SPACE STATION DEVELOPMENT WORK

SOLAR DYNAMIC SYSTEMS

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SOLAR DYNAMIC SYSTEMS

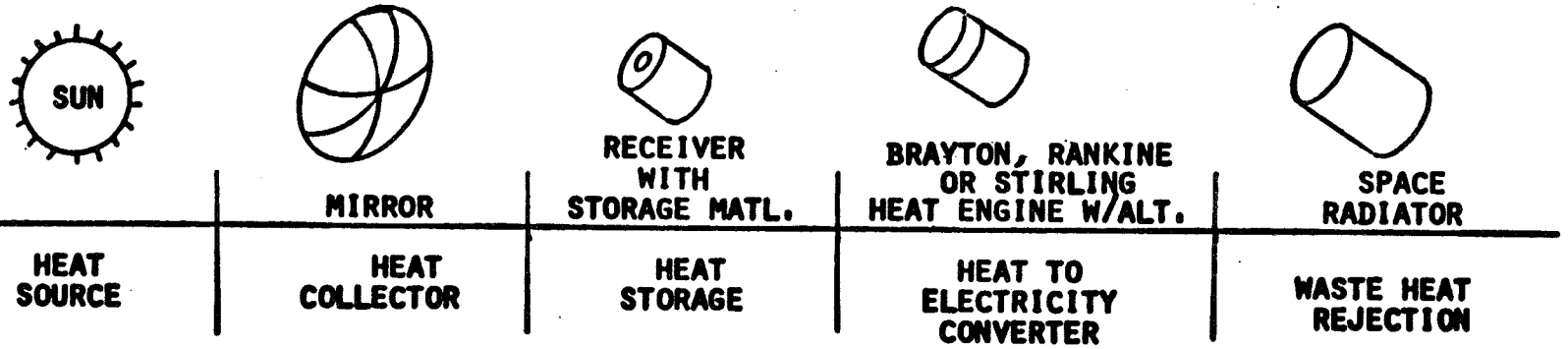
WHAT IS IT?

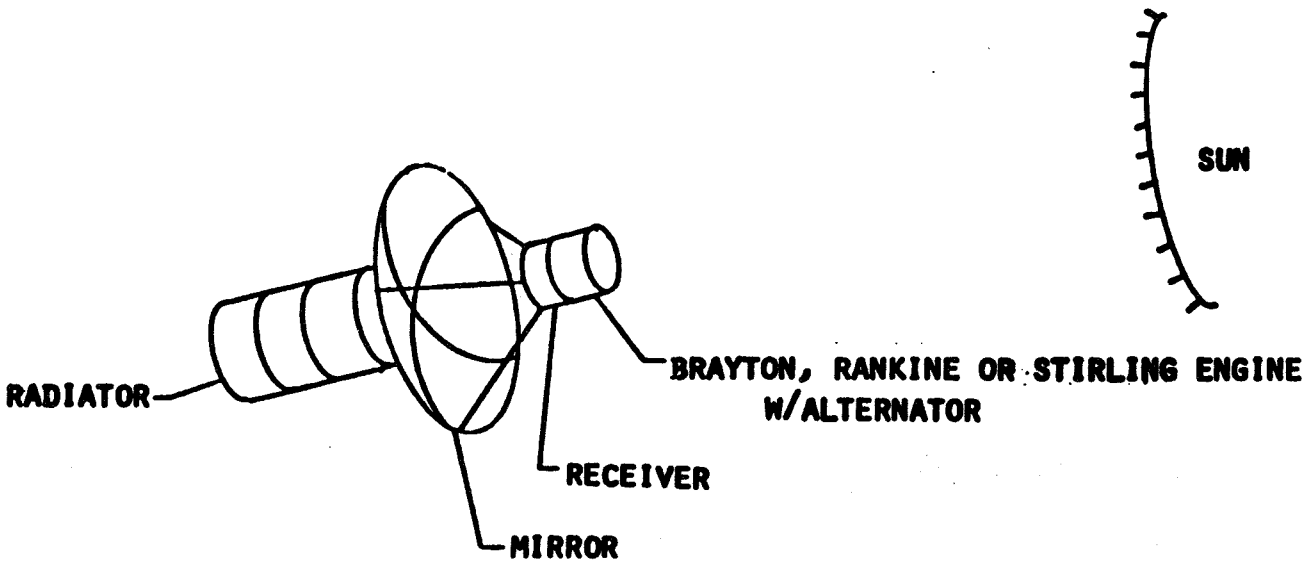
WHY ARE WE INTERESTED?

