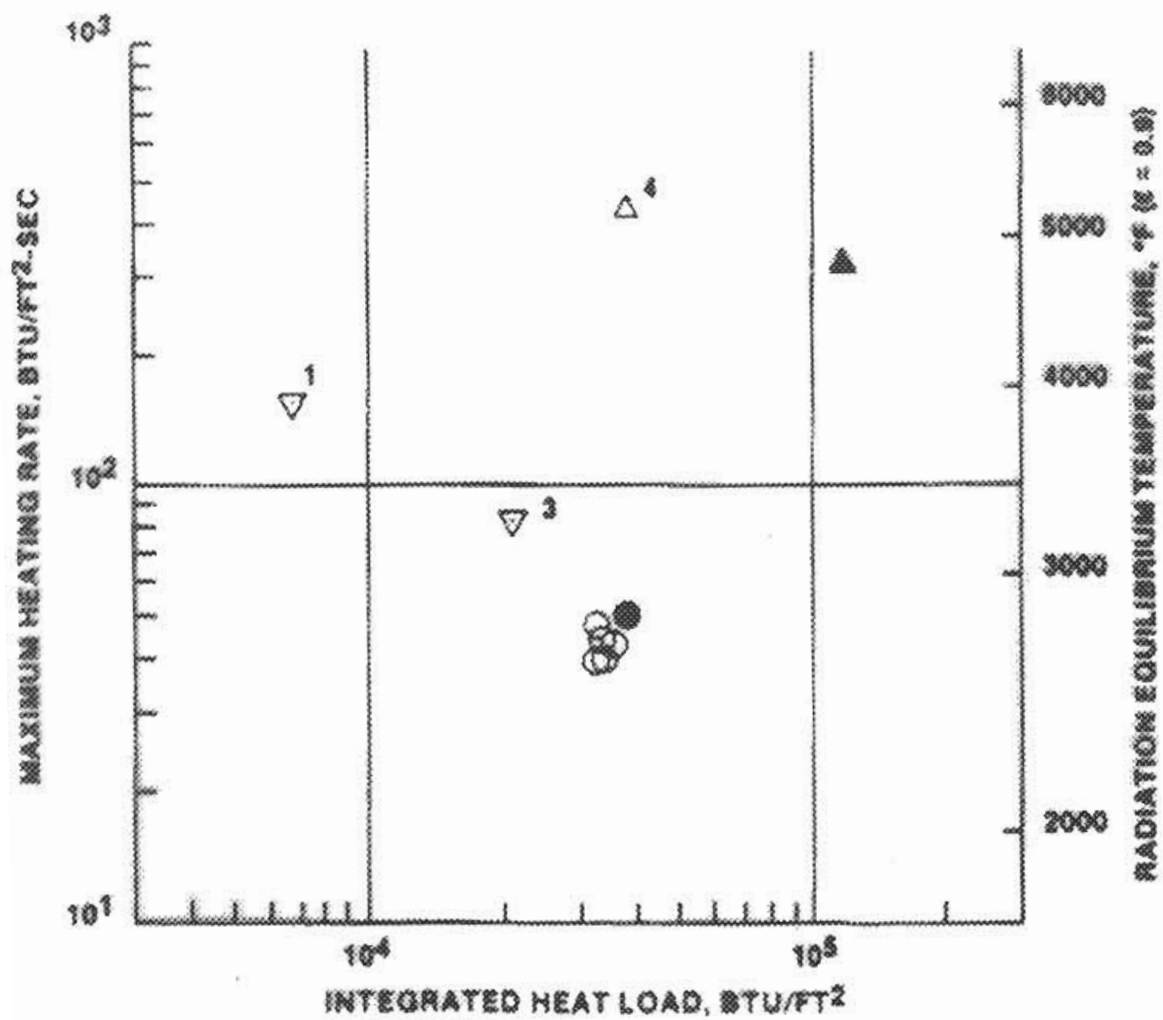


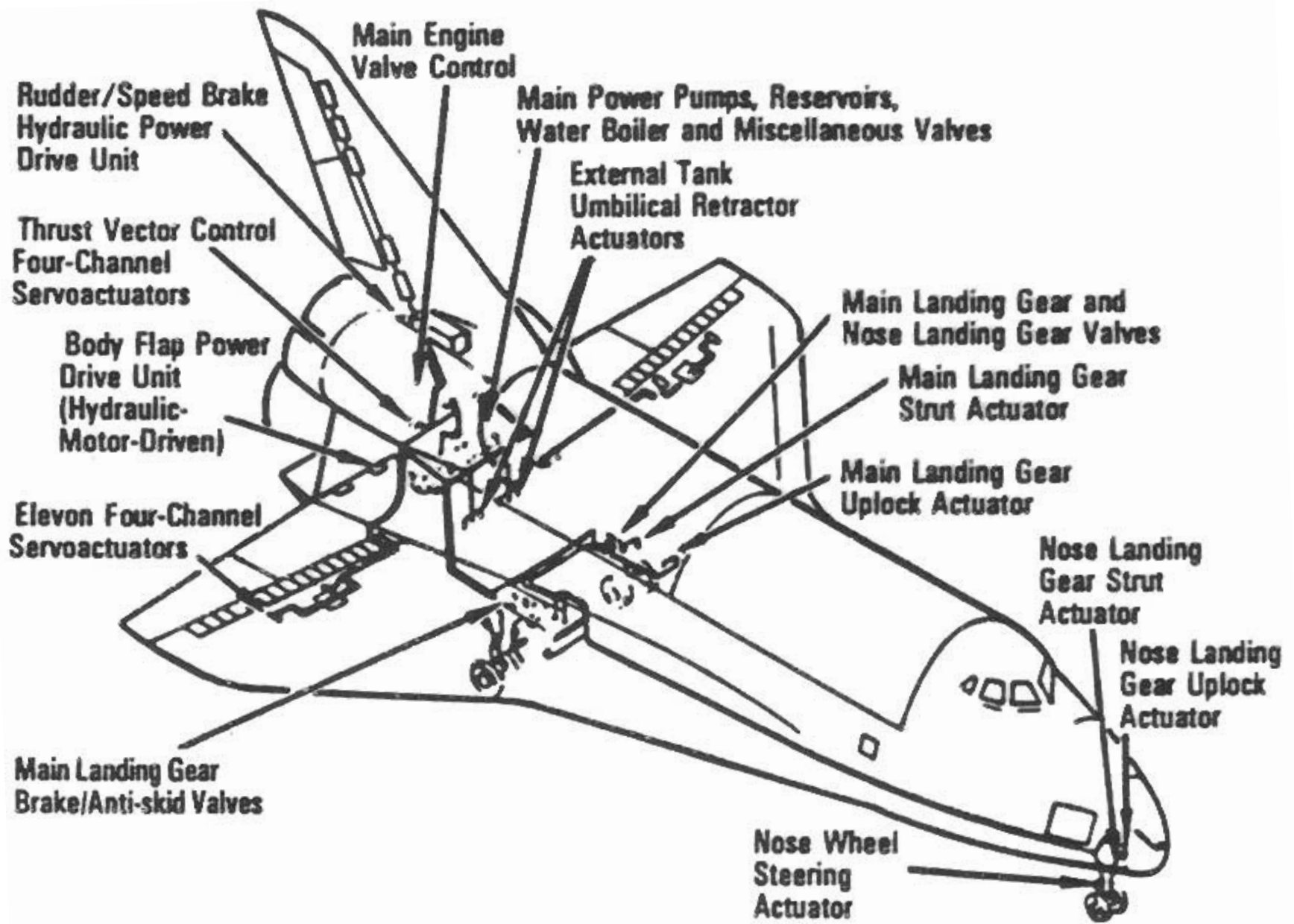
Figure 3. Guidance, Navigation and Control Subsystem Hardware Configuration.





