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Rec'd 12-10-66
6-10-66

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE
OS
FG11-4

June 10, 1966

EXECUTIVE SECRETARY

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Launches

a. The United States placed two military payloads in polar orbits, one on June 3 and the other on June 9, using Atlas Agena launch vehicles.

b. OGO III, the Orbiting Geophysical Observatory, was launched June 7 into an orbit ranging from a low point of 175 miles to a high point of 75,000 miles. One orbit takes 48 hours to complete. Early indications are that the satellite has deployed its equipment and has stabilized. This 1135 pound observatory has 21 experiments on board for the purpose of giving us better understanding of the many influences the sun has on near-earth environment. Such phenomena as solar winds, solar flares, radiation belts, etc. are to be studied.

c. The Soviet Union June 8 placed Cosmos 120 into a low circular orbit. Previous satellites with these characteristics have been recalled from orbit after eight days.

d. An Air Force scientific satellite was orbited after a Wallops Island launch June 10.

2. Surveyor. Before it was shut down because of the extreme heat of the 260 degree lunar noon, the U. S.'s first spacecraft to soft-land on the moon had taken some 4,000 excellent pictures.

3. Gemini

a. The Gemini IX mission was completed successfully June 6 when the capsule dropped within the direct view of the TV cameras which conveyed live pictures of the recovery to America and to Europe via Early Bird. During the three-day flight, the astronauts completed three difficult rendezvous missions successfully, and set a new EVA duration record when one of its astronauts stayed outside the capsule for over two hours. Human error during assembly resulted in the

shroud not completely separating from the Augmented Target Docking Adapter and hence docking of the capsule with the adapter was prevented. Moisture collected on Cernan's face plate terminated the attempt to use the maneuvering unit during the extra-vehicular activity.

b. The next Gemini launch (Gemini X) is scheduled for July 18, with Astronauts Young and Collins on board.

4. Hydrogen Test. A special engineering test payload called WASP (Weightless Analysis Sounding Probe) was launched from Wallops Island June 7 and carried a 1500 pound transparent tank of hydrogen fuel to an altitude of 148 miles while a TV monitor viewed the behavior of the hydrogen.

5. XB-70 Disaster. Cause of the tragic collision on June 8 between the F-104 jet "chase plane" and the XB-70A supersonic experimental plane is being studied.

6. Hurricane. The unseasonable hurricane Alma, which struck Florida June 7-9, was tracked by ESSA I and II June 4-7, and communities in the path of the storm were given early warnings.

7. New Facility. NASA is building a life support facility at the Langley Research Center in Virginia. The laboratory will be utilized for the development of advanced systems and the testing of man-machine environmental integration.

8. Nuclear Rocket Test. A NERVA nuclear rocket was successfully ground tested at the Nevada Test Site on June 8. The reactor was operated for a total running time of over 20 minutes with 15 minutes at full power (55,000 pounds of thrust). This is the first test of a series planned to be spaced at two-week intervals to accumulate full power operating time on the nuclear system.

9. Senate-House Authorization Conference. The Senate and House Space Committees may confer during the coming week to iron out their differences over the Fiscal Year 1967 NASA Authorization Bill.

10. Pending Launch. Another Titan IIIC development launch is scheduled for June 15. It will carry the first multiple payload of interim operational military communications satellites.

11. Space Payload Success Box Score
(June 10)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	43	36	21	21
Escape	2	1	2	2

E. C. Welsh

Friday, June 10
Time: 10:40

The White House
Washington

1966 JUN 10 AM 11 55

EF/1

rec'd 6-6-66 9:00 AM

(41)

EXECUTIVE
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(4)

UNITED STATES INFORMATION AGENCY
WASHINGTON

DIRECTOR

To Kintner

June 3, 1966

file B

MEMORANDUM FOR: The President

THROUGH: The Honorable
Robert E. Kintner RBK
The White House

I thought you might like to see the enclosed resume of press reaction on Surveyer I's successful landing on the moon.

Leonard H. Marks

Enclosure

EXECUTIVE

UNITED STATES INFORMATION AGENCY
WASHINGTON

DIRECTOR

June 3, 1966

MEMORANDUM FOR: The President

THROUGH: The Honorable
Robert E. Kintner
The White House

I thought you might like to see the enclosed

resume of press reaction on Surveyor I's

successful landing on the moon.

Leonard H. Marks

Enclosure

RECEIVED
JUN1 0 1966

USIA/IRS
June 3, 1966

SURVEYOR I "PERFECT"

First world press reports on Surveyor I's success stress that it is an almost perfect achievement. Praise for the "unsurpassed" technical triumph in effecting a safe and accurate landing on the first try and in obtaining "astonishing" pictures of the moon's surface is voiced across the political spectrum. Interspersed are judgments of many commentators that the U.S. has "caught up" with the Soviet Union in the moon race, with some even claiming that we have taken the lead.

Provisional judgments give the U.S. effort a welcome boost in moon schedules; some even specify the gain as six months on the time-table. Meanwhile, it is apparent that some science editors, notably in France, are withholding overall appraisals of U.S. space status until Gemini 9 results are known.

SPACE RACE comparisons include these: "The Americans have just made up for their lag behind the Russians in this field." (France-Soir, Paris.) "It puts them ahead of the Russians in their race to land a man on the moon." (Manchester Guardian.) One Calcutta paper places the two competitors "neck and neck," and another says the U.S., "although four months behind," has earned the "compensating distinction" of success at the first shot. Akropolis of Athens says the U.S. "no longer falls short," and "undoubtedly will take the lead soon."

Some papers single out for commendation the "hardly imaginable" precision in landing, which a Bombay paper contrasts with Luna 9's "crashing on the moon's surface." Surveyor's capacity to continue releasing pictures for a longer period than Luna's two days is noted in Seoul and elsewhere. The fact that pictures received on earth were readily relayed by satellite to Europe is particularly stressed in Rangoon and Hong Kong as evidence of U.S. superior communications.

President Johnson's call for open and world-wide exchange of moon information is the lead in London's and Tokyo's reporting. A South Korean daily comments that his "instructions to make photos of the moon available to all scientists of the world indicate that America would like to contribute to the progress of mankind as a whole."

SPACE COOPERATION is urged by many editorialists in drawing attention to the U. S. and the Soviet proposals on barring military activity in space as evidence of a mutual awareness of the urgent need to neutralize the use of the moon and other celestial bodies.

There are emotional overtones in some of this comment. A Greek paper writes: "Enthusiasm is high among scientists throughout the world." A semi-official Rangoon daily declares that "the two rivals are competing in a friendly manner. When Luna 9 made space history, President Johnson immediately sent his congratulations to the Soviet people. The reaction of the Soviet man in the street to the American success is reported to be no less joyful."

Best wishes to Astronauts Stafford and Cernan were appended by many writers, including a Communist editor in East Berlin who expressed "hope that the twice-postponed Gemini 9 project will succeed today."

EXECUTIVE

OS
FG11-4

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE SECRETARY

June 3, 1966
10:40 A.M.

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities.

1. Surveyor. The United States' first Surveyor spacecraft was soft-landed on the moon June 2 and is sending home detailed pictures of the lunar surface. All of its components survived the 8 mph landing, and the spacecraft is expected to send back pictures for the 10 to 12 earth days that it will be in lunar sunlight. The spacecraft was landed in the zone where the U.S. will attempt to land its Apollo astronauts, and early pictures the spacecraft took indicate that the 3 "footpads" sank only slightly into the lunar surface. So far, several hundred excellent pictures have been received. Surveyor's success is a major step forward in the U.S.'s attempt to land man on the moon. The event was also a major success for the launch vehicle, including the Centaur.

2. Gemini IX.

a. On June 1, Gemini IX went through a satisfactory countdown until 2 minutes of launch when a ground computer failed and the launch was postponed until June 3.

b. On June 3, Gemini IX was launched precisely and successfully with Astronauts Stafford and Cernan on board. Their missions included rendezvous, docking, and extravehicular activity.

3. Other Launches.

a. The Augmented Target Docking Adapter was placed in a planned 185 mile circular orbit by an Atlas launch vehicle June 1. The Gemini IX spacecraft will attempt to rendezvous with the vehicle, and if the vehicle's shroud separated from it, will attempt to perform docking maneuvers.

4. Soviet Proposal. The Soviet Union has responded to the President's proposal of May 11 by making a similar proposal of non-proliferation of weapons of mass destruction in space and to the non-appropriation of celestial bodies. The U.S. views the reply as constructive.

The White House
Washington

1966 JUN 3 PM 1 22

5. Saturn Explosion. The May 28 explosion of a hydrogen tank of the S-II second stage of a Saturn V test vehicle was due to human error when the hydrogen tank was over-pressurized with helium. The explosion is not expected to delay the program.

6. Mariner. The U.S. satellite which took the photographs of Mars has now come within range of earth stations again, and signals have been received from the spacecraft from a distance of 197.5 million miles. The signals indicate sufficient strength of the spacecraft's power system to function until sometime in 1968.

7. Meteoroid Threat Minimized. The design of the Apollo lunar landing spacecraft provides adequate protection for the astronauts, according to data collected from a year's meteoroid measurement by the 3 Pegasus satellites.

8. Soviet Cloud Photographs. The Soviets have released a photograph of the earth taken by the Soviets' Molniya spacecraft showing cloud cover over Europe. This is the first weather photograph publicly released by the USSR.

9. Pending Launches.

a. Launch of the Orbiting Geophysical Observatory depends upon the completion of Gemini IX.

b. Launch of an Apollo-Saturn IB spacecraft is scheduled for June 30.

c. The Air Force has scheduled launch of a scientific satellite for June 6 from Wallops Island, Virginia.

10. Storms Detected. Tropical storm Judy was sighted by ESSA I, in the mid-Pacific east of the Philippines on May 25 and was tracked through May 28 when it struck northern Luzon as a typhoon. Early warnings were sent to the affected areas.

11. Seminar. The State Department educational seminar on earth stations and communication satellites, which adjourned May 27, was attended by representatives from 46 foreign countries and 6 international organizations. A total of 120 foreign and over 400 U.S. participants were registered. This was a highly successful seminar.

12. SPACE PAYLOAD SUCCESS BOX SCORE

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	40	32	20	20
Escape	2	1	1	2

E. C. Welsh

EXECUTIVE

OS
FG11-4

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE SECRETARY

May 27, 1966

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Launches

a. The United States launched an Atmosphere Explorer satellite (Explorer 32) into orbit May 25. Its elliptical orbit goes out farther than intended. However, it is returning good and useful data from all 8 scientific experiments aboard.

b. The United States placed a military payload in polar orbit May 24, using a Thor Agena launch vehicle.

c. The Soviet Union on May 24 placed in eccentric orbit Cosmos 119, of the type normally carrying a relatively small scientific payload, and not recovered.

d. An ELDO (European Launch Development Organization) launch vehicle called Europa I was launched from the Australian Woomera range May 24. The engine cut off prematurely causing the vehicle to land about 200 miles short of its intended landing area.

2. Pending Launches

a. The first attempt by the United States to soft land a payload on the Moon is scheduled May 30, with Surveyor. It will have a television camera on board.

b. On May 31, an Atlas is scheduled to carry the substitute Gemini target docking payload to orbit, to be followed an hour and a half later by Gemini 9 with Astronauts Stafford and Cernan.

c. The third Orbiting Geophysical Observatory is also slated for launch May 31.

3. Anniversary. NASA commemorated the fifth anniversary of the decision to land men on the moon in this decade by unveiling a 365 foot high test model of the Saturn 5 launch vehicle at Cape Kennedy and moving it successfully by means of a crawler type tractor to one of its launch pads.

4. Seminar. Representatives from 40 nations have attended a State Department educational seminar on earth stations and communications satellites. These nations have invested, or will invest, in the International Communications Satellite Consortium. Approximately 300 U. S. government and industry experts participated in the seminar.

5. Soviet Weather Experiments. The Russians have revealed that the Molniya communications satellite has a complex system of TV cameras to photograph weather patterns over most of the Eurasian land mass, with special filters and focusing devices for selective measurements. They have not yet unveiled an operational weather system.

6. SST Forecasts. Industry analysts have indicated that by the year 1988 some 500 U. S. built supersonic aircraft will have been deployed to the major airlines. They estimate that the SST program will create some 50,000 new jobs in the U. S. It was further predicted that those 500 aircraft, plus the usual appurtenances, will cost the airlines some $16.6 billion, but will net the airlines over $35 billion in their first 15 years of operation.

7. Congress. The Senate May 24 passed by voice vote the NASA Authorization bill for a total of $5.008 billion, about $21 million more than voted by the House and $4 million less than requested by the President.

8. Space Payload Success Box Score

	US (May 27)		USSR	
	1965	1966	1965	1966
Earth Orbit	38	30	20	20
Escape	2	0	1	2

E. C. Welsh

Friday, May 27
Time: 10:15 a. m.