WHAT ARE THE BENEFITS?

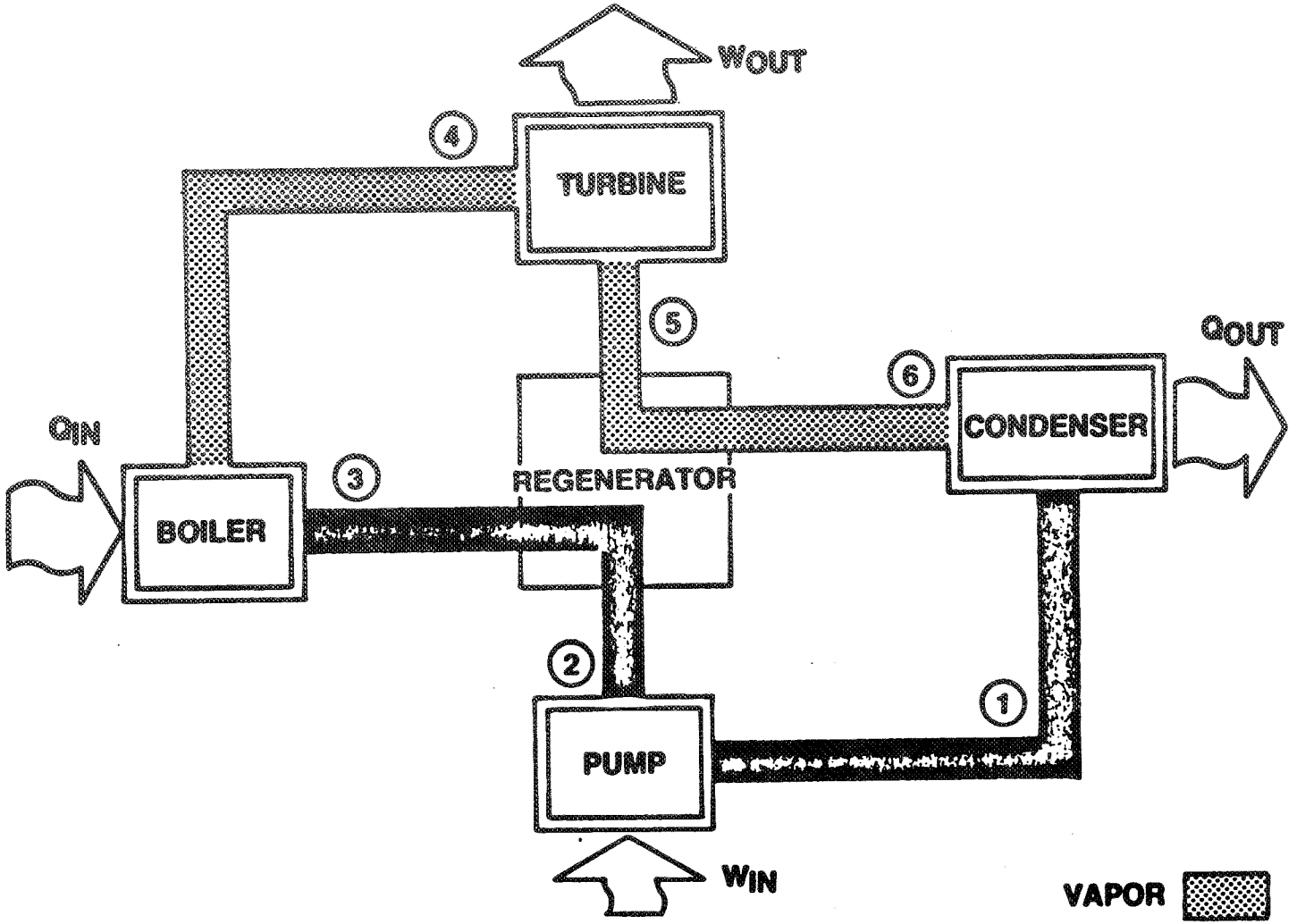
WHAT IS THE SOLAR DYNAMIC DEVELOPMENT PROGRAM?

