HOLD FOR RELEASE UNTIL
PRESENTED BY WITNESS

Statement of

Homer E. Newell
Associate Administrator for
Space Science and Applications

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the
Committee on Science and Astronautics
House of Representatives

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PHYSICS AND ASTRONOMY PROGRAMS

Orbiting Astronomical Observatories

Mr. Chairman and Members of the Subcommittee:

The objective of astronomy is to understand the universe; that is, its present structure and the physical laws by which it is governed, its origin and evolution, and its future development. Astronomical investigations seek to understand how the matter and energy of the universe interact to generate the elements, stars, galaxies, and evolutionary processes observed by the astronomer. This objective cannot be attained without the important observations from space.

Space astronomy is the study of astronomical bodies free from the obscuration and distortion of the Earth's atmosphere. The present Physics and Astronomy Program is directed to the gamma ray, X-ray, ultraviolet (UV), infrared, and radio wave radiation that cannot reach the ground (Chart EL64-209). Astrophysical theory predicts that much important information on the birth, evolution, and demise of stars and

planets is to be found in such radiation. Astronomers will use the Orbiting Astronomical Observatories (OAO) to study the spectral regions of electromagnetic radiation from the infrared to gamma rays. Early OAO's are instrumented to perform a survey and produce maps of the celestial sphere in the ultraviolet, X-ray, and gamma ray regions of the spectrum and to perform photometric and spectrophotometric studies of the ultraviolet light emitted by hot stars and nearby gas clouds. The precise locations and characteristics of the newly discovered X-ray and gamma ray celestial sources will be observed.

The OAO spacecraft is a standardized vehicle which can incorporate a variety of astronomical instruments within its cylindrical central cavity (Chart SG65-711). This cavity is four feet in diameter by ten feet in length and can carry experiments weighing 1,000 pounds. The spacecraft will provide precise pointing accuracy and stability (0.1 arc seconds on OAO-C), and control and data handling capabilities required by the scientific objectives; it has a design goal of one year lifetime.

The OAO Program is summarized in the following table and on Chart SG65-756:

OBSERVATORY	PAYLOAD	LAUNCH DATE
OAO-A1	Wisconsin - Four 8" UV Telescopes One 16" UV Telescope Two UV Spectrometers	1965
	MIT - High Energy Gamma Ray Telescope	
	GSFC - Low Energy Gamma Ray Telescope	
	Lockheed - Soft X-ray Telescope	

OBSERVATORY	PAYLOAD		LAUNCH DATE
OAO-B	GSFC	- One 36" Moderate Resolution UV Telescope	1966
OAO-A2	SAO	- Four 12" UV Telescopes	1967
	Wisconsin	- Repeat OAO-A1 Experiments	
OAO-C	Princeton	- One 32" High Resolution Telescope	1968
	London	- Three X-ray Telescopes	
OAO-D	To be selected in 1965		1969

There have been three major program changes in the past year: (1) the prototype spacecraft will be refurbished to fly in 1967 as the OAO-A2 mission; (2) the Smithsonian Astrophysical Observatory (SAO) experiment, which will provide a valuable astronomical survey in the ultraviolet, has been rescheduled to fly on the OAO-A2 mission; and (3) a gamma ray/X-ray package of telescopes has been added to the OAO-A1 payload for flight in 1965.

These program changes permit the first OAO to be launched in late 1965 or early 1966 as planned, and gives the SAO additional time to develop its system and produce the image tubes which have been a major problem and have now reached the production stage. In addition, the Gamma/X-ray Telescope package will provide a survey of the celestial sphere in these spectral regions of intense scientific interest following recent rocket flight discoveries. The Wisconsin package has been selected to fly again on the OAO-A2 mission with the Smithsonian experiment because of its continued scientific value.

The utilization of the prototype spacecraft and the selection of the Wisconsin and Smithsonian experiments for the OAO-A2 flight makes use of existing spacecraft and experiment hardware that have been developed; and thus, makes maximum use of developed hardware for the first five OAO's flying in the 1965-1969 period.

The status of the OAO component program is given in the following table:

OAO COMPONENT PROGRAM

SUBSYSTEM	NUMBER OF ASSEMBLIES	QUALIFICATION TESTS (Functional, Shock, Vibration, Acceleration, TV, and Radio Frequency Interference)
Communications & Data Handling	11	Completed
Power Supply	5	3 Completed; 2 In Process
Stabilization & Control	28	27 Completed; 1 In Process

The gimballed star tracker was the major component that was not qualified in 1964 as anticipated and, thus, caused the OAO test schedule to slip. The star tracker recently passed critical qualification vibration tests, and therefore should not delay the 1965 launch of OAO-A1.

In CY 1964 the major OAO effort was on systems testing (Charts SG65-754, SG65-703, SG65-712, and SG65-706), primarily prototype systems qualification. Tests to date have been extensive and include:

spacecraft, OAO-A1 payload, and combined spacecraft and experiment tests. These tests have been quite successful so that there is a high level of confidence that the OAO will, in fact, perform in the orbital environment as intended. There have been nearly 1,000 hours of formal testing on the OAO observatory system. The Wisconsin prototype experiment, which has almost completed qualification testing, has in its lifetime been exercised the equivalent of one-third year in orbit.