- △ APOLLO LUNAR RETURN
- ▽ APOLLO ORBITAL RETURN
- SHUTTLE ORBITER
- △ FLIGHT
- ▲ DESIGN



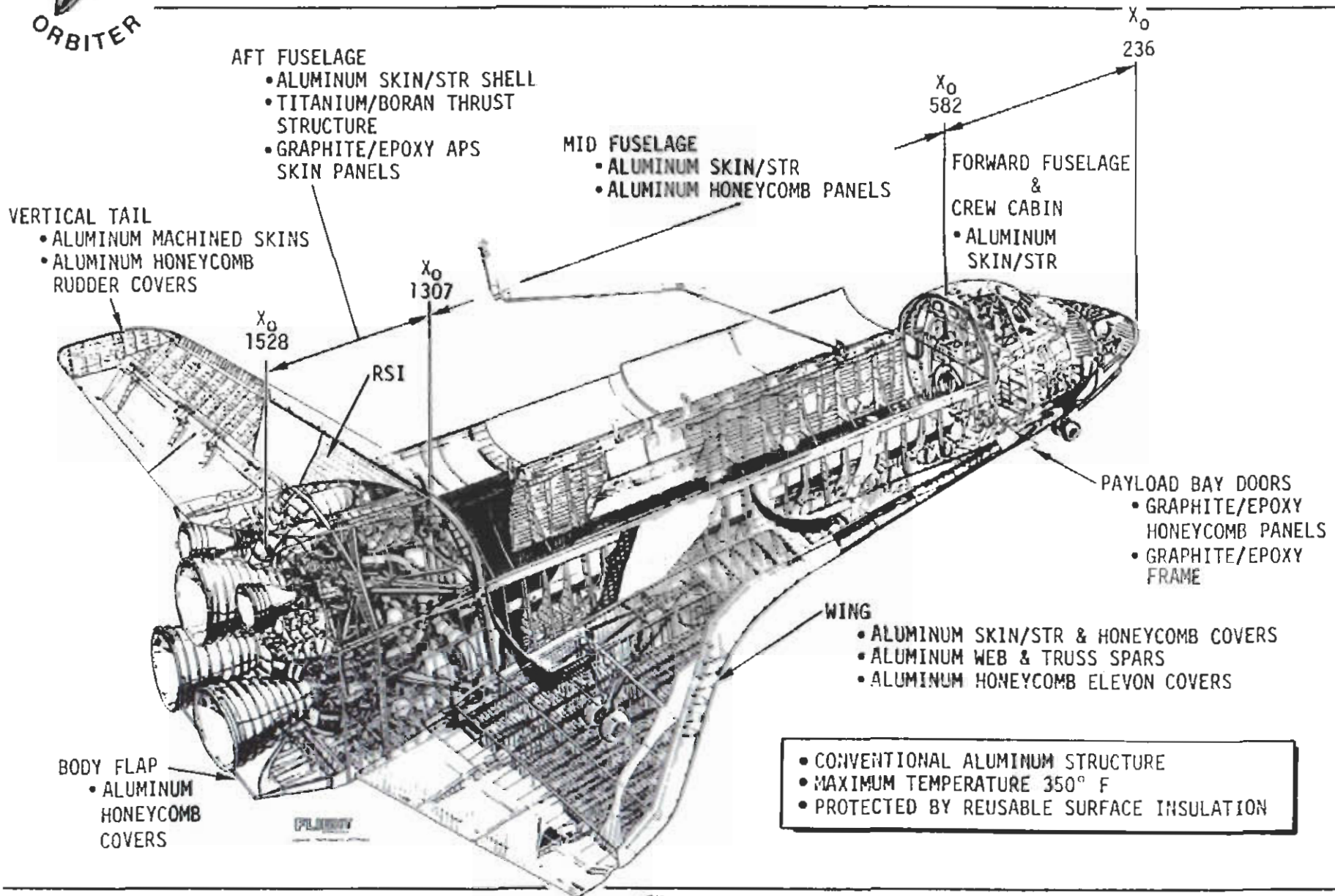


*Hydraulic Systems*