SYSTEM CONCEPT

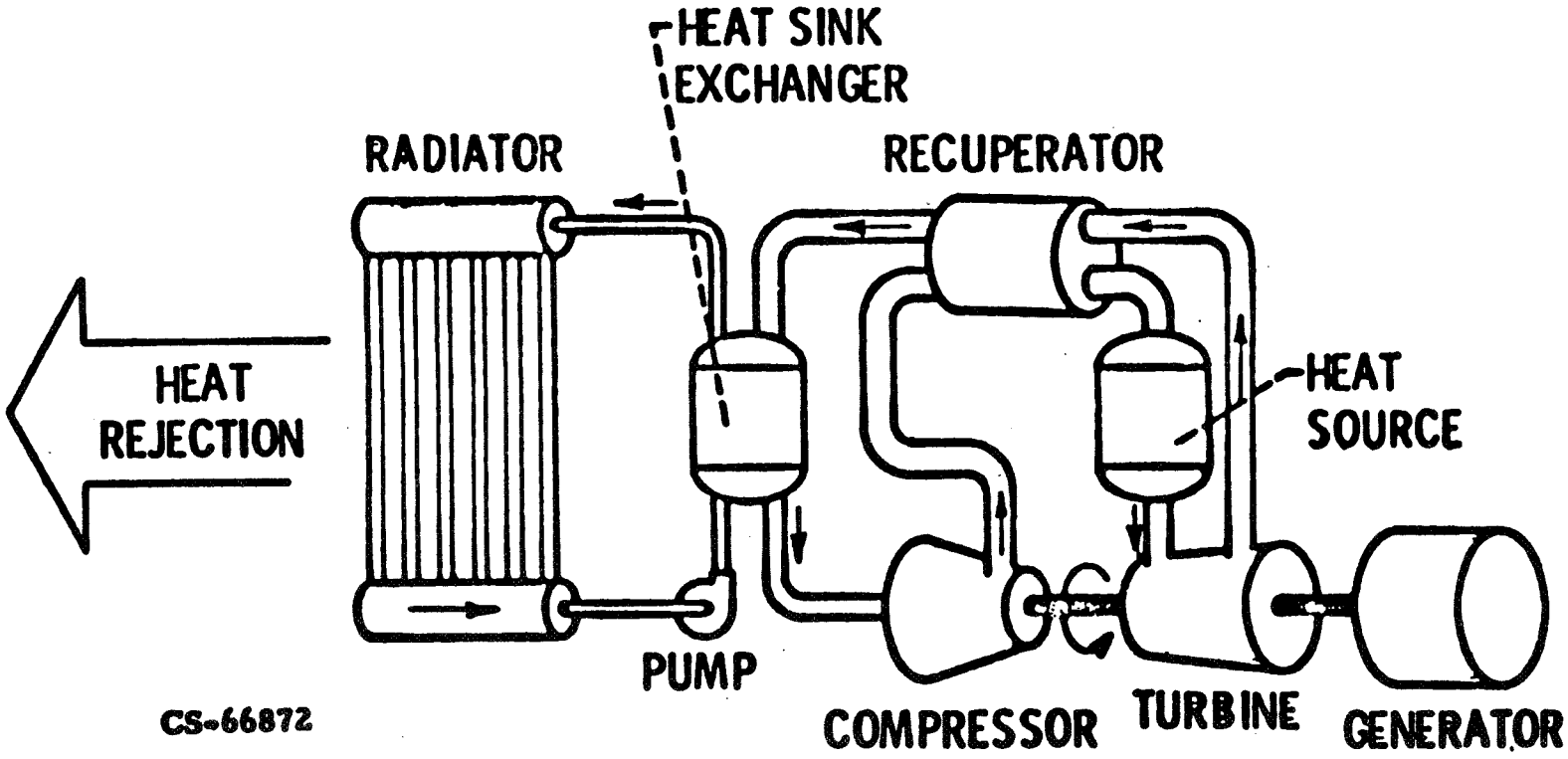




Organic Rankine Cycle



BRAYTON CYCLE SPACE POWER SYSTEM



SOLAR DYNAMIC RADIATOR REQUIREMENTS

20 KW_E

	ORGANIC RANKINE		BRAYTON			
TURBINE INLET TEMP	670K	(750F)	730K	(855F)	1080K	(1490F)
CONCENTRATOR DIA. AREA	14.6M		14.8M		12.6M	
	$167M^2$		$170M^2$		$125M^2$	
HEAT REJECTION RATE	105 KW		115 KW		80 KW	
PRIME RADIATOR AREA	$150M^2$		$220M^2$		$60M^2$	
RADIATOR TEMP	355K	(180F)	376K	(220F)	451K	(350F)
	344K	(160F)	296K	(70F)	324K	(120F)