The White House
Washington

1966 MAY 27 PM 12 08

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CENTRAL FILES

EXECUTIVE

OS
FG11-4

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE SECRETARY

May 20, 1966

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Launches

a. Nimbus II, an advanced weather satellite, was launched into a near circular polar orbit May 15 by a Thor Agena launch vehicle. The satellite is working well, and is providing excellent weather coverage from both the night and day portions of its orbit. It is giving service around the world through automatic picture readouts at 150 ground stations.

b. The United States placed a military satellite into polar orbit May 14 with an Atlas Agena vehicle and another military satellite May 18 by means of a Scout vehicle.

2. Gemini IX. Launch of Gemini IX is now scheduled for May 31. This is a rapid recovery from the delay caused by the May 17 failure of the Atlas to put the Agena into orbit as a rendezvous and docking vehicle. This time rendezvous will be attempted with an augmented docking collar device, launched separately, instead of the Agena. Most of the scheduled missions for the previous occasion are re-scheduled for this flight.

3. Apollo. Three Apollo-Saturn space vehicles are now on Cape Kennedy launch pads. An Apollo-Saturn 1B is on Launch Complex 37 being readied for launch this summer. Another Apollo-Saturn 1B is on Launch Complex 34 where preparations are being made for launch in early Fall. An Apollo-Saturn V, our largest launch vehicle, is at Launch Complex 39 in order to aid checkout of the facility. The first "power-on" electrical mating and checkout of the ground support equipment was successfully achieved May 13. Movement of the Apollo-Saturn V by the crawler to Pad A is scheduled for May 25.

4. Soviet Space Activities

a. The Soviet Union's latest Molniya communications satellite took television pictures of the earth May 18 from distances ranging from 18,000 to 24,000 miles. This could mean that the satellite is designed to photograph the earth's cloud cover for weather forecasting.

b. Soviet scientists reported changes in the muscles and calcium balance in their two dogs that spent 22 days in space. The 14-day U. S. Gemini mission did not reveal these problems, however, and the immobility of the Soviet dogs may have been a contributing factor.

5. New Transistor. NASA and private industry scientists have developed a new transistor which may simplify the process of manufacturing micro-electronic printed circuits. In this new process, the transistor is printed into the wafer simultaneously with other components.

6. Weather Satellite Warning. ESSA I sighted Typhoon Irma and warnings were sent to the central Philippines before the typhoon hit on May 15. The satellite photographs indicate that the typhoon may increase in strength and move in a direction towards Hong Kong.

7. Pending Launches. In addition to the May 31 launch of Gemini IX, the Atmosphere Explorer Satellite is scheduled for May 24. The attempt to soft-land a Surveyor satellite on the moon's surface is scheduled for May 30 and the Orbiting Geophysical Observatory for May 31.

8. Nuclear Power System. The SNAP 8 space power system received its first full system operation as an electric power generator. In the test a gas-fired heater was used as a heat source in place of a nuclear reactor. It provided 35,000 watts of net electrical power output.

9. Congress

a. NASA testified before the Senate Appropriations Committee on May 19 on NASA's funding request for FY 1967.

b. The NASA Authorization bill is planned for Senate floor action on May 24. The Senate Space Committee's Authorization Report, to be published early next week, recommends a total funding of $5.008 billion compared to NASA's request of $5.012 billion and leaves most of NASA's programs intact in contrast to the House reprogramming activity.

10. Space Payload Success Box Score

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	35	27	19	19
Escape	2	0	1	2

E. C. Welsh

Friday, May 20
Time: 10:30 a. m.

(3)

EXECUTIVE
PU2-6
OS

THE WHITE HOUSE
WASHINGTON

MEMORANDUM TO THE HONORABLE
TED SORENSEN

This is the President's chapter in the forth-coming book on the space age by Lillian Levy. You may recall it went through your shop a few weeks ago.

It is now to be reprinted as an article in the Saturday Evening Post and some changed have been suggested. I am enclosing one copy as originally written and approved and one copy with the changes marked in. Could you arrange a fast check?

Geo. Reedy

Mail by Press Office

RECEIVED
MAY 17 19
CENTRAL F

THE WHITE HOUSE
WASHINGTON

1/28/64

George:

This is news to me --

but the changes look okay.

Ted Sorensen

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE
OS
FG11-9

EXECUTIVE SECRETARY

May 6, 1966

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Congress

a. The House passed the NASA Authorization bill May 3 in the form submitted by the House Space Committee by a vote of 349 to 10. Among the amendments proposed from the floor was one to allocate $20 million for aircraft noise research. Although defeated, this amendment generated considerable interest and support.

b. The Senate Space Committee plans to mark up the NASA Authorization bill on May 11.

c. The Independent Offices Appropriations Committee approved the Space Council budget request as submitted and cut $62 million from the NASA request.

2. Pending Launches. An Atmosphere Explorer B satellite is scheduled to be launched May 11 from Cape Kennedy. The Nimbus weather satellite, whose launch was delayed last week, is now scheduled for May 13. Gemini IX is scheduled for launch May 17.

3. ComSat Agreement. Venezuela, Colombia, and Chile have signed an agreement for joint participation on the Interim Committee of the International Communications Consortium.

4. Foreign Space Activities

a. An 80-pound West German payload was launched on a French sounding rocket from their Algerian launch base April 23 to an altitude of 1250 miles, creating a barium cloud in space which was visible in Spain and France.

b. India has reported successful launchings of three Judi-Dart sounding rockets with chaff payloads this year.

c. Japanese officials now predict the launching of that nation's first satellite in September.

d. The Soviet Union has reported that the latest Soviet experimental communications satellite will transmit, on a regular basis, telephone, radio, and color television between Moscow and Vladivostok.

e. Greece has signed an agreement with the United States for ship-based rocket launches during the solar eclipse May 20.

5. Commercial Applications

a. A new class of plastic coatings developed by NASA has been described as one of the most important advances in this field during the past year. It may be used as a thermal and corrosion protective coating for titanium on supersonic transports; as a high-temperature resistant fiber for high-speed decelerators; as a semi-conductor and other electronic uses, and as a high-char ablation material for re-entry bodies.

b. A manufacturer's extension of NASA-sponsored research has developed a 500-gallon flexible fuel tank for the U. S. Army that weighs one-half to one-third as much as those presently used in Viet Nam to extend the range of aircraft for bulk fuel storage in forward areas.

6. Navigation Satellites. More precise information about specific locations on earth will soon make it possible to develop a much simpler and lighter Transit navigation satellite which in turn will result in simpler ground and shipboard equipment using the satellite.

7. Failure. The U. S. failed in an attempt to orbit a military payload May 3.

8. Weather Satellites

a. ESSA I tracked a tropical storm in the Southwest Indian Ocean for 11 days, and Mauritius, Malagasy, and Tanzania received special storm alerts.

b. Constant-level weather balloons, launched March 30 from New Zealand, have circled the earth three times and are still aloft. This is the first test of what eventually may become a part of a combined balloon-buoy-satellite system, which may be able to provide accurate weather predictions two weeks in advance.

9. Space Payload Success Box Score

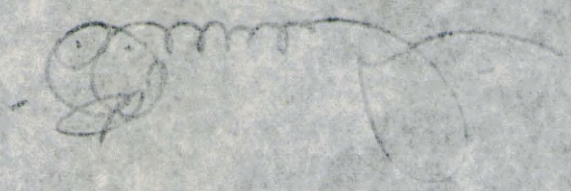
	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	31	24	17	17
Escape	2	0	0	0

E. C. Welsh

Friday, May 6
Time: 10:30 a. m.

The White House
Washington

1966 MAY 6 PM 12 51



EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

May 13, 1966

EXECUTIVE SECRETARY

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Congress

a. The Senate Space Committee on May 11 approved $5.008 billion of the NASA Authorization bill, just $4 million less than the NASA request. The committee's markup is $22 million more than the House authorization and $58 million more than the House appropriation. It also reverses the House action regarding the interplanetary flight programming and the House funding increases for the 260-inch solid rocket and the SNAP 8.

b. The Senate approved the $2.26 billion authorization request for the Atomic Energy Commission. The bill is the same as that which passed the House with no amendments and very little debate, and includes the full space authorization of $79.1 million for Nerva and $45.35 million for SNAP programs.

c. The Executive Secretary testified before the Senate Appropriations Committee on May 9 in support of the Space Council budget request, in a favorable and complimentary atmosphere.

2. Launches

a. The Soviet Union launched Cosmos 117 into a low circular orbit May 6. It is of the type usually recovered after eight days.

b. The Soviet Union placed Cosmos 118 in a 400 mile circular orbit May 11.

3. Pending Launches

a. Gemini IX has completed its pre-launch tests for its scheduled May 17 flight. The Agena, as a target vehicle, is to be launched 1 1/2 hours before the Gemini; the flight is scheduled for almost 3 days' duration; docking, rendezvousing, and extravehicular activity are among the experiments, with the last scheduled for 2 hours and 25 minutes.

b. A Nimbus weather satellite, scheduled for launch May 13, has been postponed at least 24 hours due to vehicle guidance problems; an Explorer atmospheric satellite is also scheduled for this week-end.

c. This nation's first attempt to soft land a Surveyor instrument package on the moon is scheduled for May 30.

4. USSR

a. The Soviet Union has attempted to allay scientific fears that their space probes might contaminate the moon and other planets by describing in some detail its systems for sterilizing interplanetary payloads.

b. Astronaut Carpenter is expected to attend an oceanographic Congress in Moscow, as an aquanaut. Our embassy expresses the home he will also meet with Soviet cosmonauts.

c. Blagonravov announced in Vienna that Soviets have a series of lunar probes scheduled. He also reported that the electronic failure of recent Venus spacecraft was in the general vicinity of the planet and may have been due to peculiar characteristics of the planets' environment. In addition, he stressed the importance of man in the spacecraft even though instruments are highly developed.

5. Communications Satellites

a. Three communications carriers (RCA, IT&T, and Western Union) have asked the FCC for permission to build an earth station near Woodland, Georgia, or as an alternative, near Moorefield, West Virginia, and have asked the Commission to deny the Communication Satellite Corporation permission to build a station at the West Virginia site.

b. The FCC has granted permission to provide live television coverage of the splash-down of Gemini IX from the Carrier Wasp.

c. Three more nations (Malaysia, Singapore, and the Philippines) have completed negotiations to join the International Communications Satellite Consortium.

6. Weather Satellites. ESSA I photographed a violent storm in the Indian Ocean off the Somalia coast May 5, and advisories were sent to the threatened countries.

7. EVA. The astronaut maneuvering unit to be used on Gemini IX will initiate a series of extravehicular operations which include orbital assembly, inspection repair, logistic transfer, and space rescue.

8. Treaty. Early action has been requested in the U.N. on the President's proposed treaty on the peaceful uses of outer space and the non-appropriation of territory on celestial bodies.

9. Manned Vehicles. NASA has contracted for the development of a two-gas life support system for manned space flights lasting 45 to 120 days. Present Gemini and Apollo systems are 100% oxygen. In the new system, oxygen will be combined with nitrogen or helium.

10. Space Payload Success Box Score

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	34	24	19	19
Escape	2	0	1	2

E. C. Welsh

Friday, May 13
Time: 10:30 a. m.

EXECUTIVE
OS
FG11-4

THE WHITE HOUSE
WASHINGTON

May 3, 1966

Bob -
These should all come now through you.
Bill

MEMORANDUM FOR:

1. Bill Moyers
2. Jack Valenti
3. Marvin Watson

I agree that it is a waste of time to send such reports, as that attached from Mr. Welsh of NASA; but it did not come from my office. Frankly, I don't know where it did come from.

Robert E. Kintner

Please circulate

THE WHITE HOUSE
WASHINGTON

May 2, 1966

TO: ROBERT KINTNER

FROM: Bill Moyers

The President says this is a waste of his time. Things like this ought not to come to him unless there is something of special note in them.

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE SECRETARY

April 29, 1966

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Congress

a. The NASA FY 1967 Authorization bill is scheduled for House floor action May 3.

b. The House Space Committee's report on the NASA Authorization recommends cutting the Administration's bill $26 million, from $5.012 billion to $4.986 billion. Among the changes the Committee proposes elimination of a Venus flight in 1967 and a 3 percent cut in administrative costs. It recommends the following increases: two Mariner flights to Mars in 1969, preliminary planning for the Voyager flight to Mars in 1973, the 260-inch solid rocket motor, the SNAP 8 nuclear power project, and aeronautics research. The report emphasized the need for NASA to proceed with post-Apollo plans.

2. Launches

a. The Soviet Union placed its third Molniya communications satellite into orbit April 25. The satellite's eccentric orbit reaches out to 24,000 miles at apogee, and about eight hours of service per day is provided Soviet ground stations which have transmitted television between Moscow and the Far East.

b. The Soviet Union launched a scientific satellite, Cosmos 116, into orbit April 26.