# ORBITER STRUCTURE

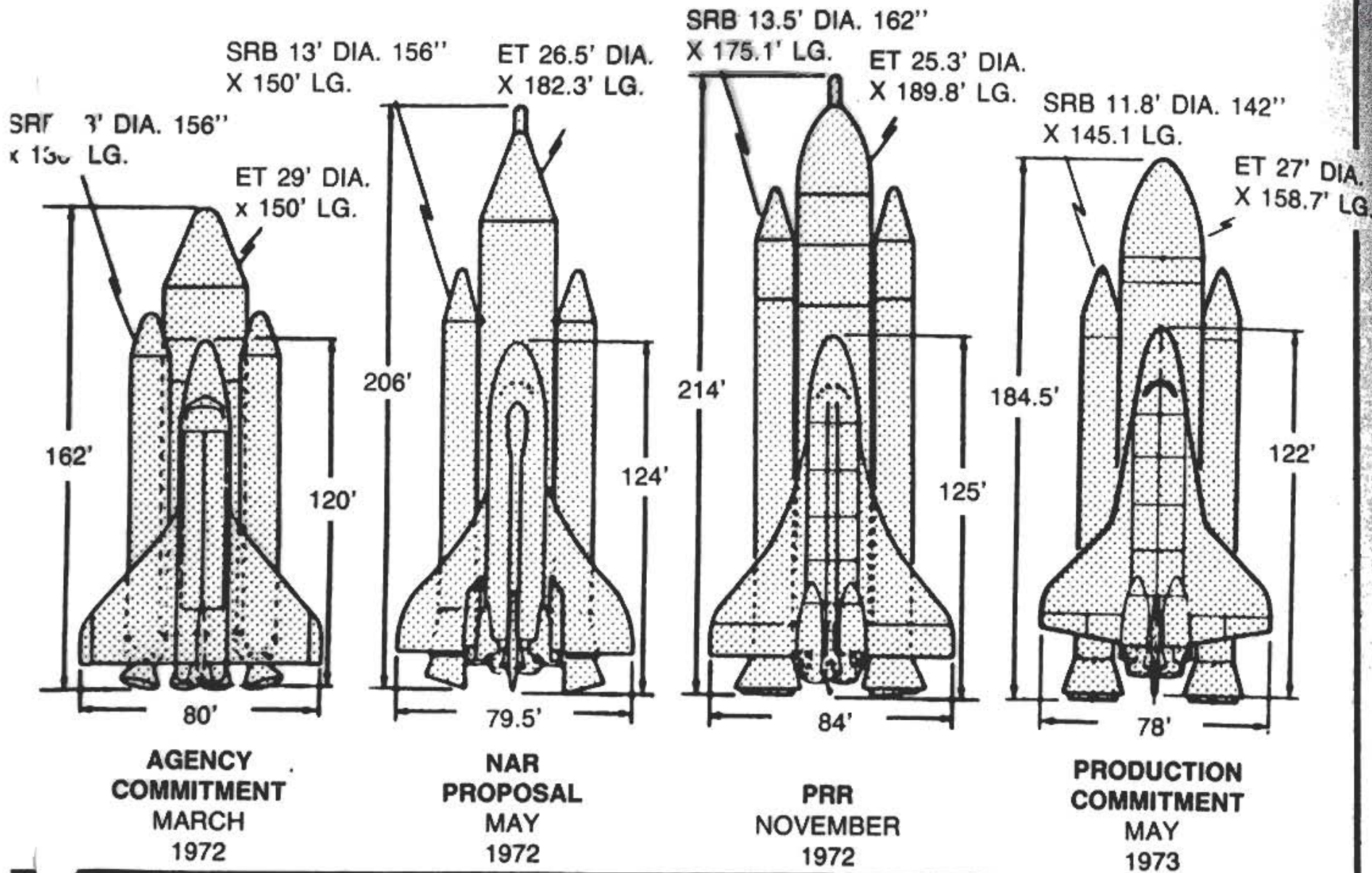


Rockwell International

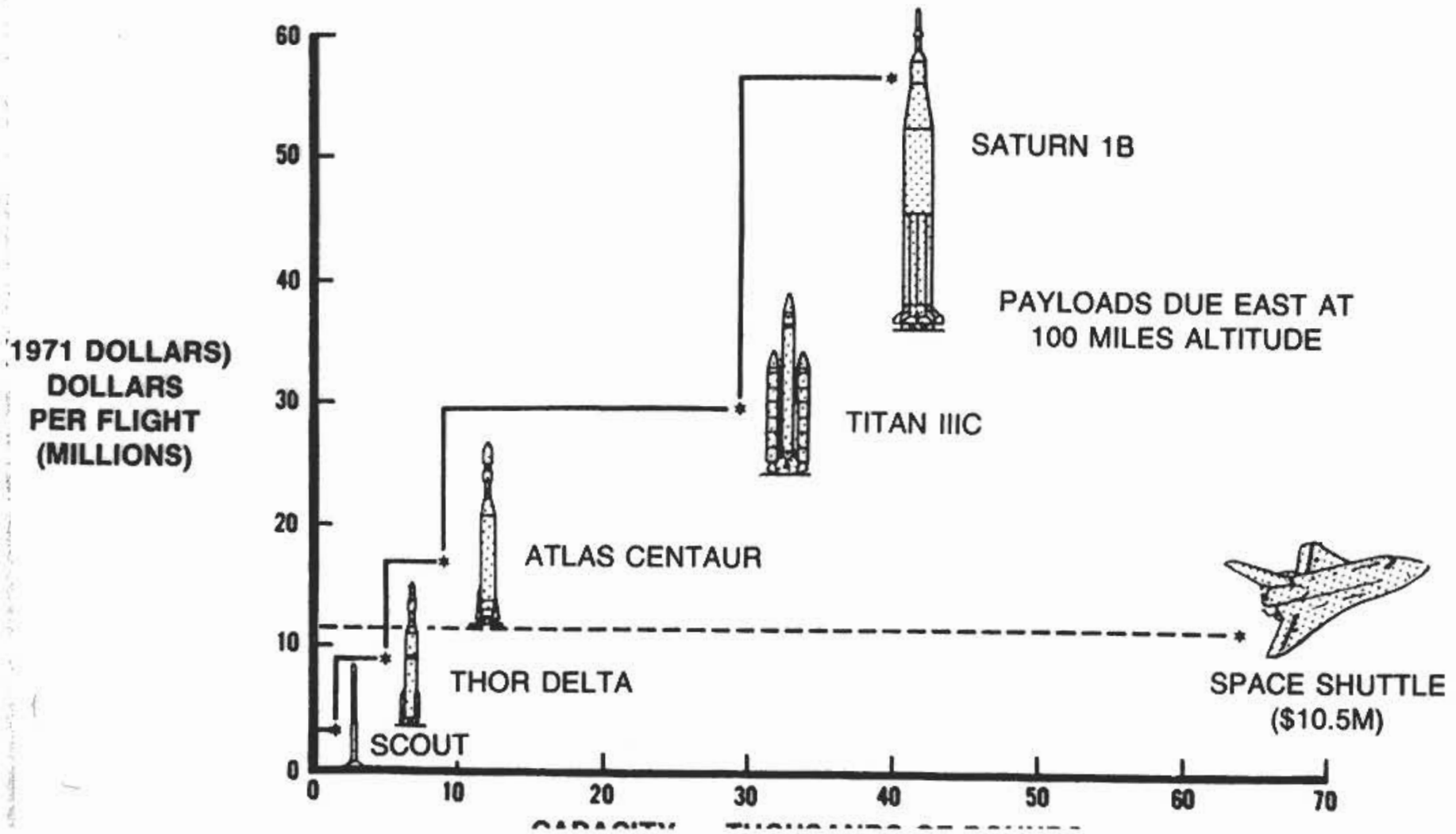
Space Division

18SSV64396B

# — FINAL DESIGN REFINEMENT — 1972-1973



# COMPARATIVE