In 1964 there was substantial testing of the launch vehicle system modifications required for launching the OAO. The OAO mission requirements have necessitated a major departure from the standard Atlas-Agena D configuration. For OAO it was necessary to enclose the entire Agena stage in a 120 inch diameter fairing. The design was successfully tested in 1964. The tests were primarily: static and dynamic load tests; vibration mode tests of the complete launch vehicle, OAO, and fairing system; and dynamic tests of fairing separation (Chart SG65-704).

Two other major milestones were completed in 1964 when the Wisconsin flight experiment (Chart SG65-747) and the Gamma Ray/X-ray Telescope package for the OAO-A1 were delivered.

In 1965 the OAO program will include the following major events: (1) the prototype observatory will complete qualification; (2) OAO-A1 will be acceptance tested; (3) the OAO-B experiment telescope (Chart SG65-748) will be qualified and observatory acceptance tests will be

initiated; (4) OAO-C experiment hardware will be delivered and qualification tests started; (5) OAO-C spacecraft fabrication will be started; (6) refurbishing the prototype observatory, OAO-A2 mission, will be started; (7) the Smithsonian experiment package for OAO-A2 will be qualified; and (8) the Wisconsin experiment package for OAO-A2 will be started.

It is planned to initiate the OAO-D program in FY 1966 (Chart SG65-776). The goal of the OAO program is to develop an observatory in space for continuous use by a number of astronomers similar in concept to a ground-based observatory. The achievement of an observatory with large optics, precise pointing, and long lifetime above the blanketing and distorting effects of the Earth's atmosphere will provide astronomers with a powerful new tool. It will perhaps require the development and operational experience of the first two launches to fully achieve the performance and lifetime goals for such an observatory. The OAO program plans for several launches of the observatory, which will be the major space observatory for optical observations of celestial objects during the next several years. It is anticipated that astronomers, both US and foreign, will propose and carry out "guest observer" observational programs, as is done with ground-based observatories.

Following the first five launchings to perform celestial surveys in the ultraviolet, X-ray and gamma ray wavelengths and for photometry and spectrometry in the ultraviolet, there will be, beginning in the

1970's, OAO telescopes with large infrared optics, large X-ray and gamma ray optics, and high resolution image capability for detailed viewing of celestial objects, as well as additional spectrophotometric instruments. Proposals for such instruments have been received from the astronomical community and initial feasibility studies and advanced research work are now being supported in the several areas.

It seems necessary that the OAO program have launchings no further apart than one year centers. The reliability and performance of this complex satellite will be dependent upon the experience accumulated during its development, production, and operation so that the dissipation of this experience is to be avoided. Because of lead time requirements, the procurement of the OAO-D spacecraft is planned for initiation in FY 1966 as previously indicated, and the astronomical instruments for OAO-D will be selected in FY 1965.

Charts Used with Testimony for Presentation
before the
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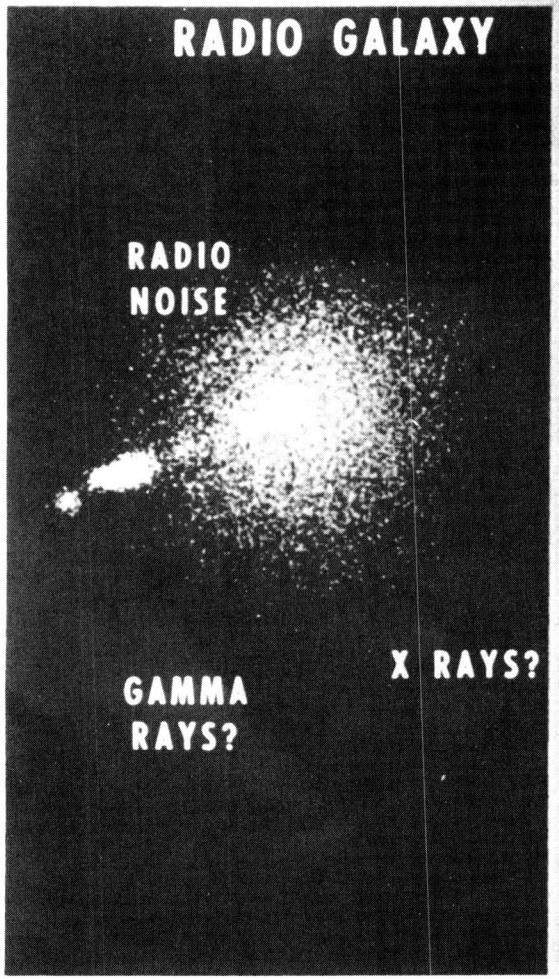
House of Representatives