3. Soviet Tests. According to reports from the Soviet Union, rocket tests will be conducted in the Pacific (southwest of Midway Island) from now until July 31.

4. Satellite Communications

a. The ComSat Corp. has asked the FCC for authority to build a ground station in the Virgin Islands, and has petitioned to deny AT&T and IT&T permission to lay a communications cable to the same area.

THE WHITE HOUSE
RECEIVED

1966 APR 29 AM 11 11

b. The ComSat Corp. has announced its intention to purchase 6 communications satellites costing about $32 million. Each satellite is to be five times the capacity of Early Bird.

5. New Defense Satellite. The Department of Defense is planning to develop a new class of satellites which will combine missile detection, nuclear blast detection, and weather reporting from synchronous altitude. Called Program 266, the satellite may use a SNAP 17 nuclear power source.

6. Labor Dispute. On April 25, Federal mediators announced that an interim agreement had been reached in the labor dispute that had slowed work down on several space programs at Cape Kennedy. The agreement provided that the striking electricians would return to work on April 28, with negotiations for a new contract continuing until May 20.

7. Weather Satellites

a. Nimbus C, originally scheduled for launch April 28, has been delayed because of difficulty with the electrical system of the Agena stage.

b. ESSA I traced a tropical cyclone in the South Indian Ocean April 20-27, and warnings were sent to the threatened areas and to the International Meteorological Center in Bombay, India.

8. Space Payload Success Box Score

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	29	24	17	17
Escape	2	0	0	2

E. C. Welsh

Friday, April 29
Time: 10:00 a. m.

FILE MEMO:
EF/dg
April 26, 1966

EXECUTIVE
FG 11-8-1/Reedy, George

SP	PR 18-2
OS	FG 810
FG 105	SP 2-4/1964
FG 110	PR 18-3
FG 296	FG 430
PE	

Box # 1404 sent to Central Files from Mr. George Reedy's Office containing

Official unclassified Material 1963 and 1964.

Speech Drafts - 1964
Space - 1963-1964
State - 1964
Treasury Department - 1963-1964
xUnited Steel Workers of America McDonald, Nordy, Hoffman and etc. - 1963
USIA - 1963-1964
Johnson Information Activities, Biographies, etc. 1963-1964
Johnson News Conferences - 1963-1964
November 4, December 9, News Conference White House, 1963 Vol. I
December 10 News Conferences - Vol II - 1963-1964
News Conference Vol. III - 1964 January and February
News Conference Vol IV - February 19, 1964 - March 16, 1964
News Conference Vol V - March 16, 1964 - March 19, 1964
Speeches, Excerpts of Speeches - Statements since November 22, 1963, Feb. 1964
AFL-CIO Exectuvie Committee - 12/4/63
Johnson Statements, Speeches - Before President Business Advisory Council, 12/4/63
State of the Union Message, 1/8/64
General Press Releases - Feb. 11, 1964 - March 1964 (Senate Nomination)
Look at Later Reedy-Reedy-Undated

RD

(7)

EXECUTIVE
OS
FG11-4

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE SECRETARY

April 22, 1966
Rec'd 12:25 pm

MEMORANDUM FOR THE PRESIDENT

(2)

Subject: Space Activities

1. Launches

a. A United States Atlas Agena launch vehicle placed a military payload into polar orbit from the West Coast April 19.

b. The Soviet Union launched Cosmos 115 into a low circular orbit from the Tyuratam launch base April 20.

c. The U. S. Air Force put into orbit by Scout vehicle a new class of scientific payload from the West Coast April 22.

2. Pending Launches

a. The second Nimbus polar orbiting weather satellite is scheduled for launch April 29. This will be the first satellite to take and transmit night cloud pictures direct to the APT ground stations throughout the world.

b. Gemini IX is now scheduled for launch May 17. Its mission includes rendezvous and docking with an Agena target vehicle and extra-vehicular activity by an astronaut for about 2-1/2 hours.

3. Engine Test

a. The descent engines of the Lunar Excursion Module (LEM) are scheduled for test firing in an airless void similar to lunar conditions April 22.

b. The first firing of a flight-weight model of the second stage of the Saturn V launch vehicle (S-II-T) is scheduled for momentary test firing at the Mississippi Test Facility. It will be the first firing ever to take place at this facility.

4. International Cooperation

a. France is building two 10-watt SNAP isotope devices for space application. A U. S. and a French firm have an agreement regarding the transfer of technology involved.

b. Spain and the U. S. have signed a cooperative agreement regarding use of the Grand Canary Island station for the Apollo program. A cooperative scientific sounding rocket program will also be undertaken.

5. French-Soviet Negotiations. Representatives of France and Russia are meeting in Moscow to discuss details of possible joint cooperative efforts in space.

6. Communication Satellites.

a. Syncom III was used to relay a message from a U. S. Navy cruiser in Viet Namese waters to Honolulu some 4,000 miles away, where it was fed into the Defense Communications System for world-wide delivery.

b. The Inter-American Development Bank has ordered a study contract for possible construction of communications satellite ground stations in Argentina, Bolivia, Brazil, Chile, Colombia, Ecquador, Paraguay, Peru, Uruguay, and Venezuela.

7. Weather Satellites. U. S. weather satellite pictures showing the conditions in the Tokyo-Mt. Fuji area during March 5 are being utilized by British and Japanese authorities investigating the crash of a British jetliner on that date.

8. Astronaut Travel. An extensive European trip for Astronaut John Glenn is being programmed by State/USIA from May 12-June 7 following his May 6-7 appearance at the international Boy Scout meeting in Germany.

9. Congress. The House Space Committee's NASA authorization bill is presently awaiting action by the Rules Committee. The Space Committee report on the bill has been completed and should be released shortly, possibly within two weeks.

10. Competition. Both the U. S. and the U. S. S. R. had their most active and productive space records during 1965. So far this year, from a quantitative point of view, the U. S. S. R. has about equalled its previous year's rate of successful launch activity while the U. S. is lagging somewhat behind last year's rate.

11. Space Payload Success Box Score
(April 22)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	27	24	15	14
Escape	2	0	0	2

E. C. Welsh

Friday, April 22
Time: 10:30 a. m.

Rec'd Rundle 4-16-66 RD
5:00P

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE
OS
FG 11-4

April 15, 1966

EXECUTIVE SECRETARY

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Congress. The House Space Committee report on the NASA authorization is planned for release on April 18. House Rules Committee action on the Authorization is not anticipated before April 25.

2. Moon. According to the Soviets, their lunar orbiter (Luna 10) has returned valuable data about the Moon, indicating that it seems more like the Earth in its structure of crust and core than had been supposed.

3. Observatory. The complex Orbiting Astronomical Observatory launched April 8 ceased operation before it had a chance to exercise its 10 telescopes. Short circuits probably caused the battery failure.

4. Pending Launches

a. The second Nimbus weather satellite is scheduled for launch late this month.

b. The May schedule includes Gemini IX for about the middle of the month; the soft lander test shot of the Surveyor for the Moon later in the month; and also other spacecraft such as an Orbiting Geophysical Observatory and an Atmosphere Explorer.

5. Cooperation. Agreement has been reached with the French to place two experiments on our Orbiting Geophysical Observatory to be launched in 1968. Of the 18 foreign experiments accepted so far by NASA for use in our satellites, 6 have been French.

6. United Nations. The Scientific and Technical sub-committee of the U. N. Committee on Outer Space will meet in Geneva next week.

7. Aeronautics

a. The XB70-2 flew at supersonic speeds for over an hour this week -- 15 minutes at Mach 3+ at a maximum altitude of 72,000 feet. Maximum heat recorded was 610°F.

b. PanAm ordered 25 Boeing 747 airliners, each scheduled to carry 490 passengers or 100 tons of cargo from New York to Europe at 625 mph. Deliveries are expected in 1969.

8. French-Soviet talks. The French and Soviets are scheduled to resume talks in Moscow next week on the possibilities and practicalities of space cooperation between the two nations.

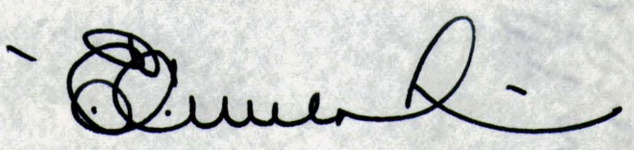
9. Japanese Plans. The Japanese indicate they expect to launch a navigational satellite by 1972.

10. Slippage. A schedule slippage has been announced which will postpone launching of the Apollo/Saturn-202 booster from the second quarter of this year. Mechanical problems which require additional checkout are responsible for the delay.

11. Tropical Storms. ESSA I sighted Typhoon Hester in the Philippine Sea from April 8 to April 12. This is the first such intensive storm of the current season, and warnings were sent to affected areas.

12. Space Payload Success Box Score
(April 15)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	27	22	14	13
Escape	2	0	0	2



E. C. Welsh

Friday, April 15
Time: 10:15 a. m.

Rec'd Branch 4-10-66 3:10P

EXECUTIVE
OS
FG11-4

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE SECRETARY

April 8, 1966
11:10 A.M.

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities.

1. Congress.

a. The House Space Committee has authorized funds totalling $4,986,864,150 for NASA in FY 1967, a reduction of $25.1 million, or 1/2 of 1% from NASA's request of $5,012 billion. The bill authorizes increased funds for two 1969 Mars Mariners flights and a 1973 Mars-Voyager flight, but cuts funds from a projected 1967 Venus flight. The Committee plans to recommend in its report that funds be distributed in such fashion as to increase money for the SNAP 8, the 260 inch solid, and aeronautics research.

b. The House Independent Offices Appropriations Subcommittee has completed hearings on the NASA bill, which is expected to be reported out early next month.

2. Launching.

a. The Soviet Union April 6 orbited a heavy payload (Cosmos 114) into an orbit inclining from the Equator by 73 degrees.

b. The U.S. launched April 7 a military payload into polar orbit using a Thor Agena vehicle.

c. The U.S. launched an Atlas Centaur vehicle, which failed in its second burn and hence remained in its parking orbit about the earth.

3. Luna 10. The 540 pound scientific payload of the Soviet spacecraft Luna 10 is in orbit around the moon. It is reported to be taking temperature, meteoroid, and gravity measurements.

4. Observatory. The Orbiting Astronomical Observatory, which has been delayed by weather and mechanical difficulties is scheduled for launch this afternoon from Cape Kennedy.

5. Astronauts. Nineteen more candidates (7 Air Force, 6 Navy, 4 civilians, 2 Marines) have been selected as potential astronauts by the National Aeronautics and Space Administration. Six women applied, but none of them was able to meet the minimum requirements.

6. Gemini 9. Activities at Cape Kennedy are proceeding on schedule in preparation for the Gemini 9 flight in the current quarter. Modifications are being made to the spacecraft to eliminate the thruster problem that caused trouble during the Gemini 8 mission.

7. Nerva. Final testing of the experimental Nerva nuclear rocket engine system was conducted March 25. During the series of test firings the system operated for a total of one hour and 50 minutes, with 50 minutes at full power.

8. Saturn V facilities. The water cooling system on Cape Kennedy's Complex was successfully tested. A total of 300,000 gallons of water was pumped to the pad, to simulate the cooling of the fiery Saturn V liftoff, from a one million gallon capacity reservoir located between Pads A and B. Sixty thousand gallons were pumped per minute during a five minute test.

9. ComSat. The ComSat Corporation revenues from the Early Bird satellite for the half of 1965 it was operational totalled $2,139,000, of which $1,833,000 was from domestic carriers.

10. SPACE PAYLOAD SUCCESS BOX SCORE
(April 8)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	27	21	14	13
Escape	2	0	0	2

E. C. Welsh

The White House
Washington

1966 APR 8 PM 2 44

31

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE
OS
FG 11-4

EXECUTIVE SECRETARY

April 1, 1966

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Launches

a. The Soviet Union announced March 31 that it had launched Luna 10 on a lunar orbiter test mission. It is expected to reach the area of the moon on Sunday.

b. The United States placed two military satellites into polar orbits last week. One was orbited by a Thor-Altair launch vehicle March 31, and the other by a Scout vehicle March 26.

c. On March 30, the United States placed two experimental scientific payloads into orbit from pods attached to an Atlas ICBM conducting its own test flight from Vandenberg AFB to a mid-Pacific target. This is the second successful use of this pick-a-back method, the first to carry out a twin launch.

2. Manned Lunar Landing. There is a possibility, even though remote, that the United States will land men on the moon by mid-1968. The official schedule still calls for such launch in late 1969, but NASA told the House Space Committee last week that lunar landing by the earlier date might be achieved.

3. Venus. Further spacecraft explorations will be necessary before it can be determined whether life can or does exist on the planet Venus. Though data from Mariner II indicated surface temperatures of 600 to 800 degrees Fahrenheit, there is a possibility that these high temperatures are at some altitude above the planet and that the surface could be much cooler.