BENEFITS OF SOLAR DYNAMIC SYSTEMS OVER PV SYSTEMS

PRIMARY

SMALLER AREA

- DRAG
- ORBIT ALTITUDE
- VIEW ANGLE
- STABILITY AND CONTROL
- ACCESSIBILITY

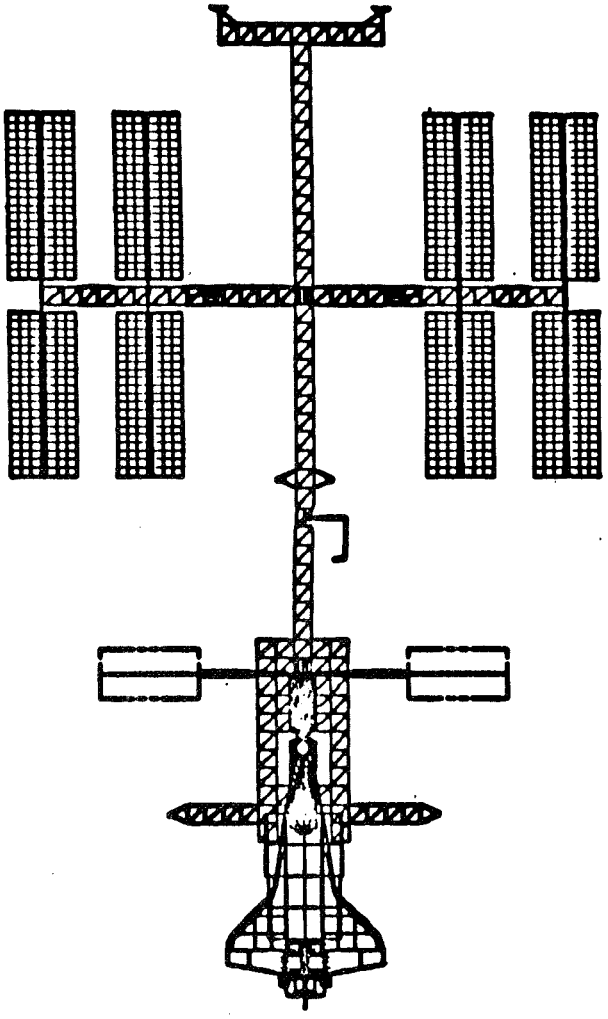
SECONDARY

LOWER MASS

LOWER COST

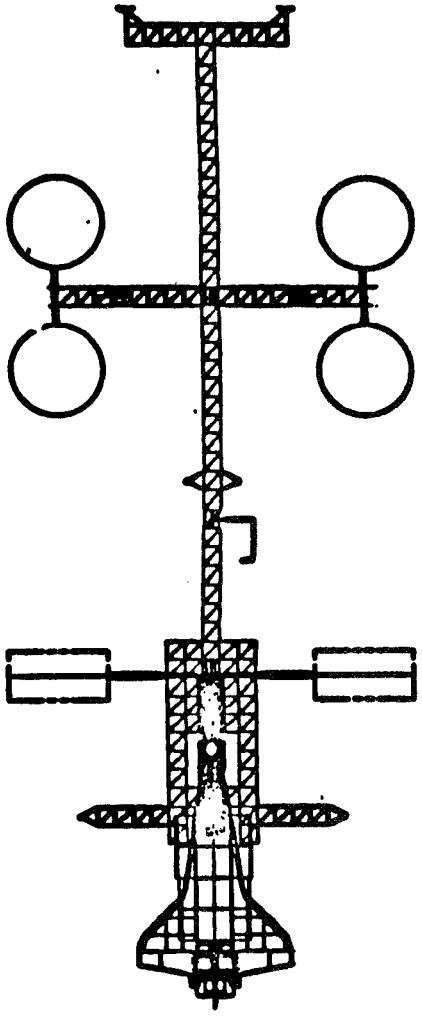
HIGHER RELIABILITY

75 KW SPACE STATION
PHOTOVOLTAIC

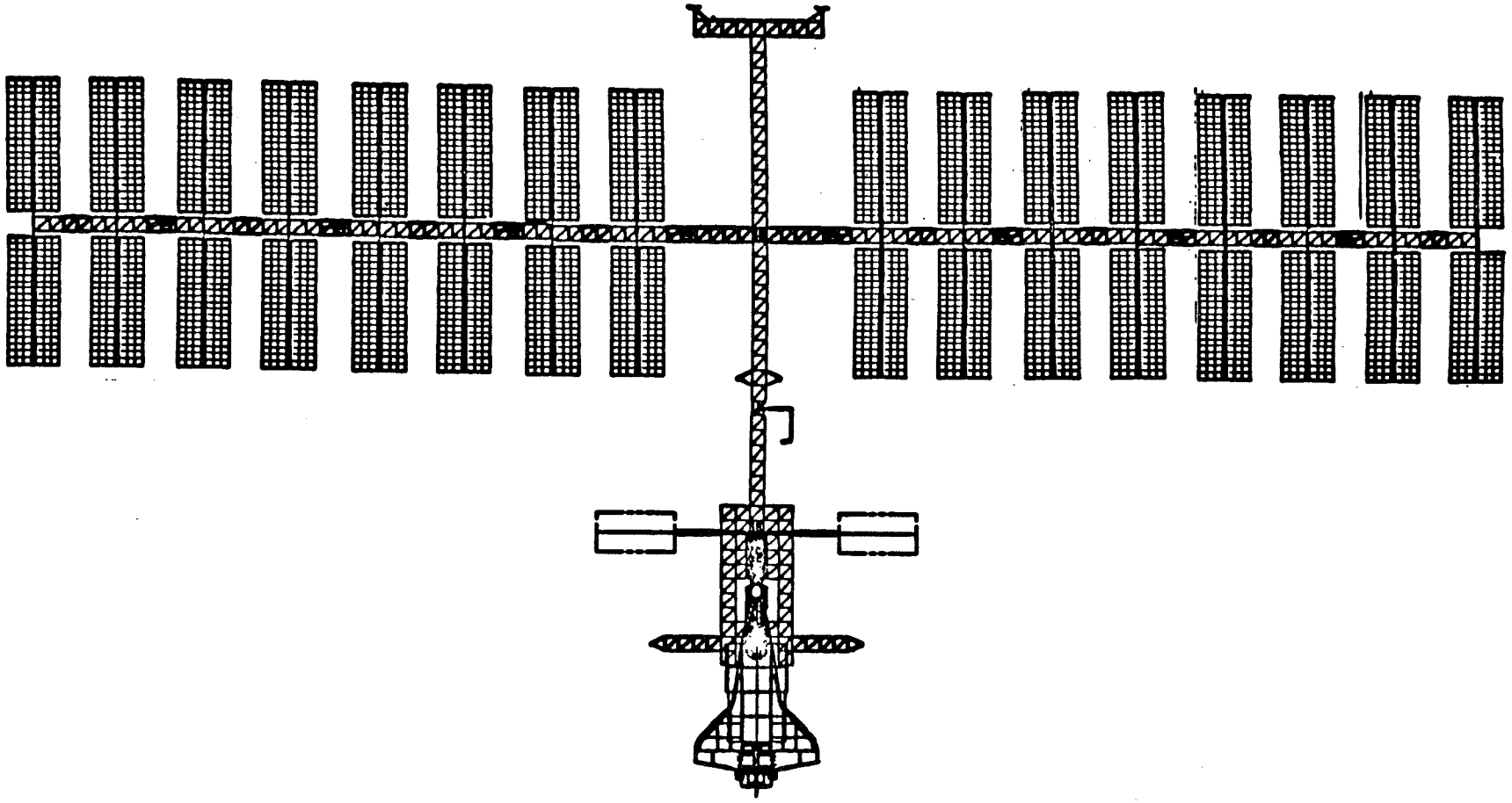


75 KW SPACE STATION

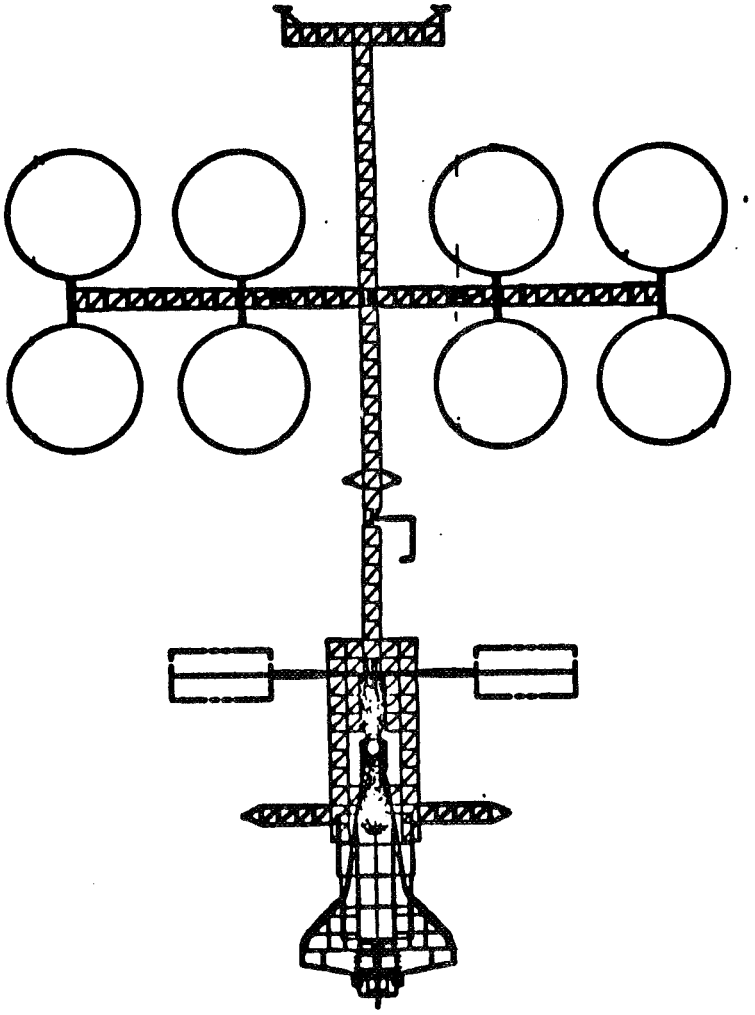
SOLAR DYNAMIC



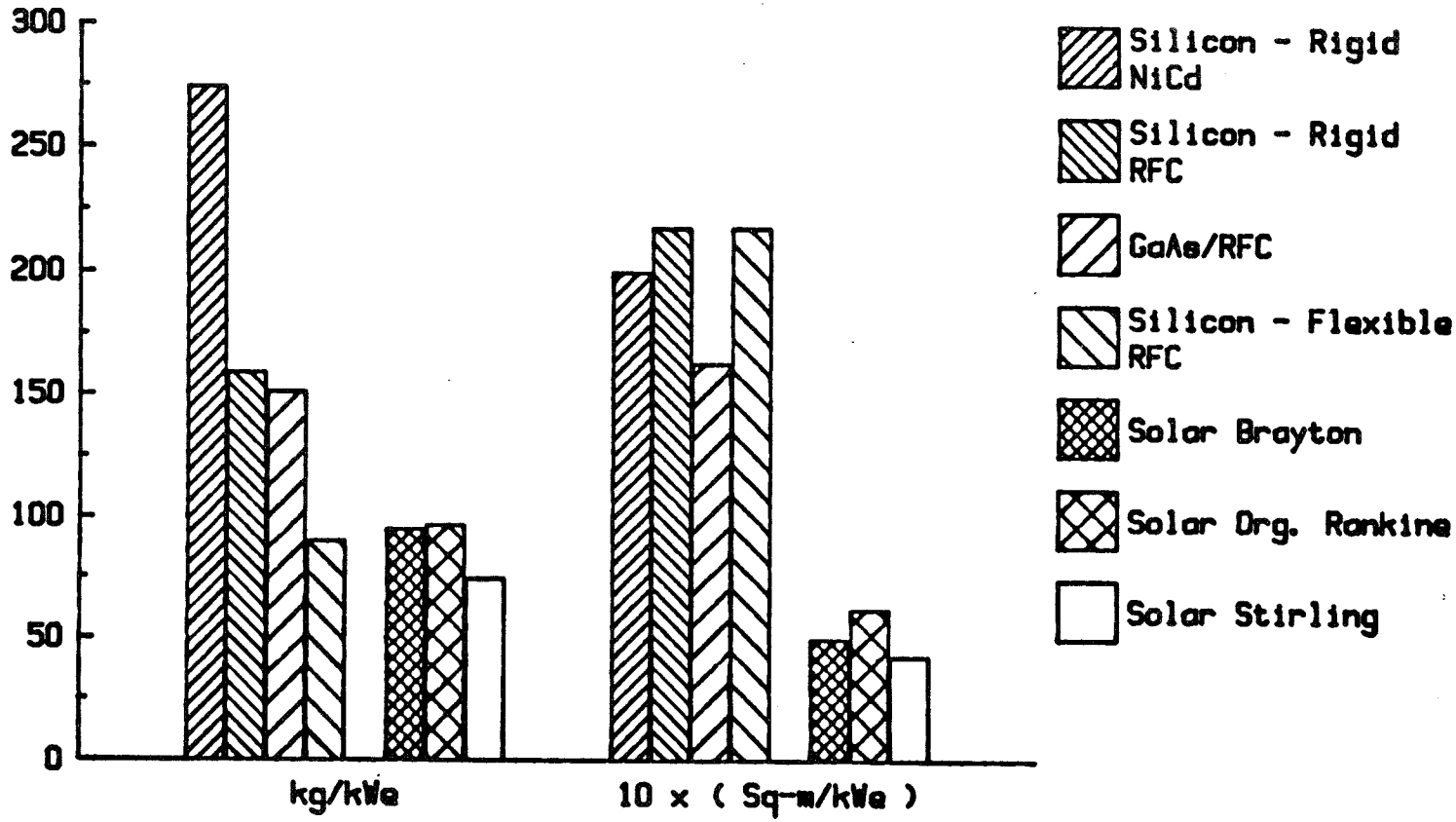
300 KW SPACE STATION
PHOTOVOLTAIC



300 KW SPACE STATION