LAUNCH COSTS





# NASA

242-0000

Shuttle Orbiter 120,100 n. mi.

Inclination 28.5

Duration 122 1/2 hours

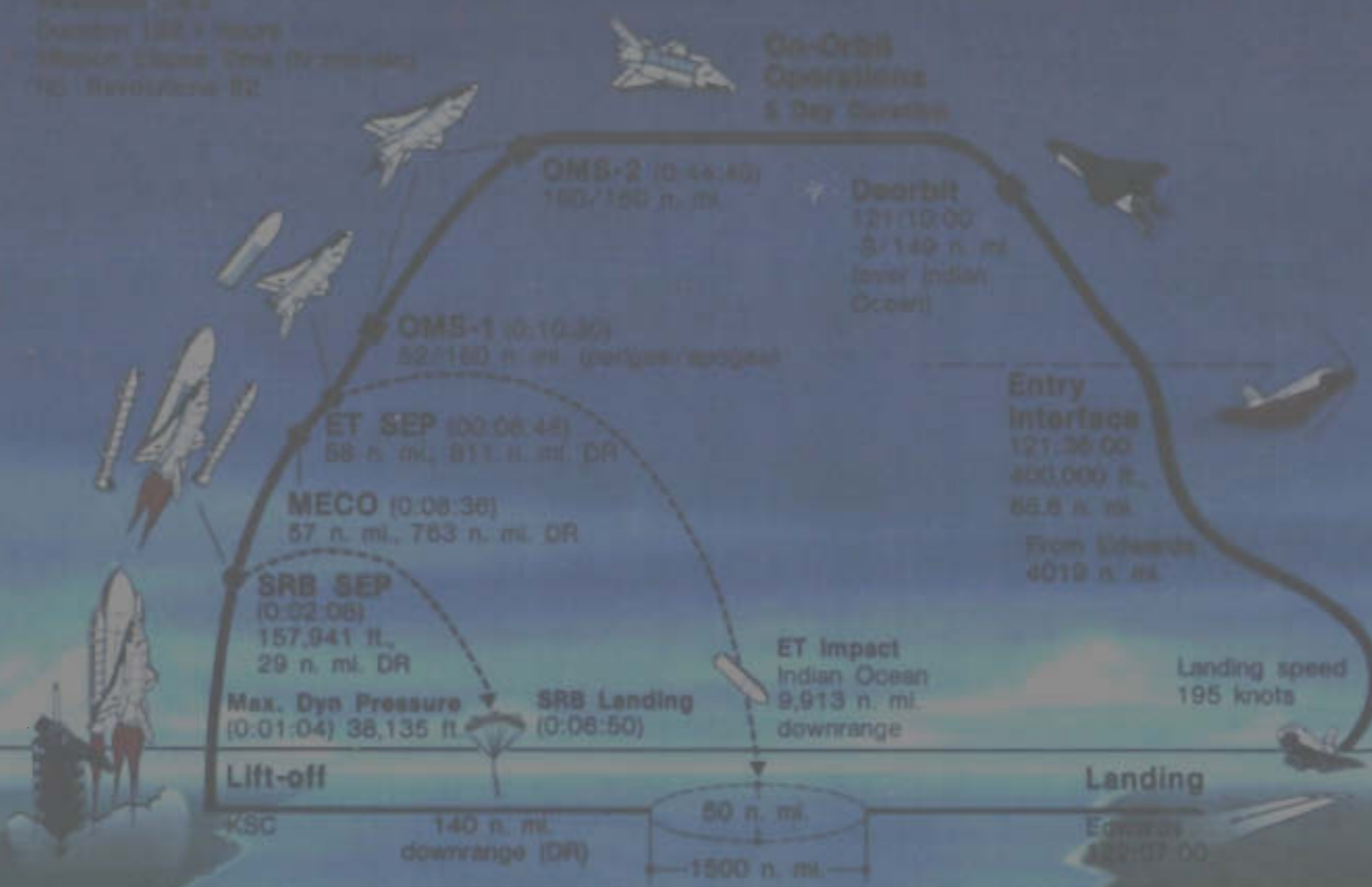
Mission elapsed time (27 minutes)