4. Launch Delay. The Atlas-Agena launch vehicle shut down almost immediately after the engines started, and this delayed launch of the Orbiting Astronomical Observatory. An Atlas-Centaur test vehicle with a mass model of the Surveyor spacecraft aboard also experienced difficulties just before the expected launch.

5. Apollo Tracking Ships. Vanguard, the first of three Apollo tracking ships, is expected to be operational by June. The remaining two, Redstone and Mercury, should be ready by the end of the year. The reentry support ships, Watertown and Huntsville, are scheduled to be ready in November and January respectively.

6. ComSat Station. The Communications Satellite Corporation has filed with the Federal Communications Commission for authority to construct a fourth U. S. earth station to be located near Moorefield, West Virginia.

7. Space Maneuvering Gun. NASA has awarded a contract for the design of a new hand-held maneuvering equipment for astronauts. Its fuel supply would give 25 times as much capability for maneuvering as the present device.

8. Weather Satellites

a. Kenya and Angola have joined the roster of 71 areas around the world which report excellent reception of local weather photographs directly from ESSA II.

b. Three tropical storms were sighted by ESSA I in the Indian Ocean this week and warnings were sent to threatened areas.

9. Congress

a. The Independent Offices Subcommittee of the House Appropriations Committee will hold hearings on NASA's FY 1967 appropriations beginning April 4.

b. The House Space Committee has received the reports of its three subcommittees on the NASA Fiscal Year 1967 authorization. The subcommittees recommend some reprogramming in the planetary and advanced research areas, but would reduce NASA's funding request by less than 1%.

10. Space Payload Success Box Score
(April 1)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	24	19	14	12
Escape	2	0	0	2

Friday, April 1
Time: 11:00 a. m.

E. C. Welsh

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

EXECUTIVE
OS
FG 11-4

March 25, 1966

EXECUTIVE SECRETARY

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Soviet Launch. Cosmos 113 was launched into a low circular orbit on March 21. Similar payloads have been recovered after eight days. This is the first time the Soviets have had two such payloads in orbit concurrently, both Cosmos 112 and 113.

2. Pending Launches

a. This nation's first orbiting astronomical observatory, which weighs 3,900 pounds, is scheduled for launch from Cape Kennedy on March 28.

b. A model of the Surveyor spacecraft, which the U. S. hopes to soft-land on the moon this summer, is scheduled for launch into earth orbit on March 29 to test an Atlas-Centaur.

c. The Air Force is scheduled to launch a pair of scientific satellites into orbit March 30 from pods attached to an Atlas ICBM.

3. French Space Plans. France has announced its intention to spend $349 million on space projects between now and 1970. Included in the program are the launch of seven satellites, three of which will be launched with the assistance of the United States.

4. Nuclear Power. A SNAP 10A nuclear reactor has been shut down after having run for 10,000 hours, during which time it produced over 4 million watt-hours of electricity.

5. Snow Cover Maps. The world's forecasters are now receiving Northern Hemisphere snow cover maps, put together by the National Environmental Satellite Center, based on photographs from the ESSA I weather satellite. The service is furnished to the World Weather Center in Washington.

6. Weather Pictures

a. Operators of 69 of the low-cost installations used to receive weather pictures both in this country and overseas have reported they are

receiving excellent weather pictures from the ESSA II weather satellite.

b. New electronic techniques are being used for the rapid preparation of mosaic weather maps based on APT photography received from ESSA II. The operation decreases processing time and makes the weather information more current.

c. Twenty-one Indian Ocean storm advisories based on ESSA I photographs were sent to the threatened areas during the week.

7. Soviet Space Dogs. The Soviets have announced that their two space dogs showed "no symptoms or disturbances due to cosmic radiation." The dogs passed through sections of the Van Allen radiation belt in a space capsule described as having new radiation shielding devices.

8. Project Gemini

a. Present information indicates that the runaway rocket thruster which curtailed the Gemini 8 mission was caused by a short circuit in the orbital attitude and maneuvering system.

b. The Agena-target vehicle, with which Gemini 8 docked, has been placed in circular orbit, and is in a favorable position for rendezvous with a future Gemini.

9. Congress. The House Space Committee is currently reviewing the reports of its Subcommittees and expects to mark up the NASA authorization bill on March 29.

10. Astronaut Visit. The Schirra-Borman visit to the Far East and Oceania is rated as an unqualified success from the standpoint of advancing U. S. interests in the area.

11. Popularity. A recent Trendex poll has indicated an ever-increasing popularity for the space program, using average statistics from the four cities polled, Cincinnati, Syracuse, Pasadena, and Des Moines. Apparently, 77% now favor the program, as against only 20% opposed to it. This represents a substantial gain over previous such polls.

12. Space Payload Success Box Score
(March 25)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	23	15	13	11
Escape	2	0	0	1

E. C. Welsh

Friday, March 25
Time: 11:40 a. m.

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON

March 18, 1966

EXECUTIVE SECRETARY

MEMORANDUM FOR THE PRESIDENT

Subject: Space Activities

1. Launchings

a. Gemini 8, launched with great precision on March 16, became the world's first spacecraft to dock with another spacecraft in orbit when it joined with its Agena target vehicle, which was launched 101 minutes ahead of the Gemini 8. Severe tumbling caused curtailment of the mission, and the astronauts and their capsule were safely brought down in the Pacific during the seventh revolution. The Agena target vehicle is still in orbit, and may be used for docking exercises on future Gemini missions.

b. The Soviet Union launched Cosmos 112 into orbit March 17. This is the first Soviet spacecraft placed into an orbit inclining from the equator 72 degrees, giving it more extensive coverage of the world. Similar satellites have been recovered after about eight days.

2. Soviet Dogs. The Soviet Union announced the successful recovery of the two dogs which were aboard Cosmos 110 after 22 days of flight. The orbit had taken the dogs through the Van Allen radiation belt.

3. Congress

a. The Senate and House Committees have almost completed their public hearings on the FY 1967 NASA authorization. Both Committees' reactions seemed to include: (1) concern regarding the lack of NASA post-Apollo plans; (2) concern about the relative vigor of the Soviet space program; and (3) doubt concerning reported NASA-Defense efforts to cooperate.

b. The House Committee has expressed criticism of the inadequacy of NASA funding for advanced research, particularly as regards the 260-inch booster, SNAP 8, and aeronautics.

c. NASA plans to launch a Venus probe in 1967 were threatened when the House Space Science Subcommittee seemed prepared to recommend reprogramming the funds for a 1969 atmospheric probe of Mars.

If precedent holds, both launch windows will be exploited by the Soviet Union.

4. Lifting Bodies.

a. NASA's HL-10 lifting body reentry vehicle is now scheduled to be flight tested. This vehicle which has three vertical fins will be tested in drop tests from a B-52 aircraft.

b. Department of Defense has selected a contractor to construct a manned lifting body test vehicle to be flown in conjunction with NASA's project in this area. Vehicle is scheduled to be flown in May 1967.

5. Weather Satellites

a. Photographs from the ESSA I weather satellite of conditions in the Pacific were used by the Gemini space flight controllers to choose the emergency recovery area for the Gemini 8 flight.

b. Favorable reception of weather pictures of local weather conditions from ESSA II have been reported from fourteen foreign countries.

c. ESSA I sighted tropical storms in the Pacific and the South Indian Ocean last week, and storm warnings were sent to the affected areas.

d. The National Environmental Satellite Center at Suitland, Maryland, has assumed control of all Tiros and ESSA weather satellites. NASA's Goddard Space Flight Center now monitors engineering data only.

6. Nuclear Rocket Test. A highly successful ground firing of the Nerva nuclear rocket engine system took place in Nevada on March 16. The reactor was operated for a total of 18 minutes, of which 13 minutes were at full power of 55,000 pounds thrust. This marks the eighth consecutive successful operational ground firing of this engine.

7. Commercial Airliner. The first flight of what is reported as being the world's largest commercial jet airliner (DC-8 Super 61) has taken place. It is scheduled to carry 251 passengers plus baggage and freight, and the aircraft company predicts that direct operating costs will be less than one cent per seat-mile for the first time in aviation history.

8. Aerospace Employment. Employment in the aerospace industry is expected to increase by 8% between September 1965 and June 1966, according to the Aerospace Industries Association. Aircraft employment is expected to show the greatest increase, with missile and space employment remaining relatively steady.

9. International Cooperation. A joint U.S.-New Zealand pilot project is starting this month to test the use of balloons as observation and data taking platforms in conjunction with satellites for data collection in a global weather monitoring system.

10. Space Payload Success Box Score
(March 18)

	USA		USSR	
	1965	1966	1965	1966
Earth Orbit	21	13	12	10
Escape	1	0	0	1

E. C. Welsh

Friday, March 18
Time: 11:55 a. m.

RD/D

Jim
Central
Files
(2)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

EXECUTIVE
OS
OS4
F62.60

IN REPLY REFER TO: FP

March 16, 1966

MEMORANDUM FOR: Mr. Bill D. Moyers
Mr. Arthur Sylvester
Mr. James L. Greenfield
Dr. Edward C. Welsh
Dr. Nicholas Golovin
Dr. Donald F. Hornig

The United States will attempt to launch its most advanced unmanned spacecraft from Cape Kennedy on March 24.

It will be the first in a series of four Orbiting Astronomical Observatories (OAO) designed to give astronomers their first sustained look into the universe from above the obscuring and distorting effects of the Earth's atmosphere.

A press kit for release March 20, is attached.

Walter A. Jenning
for O. B. Lloyd, Jr.
Director
Public Information

Attachment

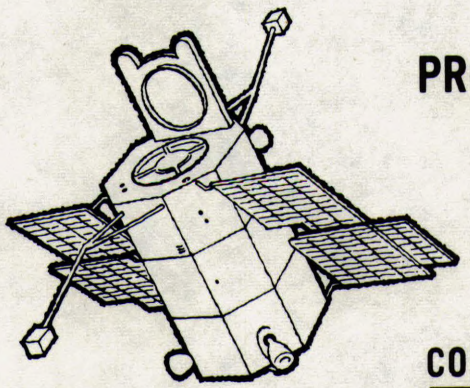
RECEIVED
MAR 21 1966
CENTRAL FILES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
TELS. WO 2-4155
WO 3-6925

FOR RELEASE: SUNDAY
March 20, 1966

RELEASE NO: 66-60

PRESS KIT



PROJECT: OAO-A1 PRESS KIT
(To be launched no earlier than March 24, 1966)

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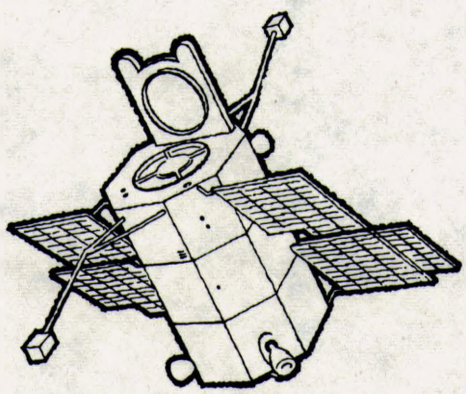
-more-



NEWS NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

TELS. WO 2-4155
WO 3-6925

FOR RELEASE: SUNDAY
March 20, 1966

RELEASE NO: 66-60

U. S. TO LAUNCH MOST ADVANCED UNMANNED SPACECRAFT

The United States will attempt to launch its most advanced unmanned spacecraft from Cape Kennedy on March 24.

It will be the first in a series of four Orbiting Astronomical Observatories (OAO) designed to give astronomers their first sustained look into the universe from above the obscuring and distorting effects of the Earth's atmosphere.

The 3,900-pound observatory will be the heaviest spacecraft ever carried by the Atlas-Agena launch vehicle. OAO's diameter is larger than that of the Agena stage, requiring a special three-section clam-shell shroud to cover both spacecraft and Agena.

-more-

This first OAO will carry four experiments to study the ultraviolet, X-ray and gamma ray regions of the electromagnetic spectrum. These radiations have shorter wavelengths and higher frequencies than visible light and cannot be studied by ground-based observations. Studies of these regions should enable astronomers to define better the chemical composition, pressure and density of stellar objects.

The spacecraft's planned orbit is circular, 500 statute miles above the Earth at an inclination of about 35 degrees, with an orbital period of about 101 minutes. This orbit is designed to carry the spacecraft above the Earth's atmosphere and yet avoid possible harmful effects of exposure to radiation at higher altitudes.

If the launch is successful, this spacecraft will be named OAO I. Prior to launch it is designated OAO-A1.

As the largest, heaviest and most electronically complex unmanned spacecraft ever developed by the United States, the OAO contains more than 440,000 separate parts and 30 miles of electrical wiring.

Its main body is a ten-foot-long, eight-sided cylinder, seven feet wide. A central tube, four feet in diameter, running through the main body, carries 1,000 pounds of astronomical observing instruments. Electronic equipment is mounted on shelves located in the main structure around the experiment-carrying tube.