SOLAR DYNAMIC



SPECIFIC MASS AND AREA OF SEVERAL SPACE STATION POWER SYSTEMS
Net Power Output = 75 kWe



LeRC Space Systems Office

SOLAR DYNAMIC DEVELOPMENT HISTORY

- SEVERAL SPACE CONCEPTS ACTIVELY PURSUED BY NASA AND USAF IN 1960's AND 70's
  - RANKINE
  - BRAYTON — 1 - 15 KW_E LEVELS
  - KINEMATIC STIRLING
- GREATEST EFFORT EXPENDED ON RANKINE AND BRAYTON POWER CONVERSION SUBSYSTEMS
- LESS EFFORT EXPENDED ON CONCENTRATORS AND RECEIVERS
- SYSTEMS DESIGNED FOR EXPENDABLE BOOSTER LAUNCH
- NO SYSTEMS HAVE FLOWN
- DEVELOPMENT DISCONTINUED IN EARLY 70's FOR LACK OF SUITABLE MISSIONS
- DOE DEVELOPING LOW COST CONCEPTS FOR TERRESTRIAL APPLICATIONS SINCE APPROX. 1977

SOLAR DYNAMIC ADVANCED DEVELOPMENT

PURPOSE:

PROVIDE A BASE OF DATA ON THE CRITICAL TECHNOLOGY OF SOLAR DYNAMIC SYSTEMS FOR SPACE STATION

- TO ASSESS VIABILITY OF THE SOLAR DYNAMIC OPTION FOR IOC
- TO PROVIDE BASIS FOR SYSTEM DESIGN

APPROACH:

- o ADDRESS PRIMARY CRITICAL TECHNOLOGY AREAS
  - RECEIVER/STORAGE
  - CONCENTRATOR
  - SOLAR DYNAMIC SYSTEM INTEGRATION WITH SPACE STATION
- o EMPLOY CONSERVATIVE DESIGN APPROACHES