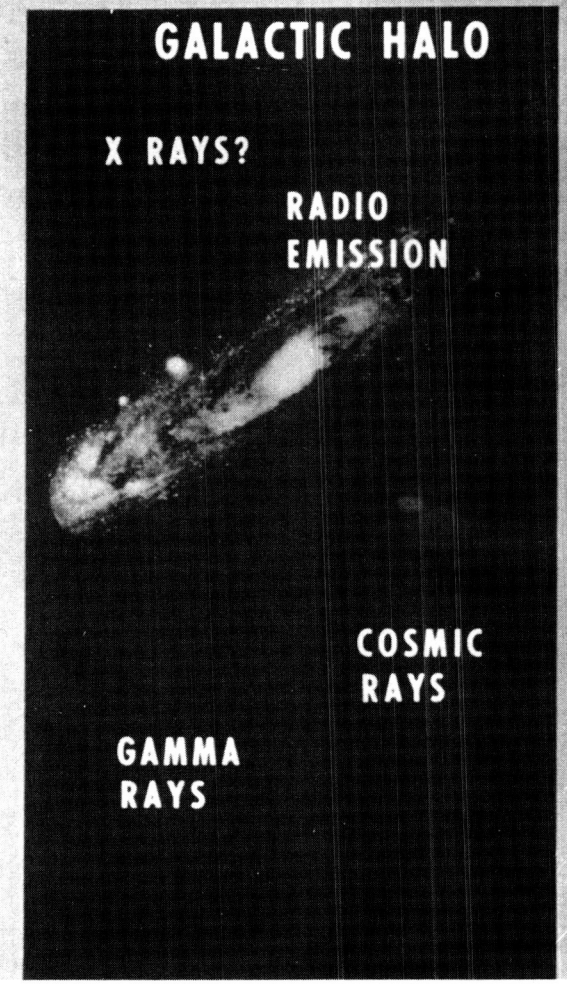
PHYSICS AND ASTRONOMY PROGRAMS

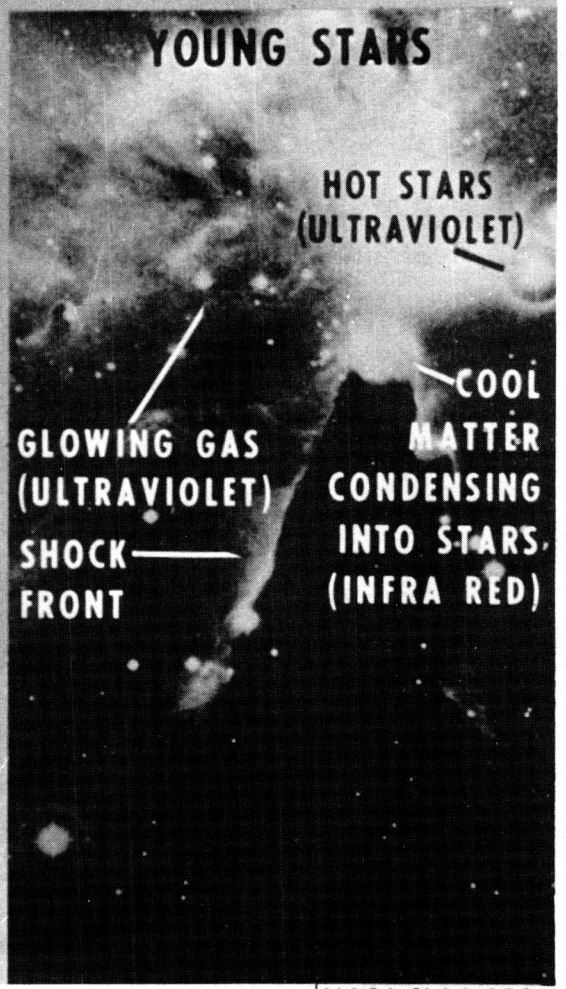
Orbiting Astronomical Observatories

SL64-209	Nature of the Universe
SG65-711	Orbiting Astronomical Observatory
SG65-756	OAO Schedule
SG65-754	OAO System Tests Completed in 1964
SG65-703	Prototype OAO in Alignment Fixture
SG65-712	OAO Flight Spacecraft
SC65-706	First OAO Flight Spacecraft
SG65-704	OAO Engineering Model
SG65-747	OAO Wisconsin Telescope
SG65-748	OAO Goddard Telescope
SG65-776	OAO Funding Requirements