With its solar panels extended, the overall width of the spacecraft is 21 feet. Other prominent external characteristics of OAO include two nine and one-half foot-long balance weight booms located at opposite sides near the top of the main body. A cover, or sunshade is mounted at the top of the central experiment tube to protect the optical instruments from the direct rays of the sun.

During the launch phase, OAO's external appendages are folded cocoon-like against the main body. Once in orbit, the solar panels and booms unfold to their operational position giving OAO a bat-like appearance.

-more-

OAO represents new milestones of engineering achievement. The challenges posed by an observatory of its magnitude are perhaps best exemplified by the development of the control system which can point scientific instruments with a precision comparable to viewing the width of a pencil at a distance of 75 feet on the first OAO and at a distance of ten miles on OAO-C.

This precise pointing capability is made possible primarily by six telescope star trackers mounted at various locations on the main body.

Other important OAO engineering features include:

-- A data storing capability of up to 8,192 words each containing 25 separate bits of experiment data and/or spacecraft status information, with a total capacity of 204,800 bits of data.

-- An on-board memory system capable of storing 128 different commands which are executed automatically when the observatory is out of range of the three OAO data-acquisition stations located at Rosman, N. C.; Quito, Ecuador, and Santiago, Chile.

-more-

This first OAO will carry four scientific experiments designed to study stars and other celestial objects in the ultra-violet, X-ray and gamma ray spectral regions. To date, the total amount of direct scientific observation in these regions, obtained from sounding rockets and balloon flights above the Earth's atmosphere, totals less than an hour.

Thus, even on its maiden mission, the potential offered by OAO in expanding man's knowledge of the universe rank it, in many respects, with the invention of the telescope.

The OAO's experiment tube contains astronomical observing instruments provided by the University of Wisconsin, the Massachusetts Institute of Technology, the Lockheed Missiles and Space Co., and the NASA Goddard Space Flight Center.

The Wisconsin experiment, a series of seven telescopes, is designed to study stars and nebulae in various regions of the ultraviolet spectrum not visible from Earth. It occupies the forward-looking or "top" portion of the experiment tube.

-more-

The aft section contains the MIT, Lockheed and Goddard experiments which are concerned with the study of X-ray and gamma ray spectral regions.

The Orbiting Astronomical Observatory program is part of the scientific space exploration program conducted by NASA's Office of Space Science and Applications. OAO project management is under direction of the Goddard Space Flight Center, Greenbelt, Md.

The Atlas-Agena is managed by the Lewis Research Center, Cleveland, O., and launched by Kennedy Space Center, Fla. Development of the OAO-A1 spacecraft was accomplished by the OAO prime contractor, Grumman Aircraft Engineering Corp., Bethpage, N.Y. The Wisconsin experiment was developed by Cook Laboratories, Chicago. Contractors from throughout the country provided various subsystems and instrumentation for the spacecraft.

Contractors for the Atlas Agena are General Dynamics/ Convair, San Diego, and Lockheed Missiles and Space Co., Sunnyvale, Calif.

(END OF GENERAL NEWS RELEASE)

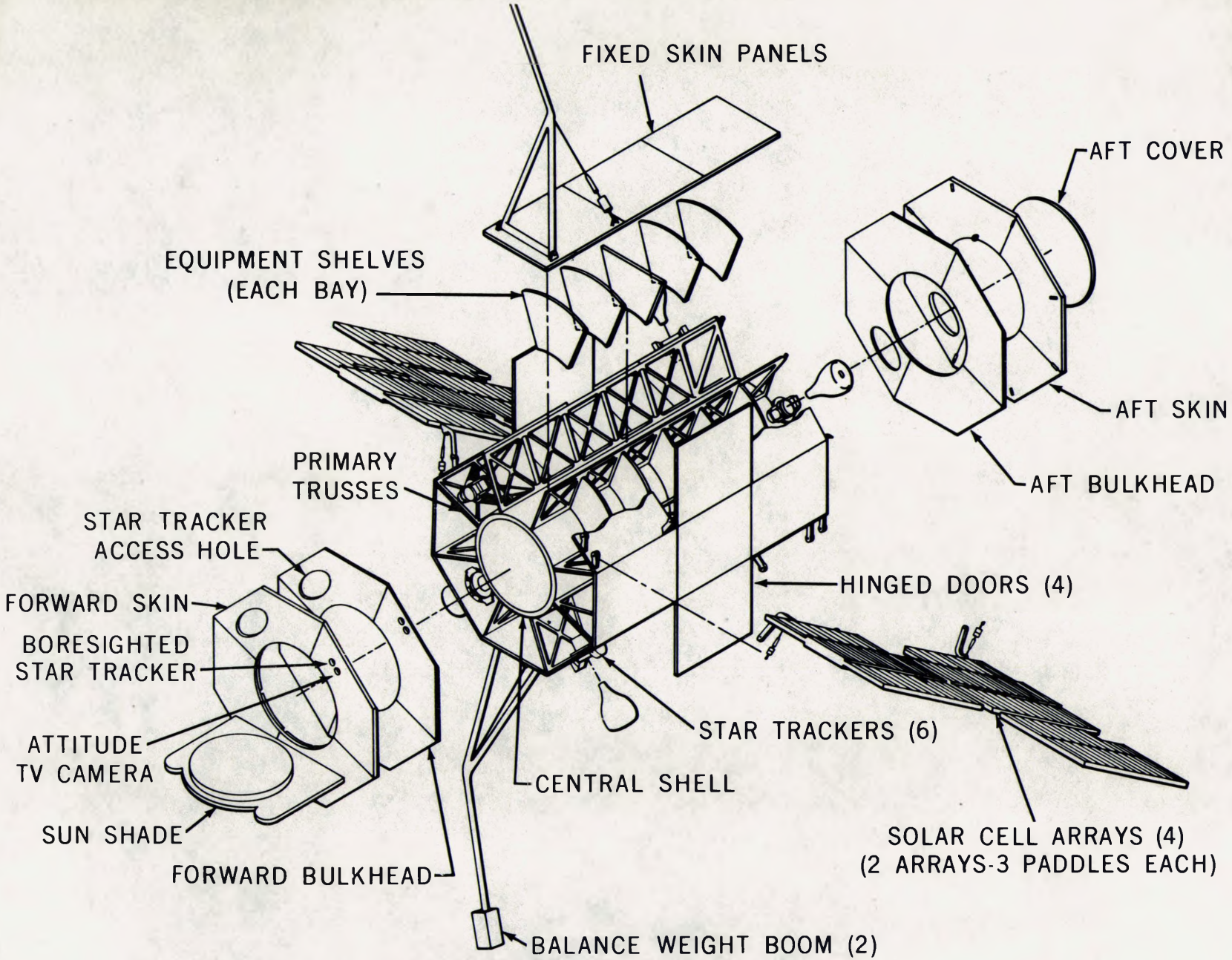
BACKGROUND MATERIAL FOLLOWS

OAO-A1 SPACECRAFT

The world's first in-space astronomical observatory consists of an eight-sided main body ten feet long and seven feet wide. Six sets of solar-cell panels, consisting of two arrays of three panels each covered with more than 74,000 solar cells, give the spacecraft its overall width of 21 feet.

The internal structure arrangement of the main body includes a four-foot-wide central tube where the experiments are mounted, surrounded by vertical trusses and horizontal shelves. The bays formed by the trusses and shelves provide space for mounting spacecraft electronics and data handling systems.

The main body is constructed of riveted or spot-welded aluminum alloy. Extensive use has been made of aluminum honeycomb in locations where high rigidity is needed. A thin nonstructural covering of specially fabricated aluminum coated with Alzak (an aluminum oxide produced by ALCOA) covers the main body except for the experiment opening. The treated-aluminum-covering is designed to protect spacecraft electronics from damage by micrometeorites and is a vital part of the passive thermal control system.



Exploded View of OAO Spacecraft

ATTITUDE CONTROL SYSTEM

Success of the OAO-A1 mission depends on the ability of the 3,900-pound observatory to point its astronomical instruments at pre-selected objects in space. The OAO control system is one of the most advanced ever developed.

After launching and separation from the Agena D upper stage rocket, the control system will first reduce the separation tumbling rate and stabilize itself on the Sun. Once Sun stabilization is achieved, a stellar reference point will be established by a pre-programmed, on-board set of stored commands or through ground command. The spacecraft will then be turned automatically to the desired pointing direction. This pointing direction must be precisely maintained to permit experiment observations.

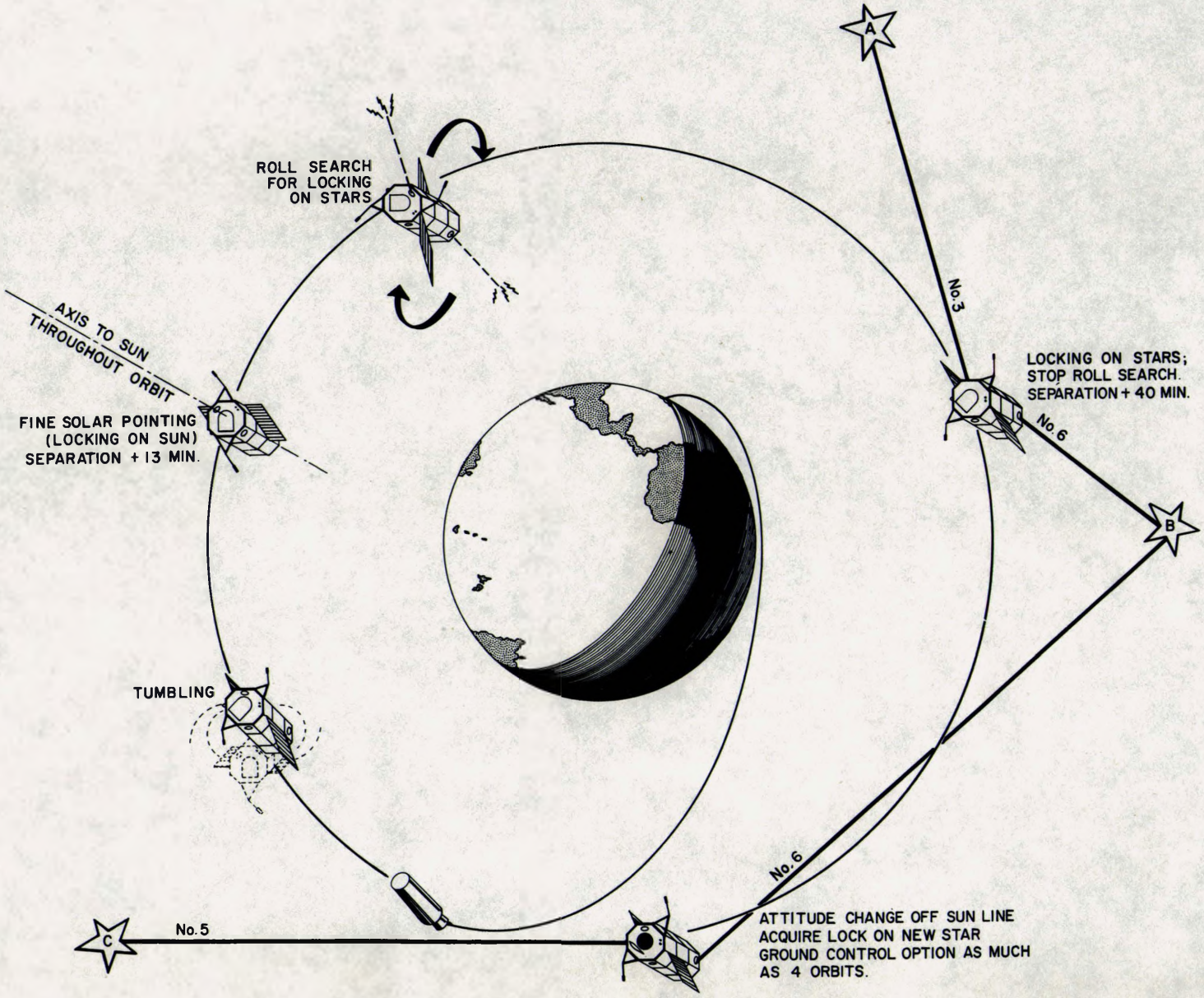
The equipment used to sense OAO motions consists of rate gyros to measure initial tumbling rates, solar sensors to establish the direction of the Sun, and six gimbaled star trackers--the heart of the system. The star trackers are designed to acquire selected guide stars, track them continuously and at the same time to measure their direction with respect to the spacecraft axes.

Included as a backup is a wide-angle TV camera with a reticle for angle measurements and a fixed star tracker which will be bore-sighted to the optical axis of the Wisconsin experiment to improve spacecraft pointing accuracy.

To initiate control maneuvers, the spacecraft uses a nitrogen gas jet system--used primarily for initial stabilization--a coarse momentum wheel system for large angle reorientation and a fine momentum wheel system for star tracker control.

The key to the OAO control system is the star tracker system. It must be able to point the observatory to an accuracy of one minute of arc and maintain this pointing direction within 15 arc seconds for 50 minutes. This accuracy is needed to assure that desired "target" stars fall within the field of view of the experiments.