120 Reynolds/Orbit

## Space Shuttle Nominal Mission Profile for STS-5

Orbit 120,100 n. mi.  
Inclination 28.5

On-Orbit  
Operations  
5 Day Duration



## SPACE SHUTTLE SYSTEM

## SPACE SHUTTLE SYSTEM

● OVERALL LENGTH	184.2 FT	(56.2 m)
● HEIGHT	76.6 FT	(23.4 m)
● SYSTEM WEIGHT		
- DUE EAST	4490.8K LBS	(2041.3K Kg)
- 104°	4449.0K LBS	(2022.3K Kg)
● PAYLOAD WEIGHT		
- DUE EAST	65K LBS	(29.5K Kg)
- 104°	32K LBS	(14.5K Kg)

## EXTERNAL TANK

## (TANK 7 AND SUBSEQUENT)

● DIAMETER	27.8 FT	(8.5 m)
● LENGTH	184.4 FT	(47.1 m)
● WEIGHT		
- LAUNCH	1649.6K LBS	(748.2K Kg)
- INERT	71.0K LBS	(32.2K Kg)

## SOLID ROCKET BOOSTER

● DIAMETER	12.2 FT	(3.7 m)
● LENGTH	149.1 FT	(45.4 m)
● WEIGHT (EACH)		
- LAUNCH	1292.6K LBS	(586.3K Kg)
- INERT	183.8K LBS	(83.4K Kg)
● THRUST (EACH)		
- LAUNCH	2.7M LBS	(12.0M N)
● SEPARATION MOTORS (EACH SRM)		
- 4 APT 4 PWD		
- THRUST (EACH)	22K LBS	(97.9K N)

## ORBITER

● LENGTH	122.2 FT	(37.1 m)
● WINGSPAN	78.1 FT	(23.8 m)
● TAXI HEIGHT	~57 FT	(17.4 m)
● PAYLOAD BAY		
- 15 FT DIA X 60 FT LG	(4.6 m DIA X 18.3 m LG)	
● 1100 N MI CROSS RANGE		(2038 Km)
● MAIN ENGINES (3)		
- 476K LBS VAC THRUST EA		(2090.7K N EA)
● OMS ENGINES (2)		
- 8000 LB VAC THRUST EA		(28.7K N EA)
● RCS		
- 30 ENGINES		
- 870 LB VAC THRUST EA		(3869.8 N EA)
- 6 VERNIER		
- 28 LB VAC THRUST EA		(111.2 N EA)
● WEIGHT		
- INERT	162.4K LBS	(73.7K Kg)
- LANDING		
W/PAYLOAD	~205.5K LBS	(93.2K Kg)
W/O PAYLOAD	~175.5K LBS	(79.6K Kg)



# THERMAL PROTECTION SYSTEM

## INSTALLATION



# THERMAL PROTECTION SYSTEM