NATURE OF THE UNIVERSE
AREAS OF INTEREST

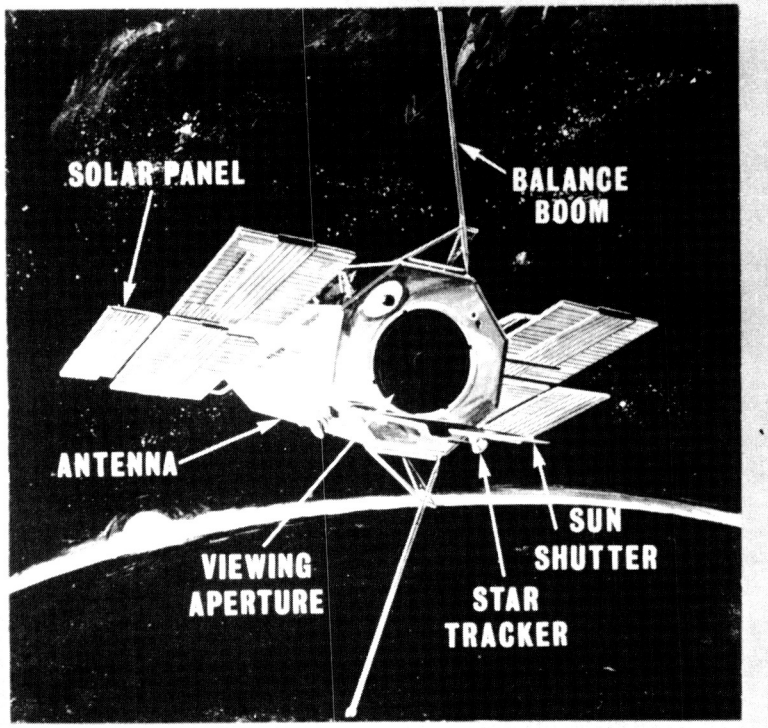






NASA SL64-209

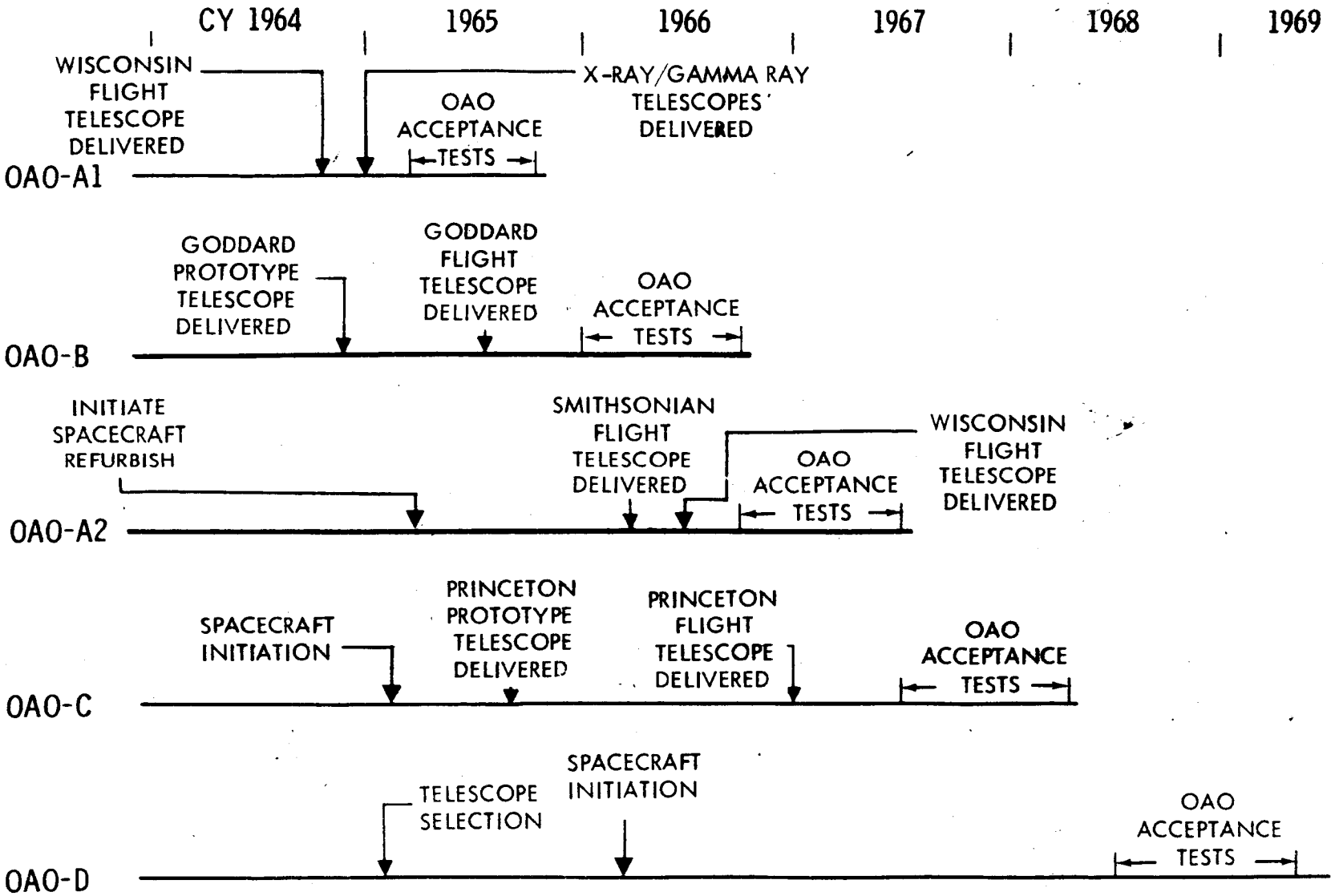
ORBITING ASTRONOMICAL OBSERVATORY



GROSS WEIGHT	3,900 LBS
INSTRUMENT WEIGHT	1;000 LBS
INVESTIGATIONS	SEVERAL
STABILIZATION	ACTIVE 3 AXIS
LAUNCH VEHICLE	ATLAS-AGENA
ORBIT	CIRCULAR 500 MILES INCLINATION 32°
FIRST FLIGHT	LATE 1965 OR EARLY 1966