- o FABRICATE AND TEST CRITICAL COMPONENT FUNCTIONS

SOLAR DYNAMIC ADVANCED DEVELOPMENT

CRITICAL CONCENTRATOR TECHNOLOGY

CENTERS: LeRC, JPL

- DEFINE CONCENTRATOR REQUIREMENTS
- DEVELOP SEVERAL DESIGN CONCEPTS FOR 12-18 M. DIAMETER CONCENTRATORS
  - FAB TECHNIQUES
  - ACCURACY
  - DISTORTION
  - SINGLE VS. CASSEGRAINIAN
  - COATINGS
  - POINTING REQUIREMENTS
  - SHUTTLE REQUIREMENTS
  - STOWAGE
  - DEPLOYMENT/ERECTION
- FABRICATE AND TEST ELEMENTS OF SELECTED DESIGNS
- TEST REFLECTIVE SURFACE SAMPLES IN SPACE

SOLAR DYNAMIC ADVANCED DEVELOPMENT

CRITICAL HEAT RECEIVER TECHNOLOGY

CENTER: LeRC

- o DEFINE HEAT RECEIVER REQUIREMENTS
- o DEVELOP SEVERAL DESIGN CONCEPTS FOR RECEIVERS IN THE RANGE OF 75-160 KW_T AND TEMPERATURE NEAR 700K AND PERHAPS TO 1100K)
  - THERMAL STORAGE MATERIAL
  - CONTAINMENT OF STORAGE MATERIAL
  - MOVEMENT OF STORAGE MATERIAL
  - HEAT PIPES
  - TEMPERATURE CONTROL
  - FABRICATION METHODS
  - COATINGS
  - APERTURE MATERIAL
- o FABRICATE AND TEST DESIGNS OF ALTERNATE APPROACHES
- o CAPSULE TESTS OF STORAGE AND CONTAINMENT MATERIALS