Each star tracker is a small 3.5-inch reflecting telescope mounted in two degree-of-freedom mechanical gimbals. The incoming target star image is split into two light beams to provide error signals about the two gimbal axes. The beams are modulated by a system of vibrating reeds, detected by a photomultiplier and electrically separated into error signals.



OAO Star Acquisition

The resulting error signals are then used to drive dc* torquer motors in the gimbal axes. Gimbal angles are measured by variable capacitance transducers with a resolution of about five arc seconds.

Two trackers are sufficient to provide pointing information under normal operating conditions. However, six trackers are used to allow for occultation of guide stars by the Earth, to maintain proper reference when the spacecraft shifts guide stars and for redundancy to improve the lifetime of the observatory.

THE COMMUNICATIONS SYSTEM

The communications system of the OAO includes equipment to receive command signals from the ground and to transmit tracking signals, command verification signals, and spacecraft and experiment data. The equipment consists of four radio links:

Radio PCM/AM command, transmitting on 148 Mc.

Radio tracking beacon, transmitting on 136 Mc.

Wideband PCM/NRZ/FM telemetry, transmitting on 400 Mc.

Narrowband PCM/PSK telemetry, transmitting on 136 Mc.

*direct current

The radio command system includes two pairs of command receivers used with two VHF (very high frequency) antennas in what is described as a diversity receiving system. These receivers, used with each of the antennas for redundancy, provide the basic radio link for ground control of spacecraft subsystems and the experiments.

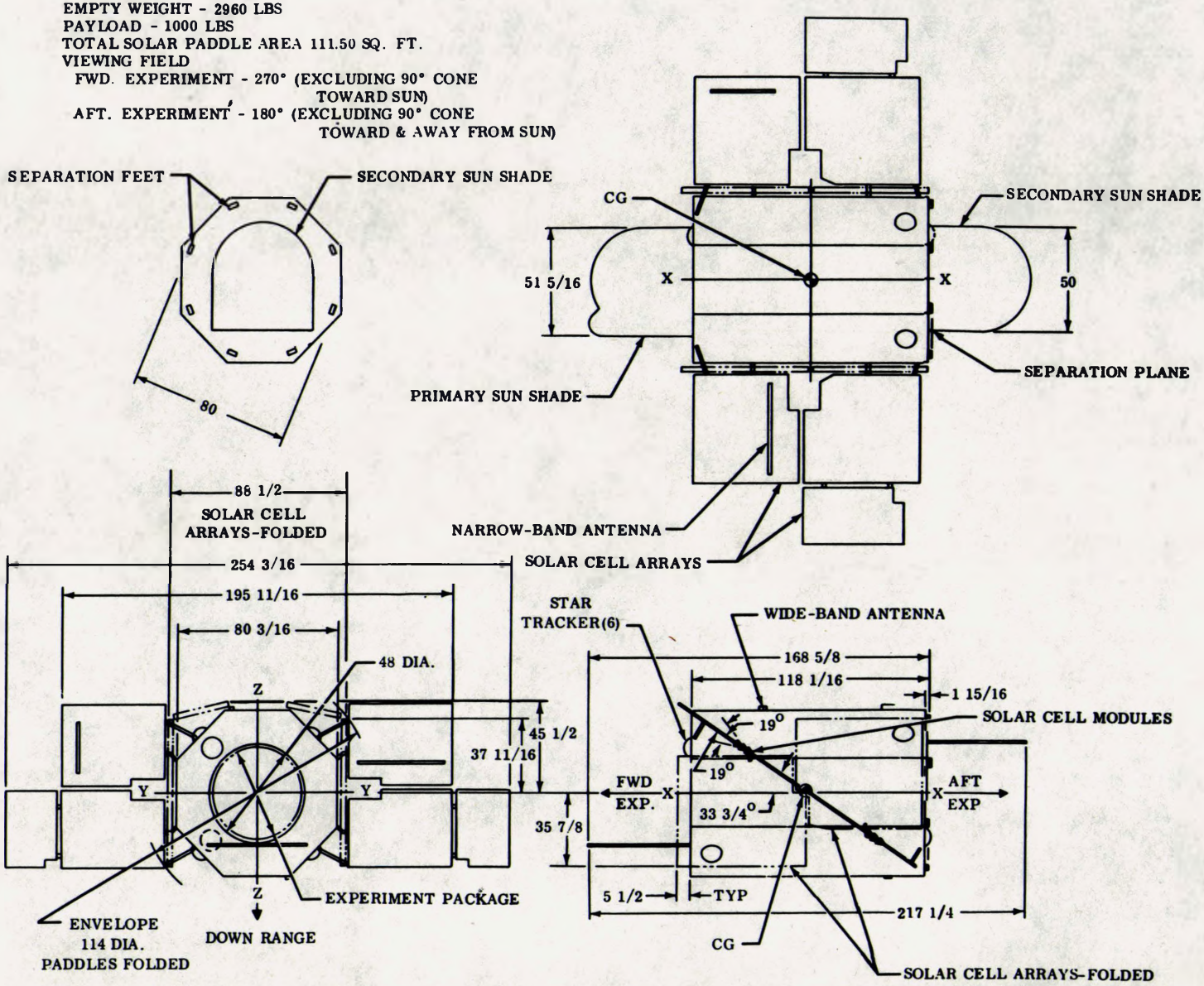
The radio tracking beacons (two are used for redundancy) are designed to provide continuous signals to permit ground tracking of the spacecraft by the world-wide NASA Satellite Tracking and Data Acquisition Network (STADAN).

The wideband telemetry link consists of two identical transmitters (either of which may be selected by ground command) to transmit analog and digital data from the experiments and spacecraft. Data to be transmitted will be selected by ground command. Analog data will be transmitted in real time only; digital data will be transmitted either in real time or from on board storage at rates up to 50,000 bits per second.

The narrowband telemetry link consists of two identical transmitters (either of which may be selected by ground command) to transmit information from the spacecraft subsystems' environmental instrumentation, and signals from the command

GENERAL INFORMATION

GROSS WEIGHT - 3900 LBS
EMPTY WEIGHT - 2960 LBS
PAYLOAD - 1000 LBS
TOTAL SOLAR PADDLE AREA 111.50 SQ. FT.
VIEWING FIELD
FWD. EXPERIMENT - 270° (EXCLUDING 90° CONE TOWARD SUN)
AFT. EXPERIMENT - 180° (EXCLUDING 90° CONE TOWARD & AWAY FROM SUN)



OAO-A1 Dimensions

system transmitted to the ground for verification. This link will also be used as a back up to the wideband link.

Two pairs or sets of antenna radiators will also be employed on OAO-A1. From a functional standpoint, excluding the redundancy of transmitters and receivers, an antenna set will operate with the tracking beacon and narrowband-telemetry transmitters at approximately 136 Mc, and with the command receivers at approximately 148 Mc. Finally, a UHF (ultrahigh frequency) antenna set will be used with the wideband-telemetry transmitter at approximately 400 Mc. This antenna arrangement provides omnidirectional coverage about the observatory, and its polarization characteristics are compatible with those of the ground systems.

Operating commands for OAO will be transmitted from specially equipped STADAN stations located at Rosman, N. C.; Quito, Ecuador; and Santiago, Chile. The command program will be directed through the OAO Control Center located at the Goddard Space Flight Center.

DATA PROCESSING SYSTEM

The OAO on-board data-processing subsystem has circuitry and storage capabilities to verify, decode, store, and distribute digital data and transmit this information from storage on ground command. The system provides timing signals for internal synchronization of the data-processing subsystem as well as for use by the experiment and spacecraft housekeeping functions. The system includes spacecraft and experiment data-handling equipment to accept digital data, accept and convert analog data to digital data, and to assemble the data into a format suitable for storage or real-time transmission to the ground.

The command decoder can handle two classes of commands, real-time and stored. Real-time commands are those designed to be executed immediately after having been verified in the spacecraft from a bit-by-bit comparison of the command with its complement as received from the ground station. Stored commands are those placed in storage for execution at a later time. Stored commands will have on-board verification by complement comparison before storage. In addition, all commands will be retransmitted to the ground and the contents of the command storage may be transmitted to the ground over the narrowband-telemetry link, to permit ground verification. Stored commands will be programmable for times between 0 and 1,023 minutes, and can be executed in one-minute increments.

If two or more commands have the same time code, they will be executed within the same minute increment, in the same order in which they were received.

The three types of OAO-A1 commands are (a) control, (b) experiment, and (c) pointing. Control commands--those intended to control spacecraft equipments--will turn equipment off and on, change operation modes, and program operations. Experiment commands will control experimenter equipment. The command word, containing a maximum of 30 operational instruction bits, will be sent to the experiment serial over one of 26 preselected channel address wires. Pointing commands will consist of the star tracker gimbal-angle commands and coarse wheel-slewing commands needed to orient the observatory.

The command storage capacity is 128 commands. The data-storage instrument uses ferrite-core memory devices in which stored data will not be destroyed by readout or loss of power. The OAO-A1 data-storage capacity is 4,096 words--25 bits per word--when operating in a 100 percent redundant mode. It is capable of nonredundant operation with the capacity doubled to 8,192 words.

Data will be storable in parallel form. Read-in time for parallel data will be approximately 10 microseconds per word. The stored data will be read out in serial form under control of the data programmer, and routed through either the wideband or the narrowband transmitter system. The data programmer will select the appropriate data-read rate.

A system clock, which provides the timing signals or pulses required by the observatory, will synchronize all data words and command words. The clock will also provide 1,024 minutes of elapsed time, available in one-minute increments, for timing correlation of command input data plus experiment and spacecraft output data. Spacecraft data-handling equipment will process spacecraft status data. Approximately 400 time-multiplexed data channels will be available.

Analog data will be encoded to an accuracy of eight binary bits. Encoded analog data and data originally generated in binary form will be assembled into a format suitable for storage or real-time PCM/PSK (Pulse-code modulation, phase-shift-keyed) transmission to the ground over the narrowband-transmitter system.

Experiment data-handling equipment on the spacecraft will accept, convert, and assemble experiment and selected status data into a format suitable either for storage or for real-time transmission to the ground as a PCM pulse train. Real-time transmission of experiment data will back up the data-storage system. During real-time transmission, data sources will be sampled in a cyclic time sequence controlled by a real-time programmer included as part of the experiment data-handling equipment.

POWER SUPPLY

The basic power source for the observatory is an array of 74,618, glass-covered, p-on-n, silicon solar cells mounted on six panels to convert solar energy into electrical energy. A nickel-cadmium storage battery, rechargeable from the solar cells, will supply power while the OAO-A1 is in the Earth's shadow, and for short peak requirements which exceed the instantaneous capability of the solar array.

Anticipated power requirements for the complete observatory are 405 watts average per orbit, with short peak demands as high as 980 watts. Of this power, 30 watts average and 60 watts peak will be available to the experimenters. Nominal supply voltage for the observatory will be 28 volts.

SPACECRAFT THERMAL CONTROL

OAO-A1 thermal control is a passive system accomplished by isolating the internal spacecraft structure from both internal and external heat sources. The objective is to permit the observatory's internal structure to operate in a constant termperature environment with only minor changes, thereby minimizing thermal distortions during flight.

The spacecraft surface, which is the primary source of external heat, is isolated from the internal structure by insulation consisting of nylon fittings. Furthermore, the design of the spacecraft outer surface permits distortion due to thermal effects without imposing loads on the internal structure.

The observatory's electronic equipment is the primary source of internal heat. The heat is isolated from the internal structure, as much as possible, by insulating mounting brackets to reduce heat conduction, and by enclosures of foil-type insulation which reduce radiant heat effects.

The observatory's equipment has an operational temperature range of approximately 0° to 100° F.

Environmentally, the OAO's internal structure will be subjected to a temperature range of from -40° or +5° F.

OAO-A1 SCIENTIFIC OBJECTIVES

Until the advent of the space age, astronomers studied the universe under the obscuring and distorting effects of the Earth's atmosphere. These studies were largely limited to relatively small portions in the visible light radio-frequency spectral regions.

Despite these handicaps, contributions by astronomers over the centuries have immeasurably extended man's understanding of the solar system and the universe.

With the OAO, the opportunity now exists to greatly extend the frontiers of astronomy, by placing observing instruments above the atmosphere. For the first time, the ultraviolet, x-ray, and gamma ray regions of the spectrum will become accessible to study for extended periods of time. No longer will observations be restricted because of the twinkling effect of the atmosphere, nor will light in the night sky limit the detection of faint objects.

The scientific potential offered by the OAO spacecraft series--conducting studies throughout the entire electromagnetic spectrum--should have a great impact on the future course of stellar astronomy.