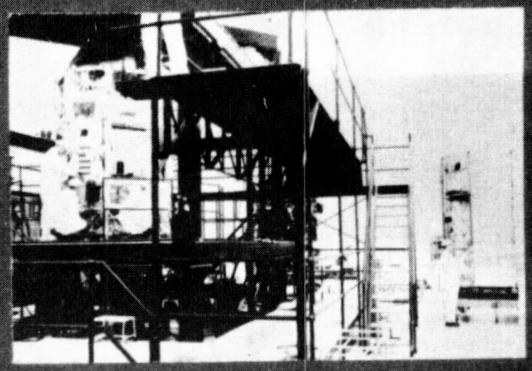
NASA SG 65-711
2-15-65

OAO SCHEDULE



NASA SG 65-756
2-17-65

OAO SYSTEM TESTS COMPLETED IN 1964



PROTOTYPE INTEGRATION

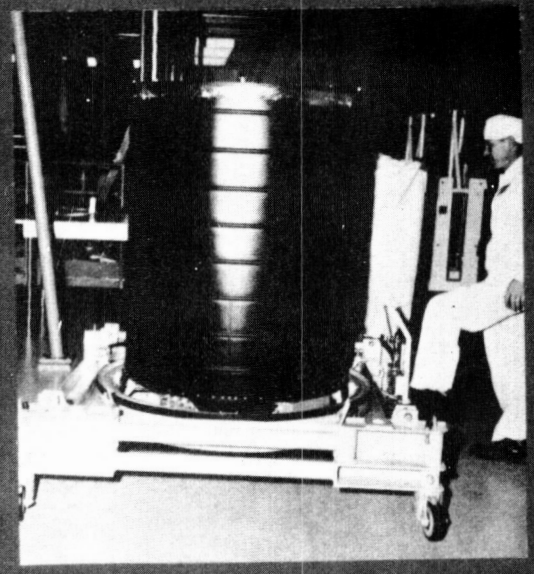
OBSERVATORY

- PROTOTYPE INTEGRATION, ENVIRONMENTAL AND INTERFERENCE
- FIRST FLIGHT INTEGRATION

PROTOTYPE MAGNETIC SURVEY

EXPERIMENT

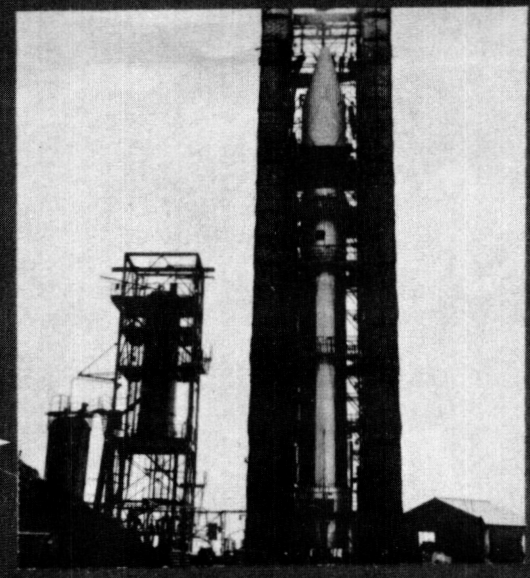
- WISCONSIN PROTOTYPE VIBRATION & LOW TEMPERATURE
- WISCONSIN FLIGHT INTEGRATION, ENVIRONMENTAL AND INTERFERENCE



WISCONSIN EXPERIMENT PACKAGE INTEGRATION

LAUNCH VEHICLE

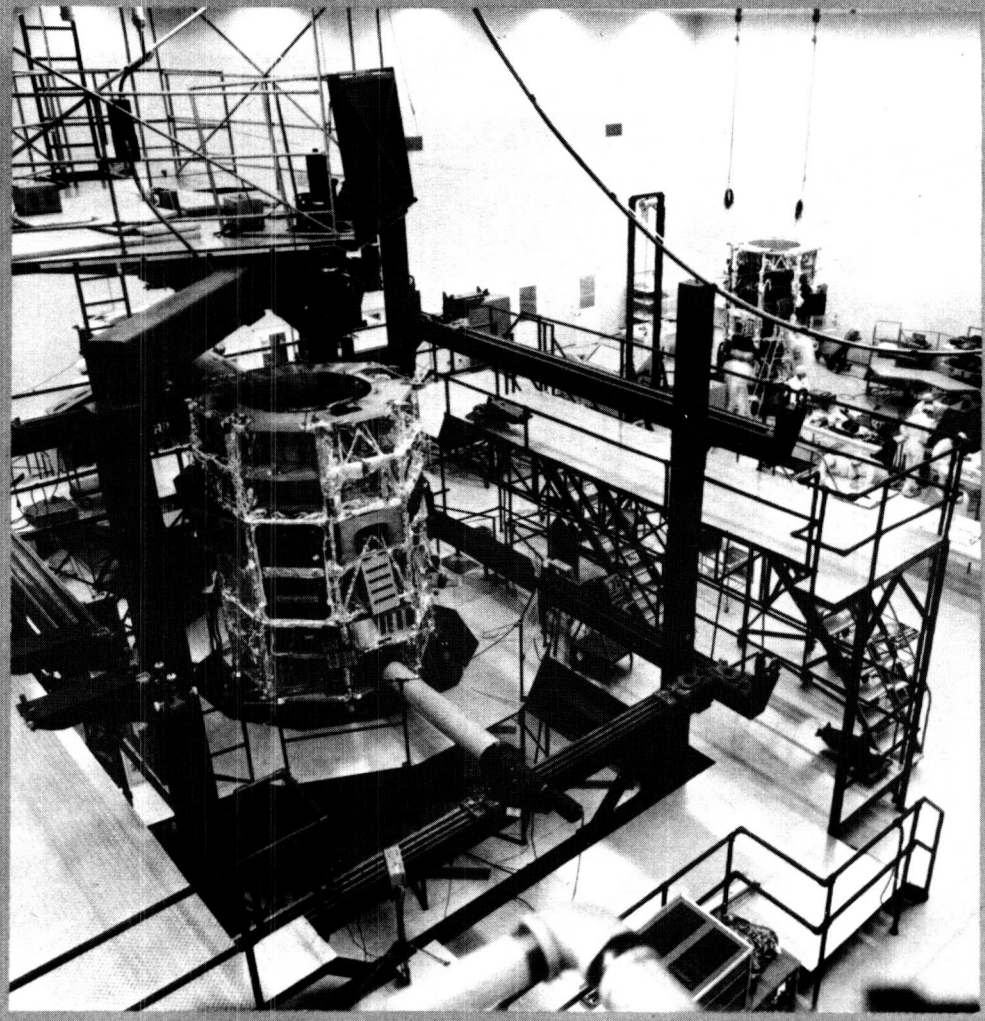
- STATIC & DYNAMIC LOAD
- VIBRATION
- FAIRING SEPARATION



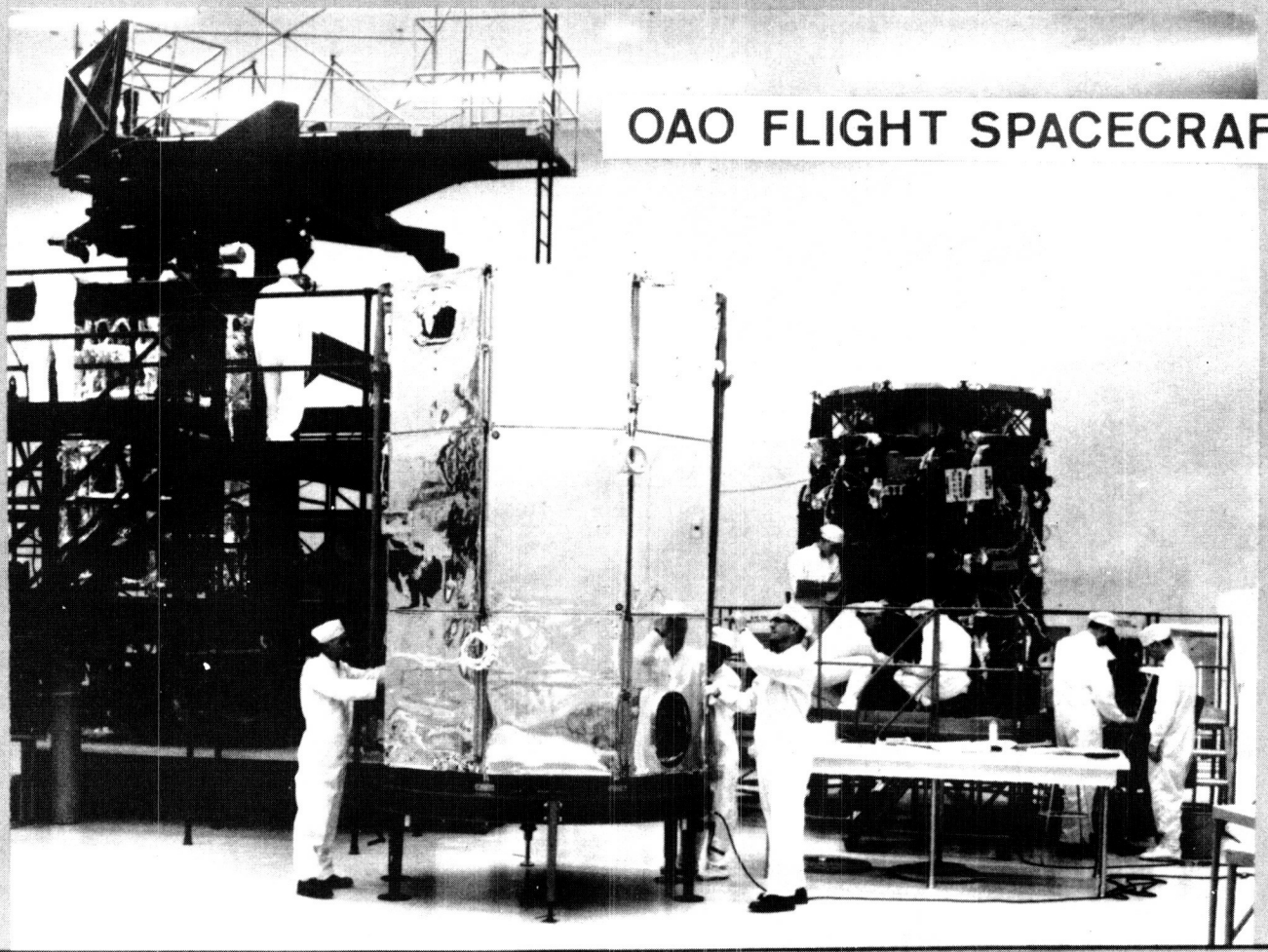
OAO-AGENA MATCH MATE

NASA SG 65-754
2-16-65

PROTOTYPE OAO IN ALIGNMENT FIXTURE



NASA SG 65-703
2-15-65

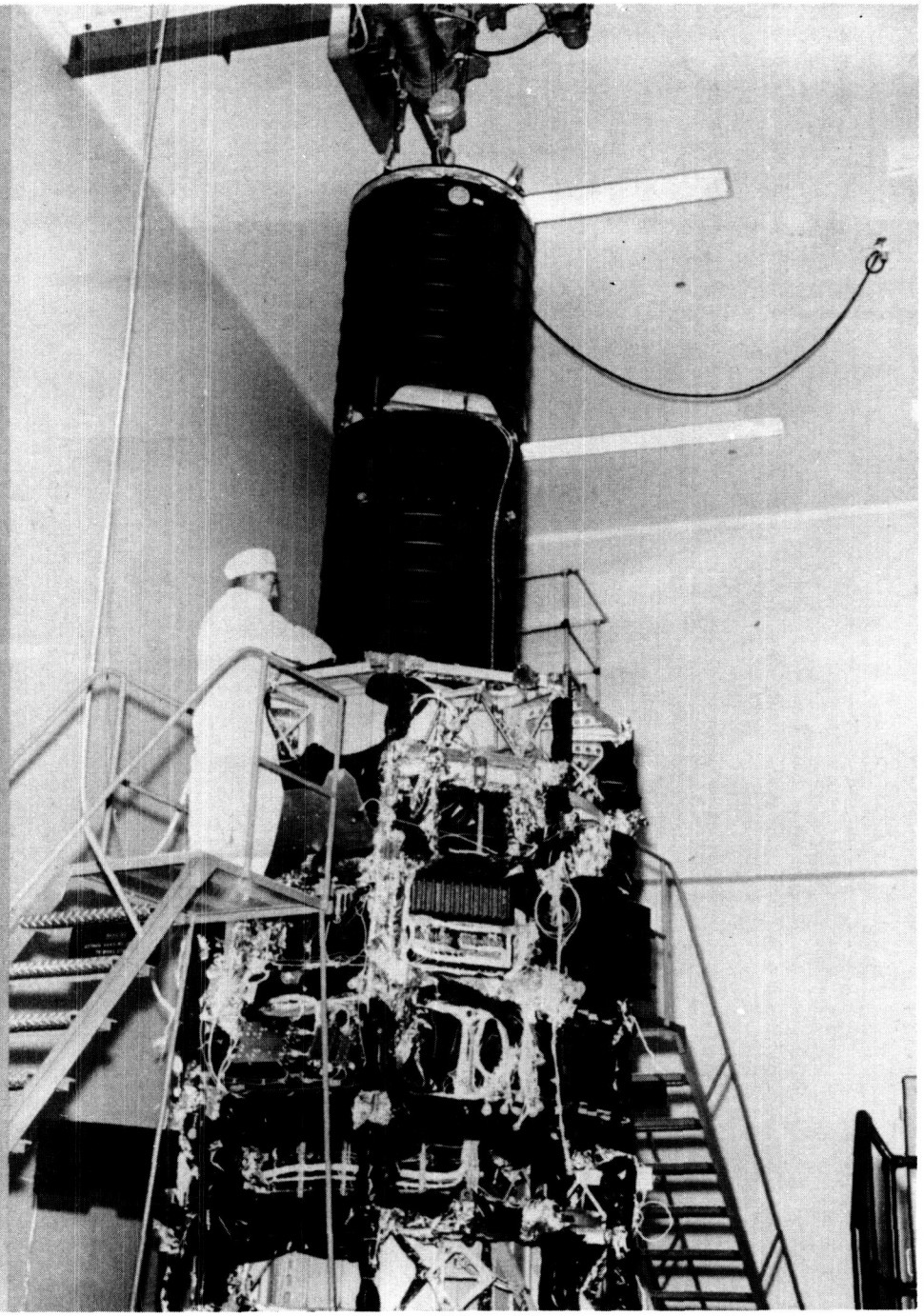


SECOND FLIGHT SPACECRAFT IN THERMAL TEST PREPARATION

FIRST FLIGHT SPACECRAFT IN INTEGRATION TESTING