Some of the present and potential areas of OAO investigation include:

- Study of very hot stars radiating strongly in ultraviolet light.
- Study of x-ray and gamma ray radiation.
- Greater insights into the process of star evolution.
- Study of galaxies in ultraviolet light to determine aging effects.
- Observation in infrared to permit the first look at the center of our galaxy.
- Study of planetary radiations in the ultraviolet and infrared.
- The use of telescopes of great resolution on future OAO spacecraft could give astronomers a look at objects near the edge of the universe.

SCIENTIFIC EXPERIMENTS ASSIGNED TO FUTURE OAOS

Experiments for the next three OAO spacecraft are:

- OAO-B, scheduled to be launched in early 1967, will fly the Goddard Experiment Package (GEP), an instrument of moderate resolution to do absolute spectrophotometry in the ultraviolet region.
- OAO-A2, carrying the ultraviolet sky survey Celescope instrument of the Smithsonian Astrophysical Observatory and a repeat of the University of Wisconsin experiment, will be launched late in 1967.
- OAO-C, scheduled for mid-1968, will carry a high resolution ultraviolet optical instrument developed by Princeton University and a stellar and nebular x-ray instrument developed jointly by the University College, London, and the University of Leicester, England.

ORIGINS OF THE OAO PROGRAM

Shortly after the launching of Sputnik I by the USSR in 1957, Dr. Lloyd, V. Berkner, chairman of the Space Science Board of the National Academy of Science, requested 200 U.S. scientists to submit recommendations to him for scientific experiments which could be performed by a satellite with a 100-pound payload. Much of NASA's early scientific space effort was based on the replies to Dr. Berkner's request.

In May 1959, the requirements of various proposed experiments were formulated in detail, and some general engineering approaches were discussed. On the basis of material developed, a group from the Ames Research Center prepared a set of preliminary engineering specifications for Orbiting Astronomical Observatory spacecraft.

Final specifications prepared by the original OAO project team headed by Robert R. Ziemer, Project Manager, were circulated to industry in the spring of 1960. In October 1960, the Grumman Aircraft Engineering Corporation, Bethpage, N. Y., was formally designated as the prime contractor for the spacecraft system.

OAO-A1 SCIENTIFIC EXPERIMENTS

The four astronomical experiments slated for flight on board OAO-A1 are designed to cover a broad range of measurements in non-visible spectral regions. They include the University of Wisconsin broad band ultraviolet telescope package, detection devices to study soft x-rays and more energetic light called gamma rays. Through its complex ground spacecraft attitude control system, OAO-A1 will be aimed at individual objects in space with a precision never before attained by an orbiting satellite. What the experiments "see" will be radioed back to Earth in the form of digital data for analysis by the experimenters.

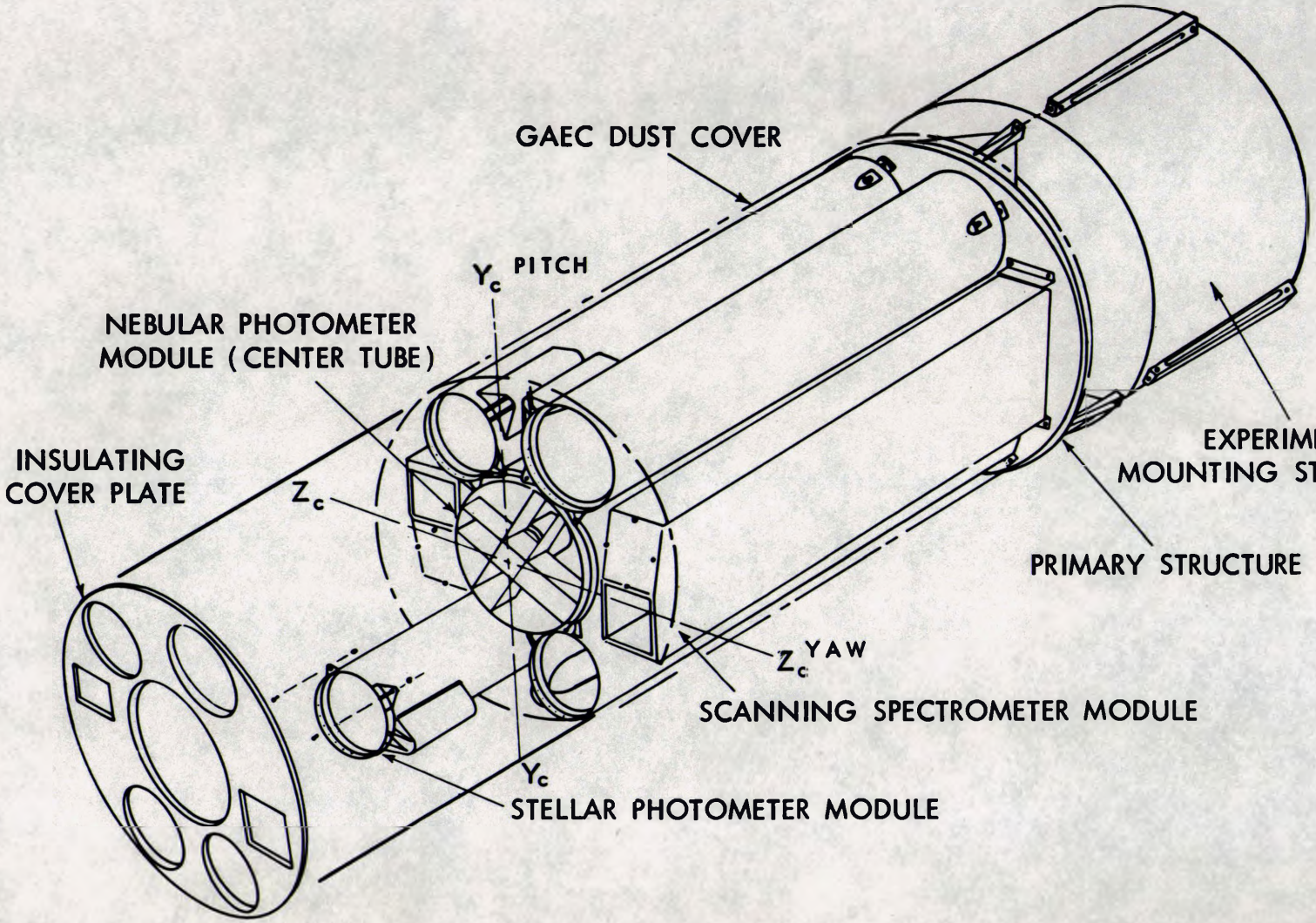
THE UNIVERSITY OF WISCONSIN EXPERIMENT

This experiment, a complex series of special ultraviolet telescopes and associated electronics, is designed to conduct a detailed study of emissions in ultraviolet light from about 200 stars and nebulae. The ultraviolet spectrum is near to the blue band of the visible light portion of the spectrum. The experiment's range of operation is from about 1,000 to 4,200 Angstroms. (Angstrom is a unit of measurement about 254 millionths of an inch long used to measure the length of light waves.)

The resulting information, in terms of spectral energy distribution and time-varying spectral intensity, will enable astronomers to better define the chemical composition, pressure and density of stellar objects. This information could result in revision of present theories of stellar origin and evolution. The actual measurements will be obtained by photometers, stored on board the spacecraft, and transmitted to Earth by telemetry.

Developed by the Space Astronomy Laboratory of the University of Wisconsin under direction of Professor Arthur D. Code, the experiment consists of three basic photometric systems:

University of Wisconsin UV Experiment



1. A multicolor filter photometer system intended primarily for measurement of stars, consisting of four eight-inch telescopes, each sending information to a separate three-color filter photometer.

2. A multicolor filter photometer system designed primarily to study nebulae, consisting of a 16-inch telescope.

3. A scanning spectrometer system employing two objective grating spectrometers with an aperture of about six by eight inches.

In general terms, the experiment works as follows: The stellar photometer telescopes and associated mechanisms measure the intensity of incoming ultraviolet light and convert these measurements into electrical signals. By using a rotating filter wheel, measurements at different wavelengths are obtained. The nebular photometer performs similarly. The spectrometer spreads the star light into a "rainbow" allowing the independent measurement of various wavelengths (colors) without the need for filters.

The experiment is controlled by a complex electronic system containing more than 450 encapsulated digital circuit modules located on an equipment shelf of the spacecraft's main body.

The experiment optics are protected by a sunshade located at the top of the spacecraft. During the launch phase the sunshade will be closed over the experiment tube. After orbit is attained, the sunshade will be opened to permit experiment operation. If the OAO-A1 control system is inadvertently pointed toward the Sun, the shade will close automatically to keep out potentially damaging solar rays.

THE MIT GAMMA RAY EXPERIMENT

This high-energy gamma ray detector device, developed by Dr. W. L. Kraushaar of the Massachusetts Institute of Technology, was first flown on board the Explorer XI by NASA in April 1961. However, since the satellite was not designed to be precisely stabilized, the detector, although it operated for 141 hours, viewed the sky haphazardly and could not be aimed at gamma ray sources. The short operating life resulted from the high orbit of this satellite since the experiment could operate only below the radiation belts

With the stabilized OAO-A1 and lower orbit this problem should be overcome and the detector--a "sandwich" crystal scintillator--should be a most useful tool to measure the intensity and arrival direction of high energy gamma rays. These rays are believed to result from the collision of cosmic rays and the gas which exists in the space between stars. By learning the point of origin of high energy gamma rays, the question of the origin of cosmic rays may be answered. The study of high energy gamma rays for this purpose is important since, unlike cosmic rays, gamma rays are electrically neutral and thus can travel through interstellar space undeflected by magnetic fields.

THE LOCKHEED X-RAY EXPERIMENT

The study of recently discovered sources of so-called soft X-rays, as a result of sounding rocket investigations, is the purpose of this experiment developed by the Lockheed Missiles and Space Co., under the direction of Dr. Philip C. Fisher at the Lockheed Palo Alto Research Laboratories.

Although X-ray emissions from the Sun have been studied for about 15 years, no other stellar source of X-rays was known until 1962. Since then, based on investigations conducted with sounding rockets, about ten different celestial X-ray sources have been discovered. Current theories suggest that these sources are located within our own galaxy. This is particularly significant since the quantity of this radiation is possibly a million times greater than similar radiation from the Sun.

The Lockheed device, a gas proportional counter similar in many respects to a Geiger counter, will be at least ten times more sensitive than devices flown previously on board sounding rockets. Its purpose is to better map and define X-ray sources. Results from this experiment could add substantially to our knowledge of stellar evolution.

THE GODDARD LOW ENERGY GAMMA RAY EXPERIMENT

This device, developed under the direction of Kenneth Frost at the Goddard Space Flight Center, consists of an anticoincidence shielded detector designed for flight on board the Orbiting Solar Observatory E spacecraft, modified for observation of low energy gamma rays.

It will look for sources of photons in the two to 180 Kev range throughout the celestial sphere. Previously detected X-ray sources below 10 Kev will be examined for the presence of a high energy component of their spectra out to 180 Kev. The directionality of the detector and the attitude control of OAO will permit identification of the sector of the sky from which the photons originate.

Data from this experiment, along with data from other experiments operating at lower energy, should provide a knowledge of the spectra of X-ray sources over a wide energy range. This knowledge will aid in suggesting and evaluating possible causes of X-ray emission in the sources examined.

ATLAS-AGENA D LAUNCH VEHICLE

OAO-A1 will be placed in its 500-mile circular orbit by an Atlas-Agena D launch vehicle. OAO is the heaviest payload ever carried by this vehicle combination.

Because of the large diameter of the OAO spacecraft, the special three-section shroud developed to cover it will enclose the Agena second stage as well as the spacecraft.

The launch vehicle portion of this mission will be longer than usual in that there is a coast of 50 minutes in a transfer orbit before the Agena fires for a second time to circularize the orbit. The Agena second burn and injection will occur when the Agena/OAO spacecraft combination is south of Australia.

AGENA STAGE

The Agena airframe consists of a forward section, a tank section, an aft section and a booster adapter section. The forward section, or forward equipment rack, houses and supports the flight control system helium tank, electrical power equipment, and communications and control equipment. The aft section houses and supports the propulsion system and associated control mechanisms, and the attitude control gas supply tank. The booster adapter section encloses the Agena aft section and remains with the Atlas when it separates from the Agena.

Propulsion is provided by a liquid propellant rocket engine system using regenerative cooling. The fuel is unsymmetrical dimethylhydrazine (UDMH) and the oxidizer is inhibited, red fuming nitric acid (IRFNA). The mixture is hypergolic and, in the Agena, produces a thrust of 16,000 pounds for 240 seconds in a vacuum.

A helium storage system mounted in the forward equipment rack provides pressurization for the propellant tanks. The tanks are provided with sumps at the aft ends to contain propellants at the inlets to the fuel and oxidizer pumps.

The sump design incorporates a fine mesh containment screen that permits flow of propellants into the sump as a result of the acceleration forces during powered flight, and inhibits return flow during vehicle coast periods. This feature eliminates the requirement for ullage rockets for propellant positioning.