NASA SG 65-712
REV. 3-1-65

FIRST OAO FLIGHT SPACECRAFT AND WISCONSIN TELESCOPE PACKAGE



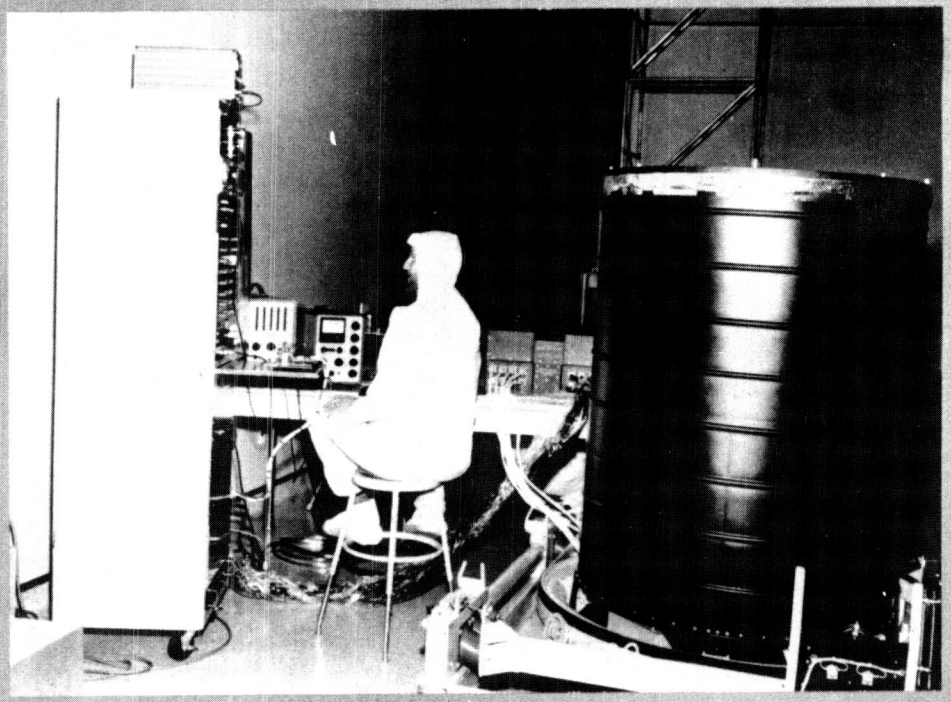
NASA SG 65-706
2-15-65

OAO
ENGINEERING MODEL
& LAUNCH VEHICLE
SHROUD TESTS

NASA SG 65-704
2-15-65

OAO WISCONSIN TELESCOPE

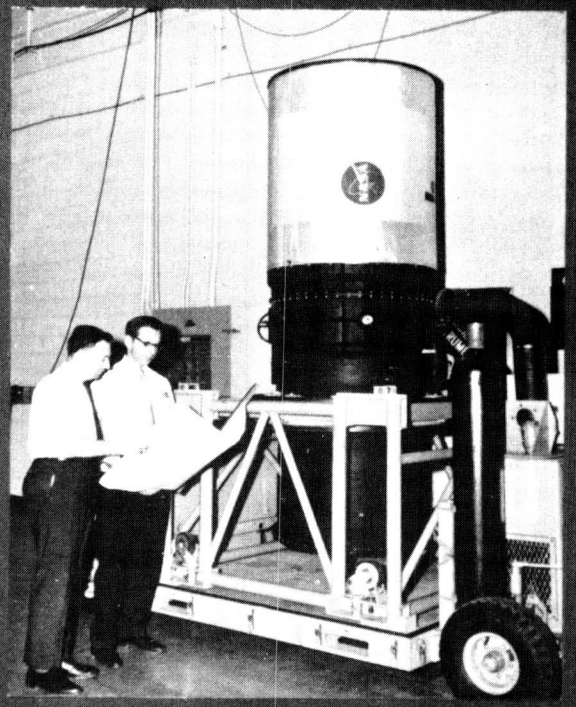
COMPLETED FLIGHT
TELESCOPE SYSTEM



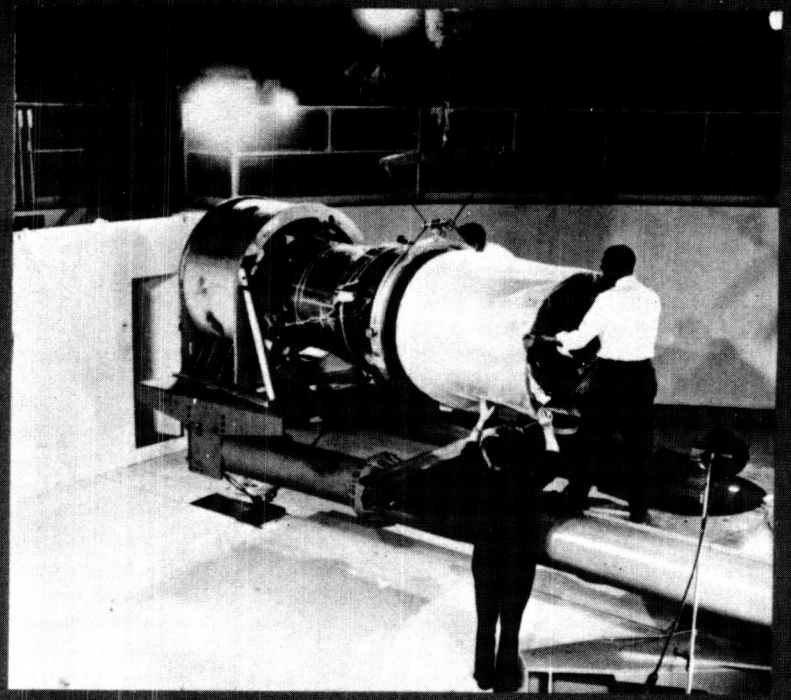
FLIGHT PACKAGE AT GRUMMAN FOR
SPACECRAFT INTEGRATION TEST

NASA SG 65-747
2-16-65

OAO GODDARD TELESCOPE



PROTOTYPE PACKAGE AT
GODDARD FOR SYSTEMS TESTS



PROTOTYPE PACKAGE AT
GRUMMAN FOR ACCELERATION TESTS

NASA SG 65-748
2-16-65