OAO SHROUD

The shroud for the OAO spacecraft encloses both the Agena and the spacecraft and is approximately the same diameter as the Atlas vehicle. Because the OAO spacecraft, in its folded configuration, is larger in diameter than the Agena, a shroud designed to cover only the spacecraft would have resulted in a large hammer-head configuration unfavorable both aerodynamically and structurally.

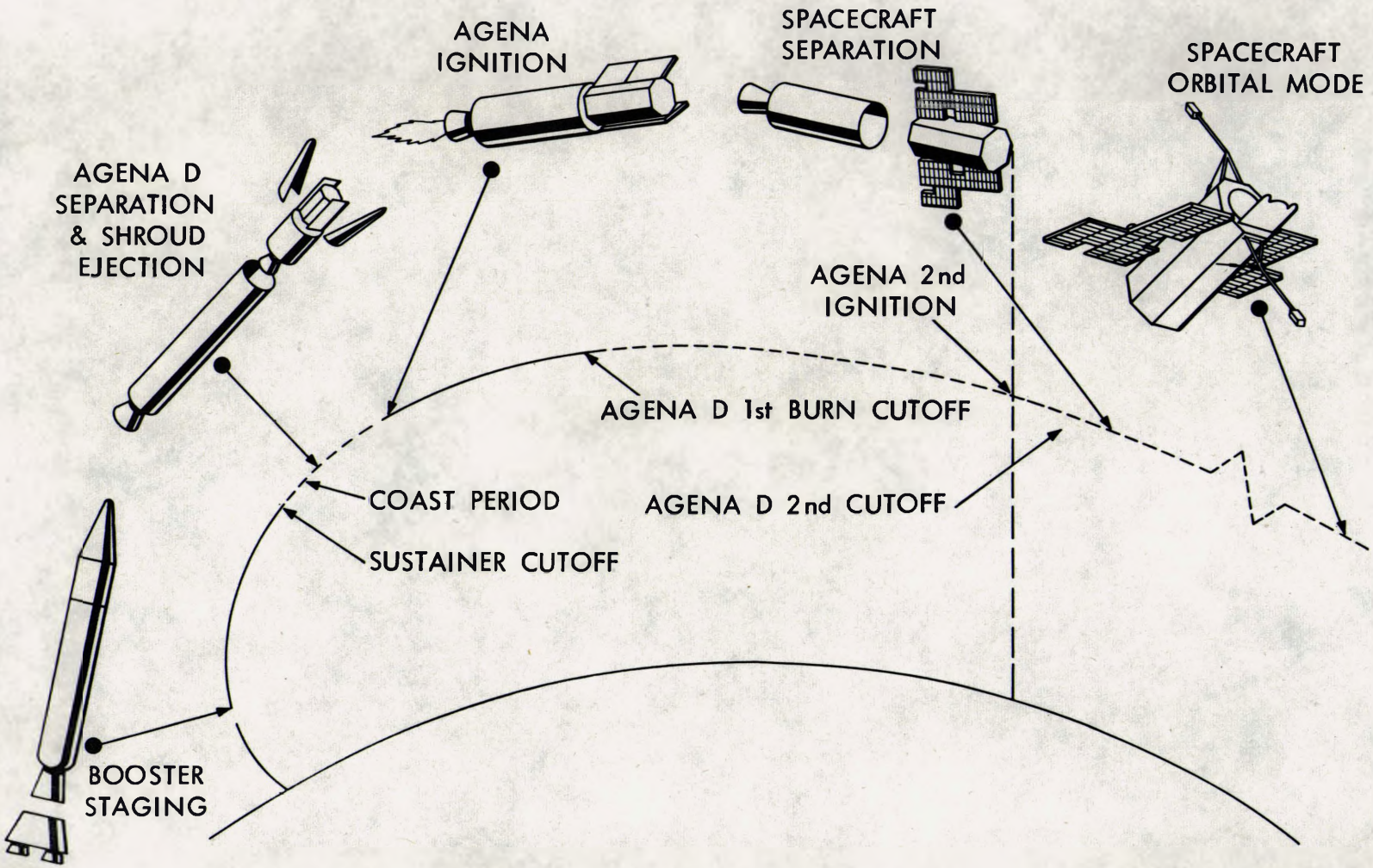
The present shroud, built by General Dynamics/Convair under Lewis contract, is composed of three fairings. The nose fairing is constructed primarily of fiberglass; the mid and aft fairings are aluminum.

The nose and mid fairings are jettisoned after Atlas sustainer engine cut-off during vernier firing in clam shell fashion and the aft fairing remains with the Atlas at the separation of Atlas from Agena.

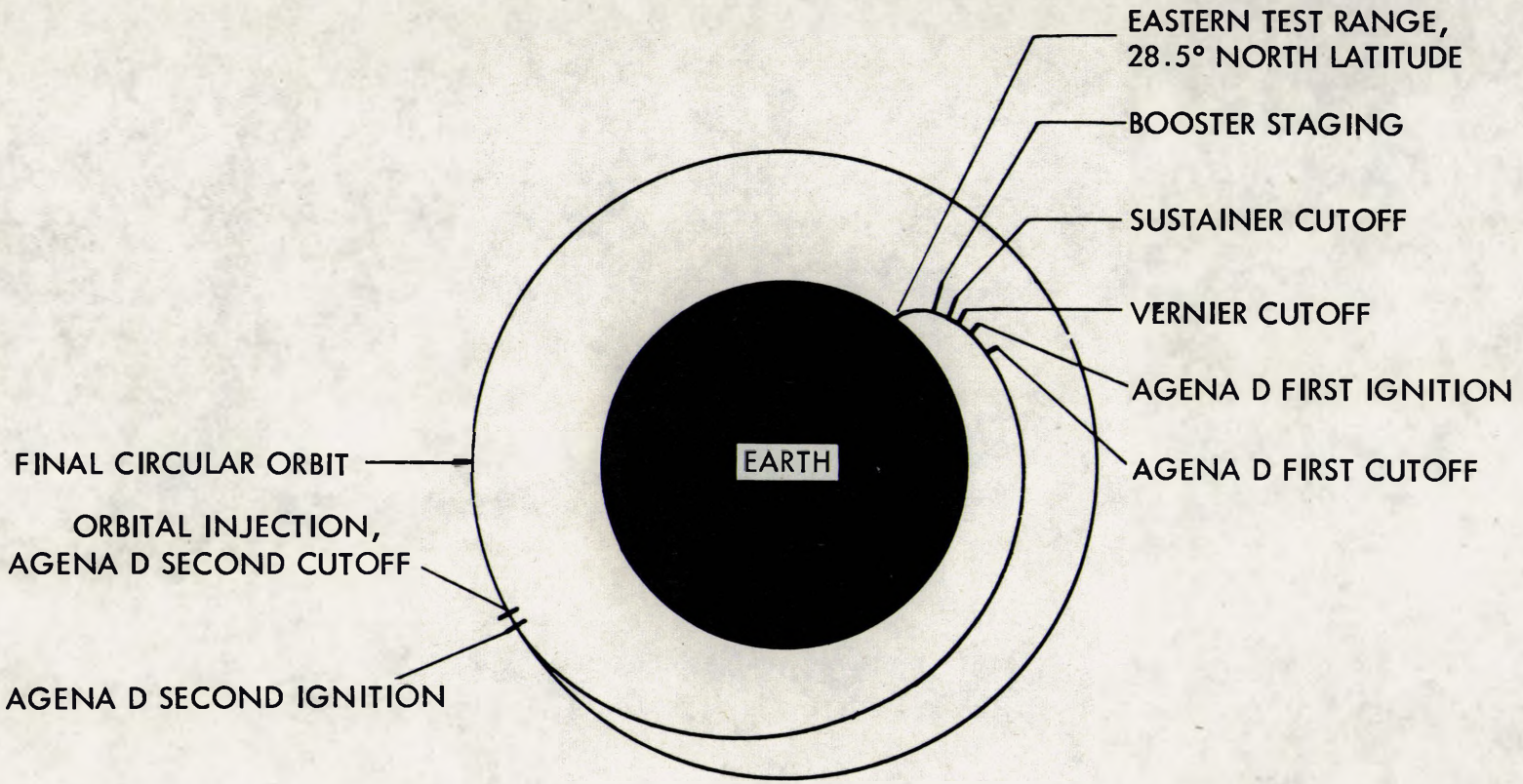
THE FLIGHT PLAN

The Atlas booster, using liquid oxygen and RP-1 kerosene-type fuel, launches Agena and the OAO-A1 from Pad 12 at Cape Kennedy. The Atlas rolls to a trajectory azimuth of 67° east of north during the vertical ascent after lift-off. This unusual northward launch is dictated by spacecraft communications which require contact with Rosman, N. C., for the first several orbits.

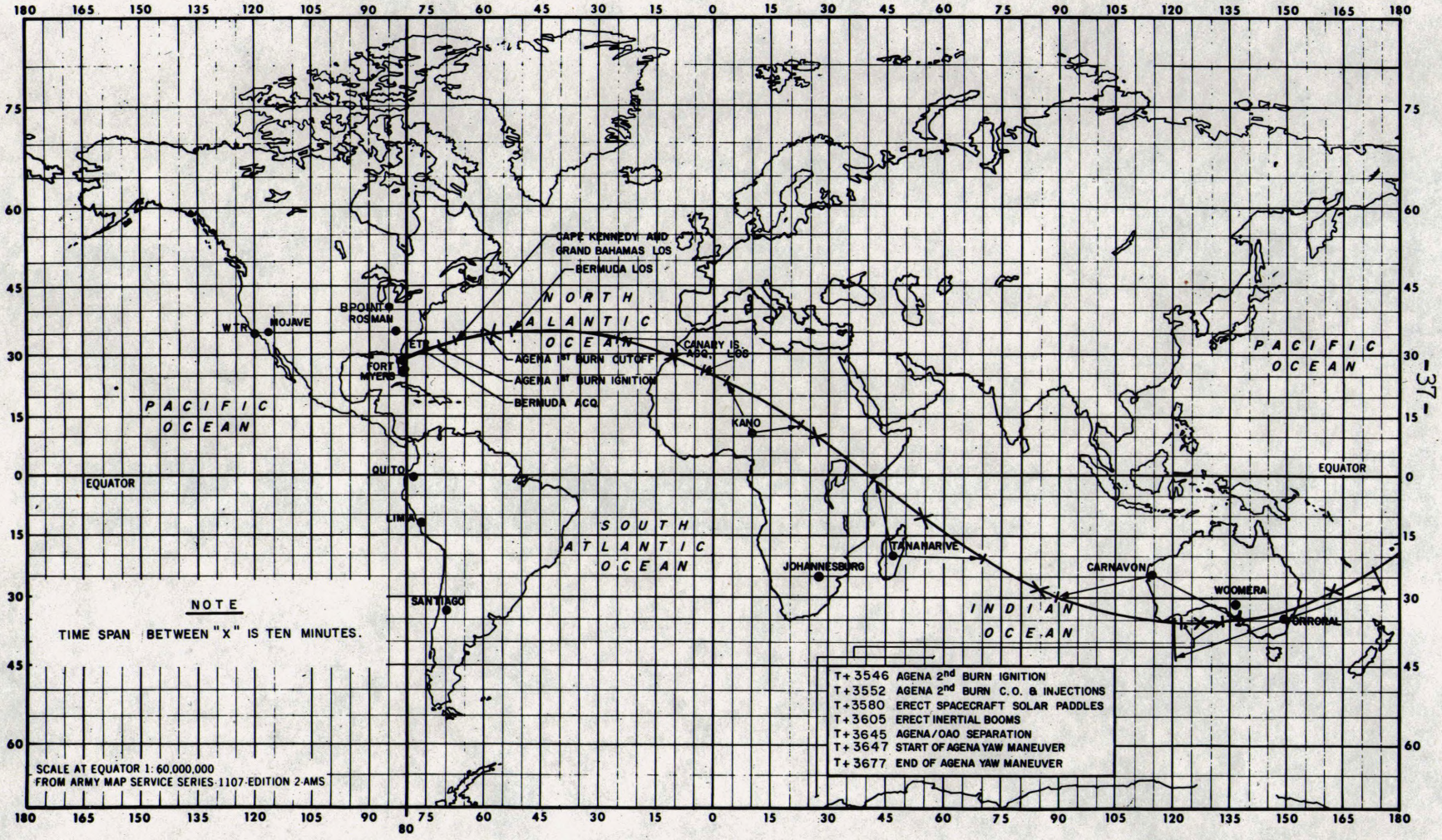
BECO (booster engine cutoff), followed by booster separation, occurs some 140 seconds after liftoff. The sustainer engine continues the boost phase for some 120 seconds longer. Some 4 1/2 minutes into the flight, the shroud is jettisoned. Atlas has boosted the Agena/OAO to an altitude of 100 miles at vernier engine cutoff (VECO).



OAO Launch Phase



OAO-A1 Orbit Plane

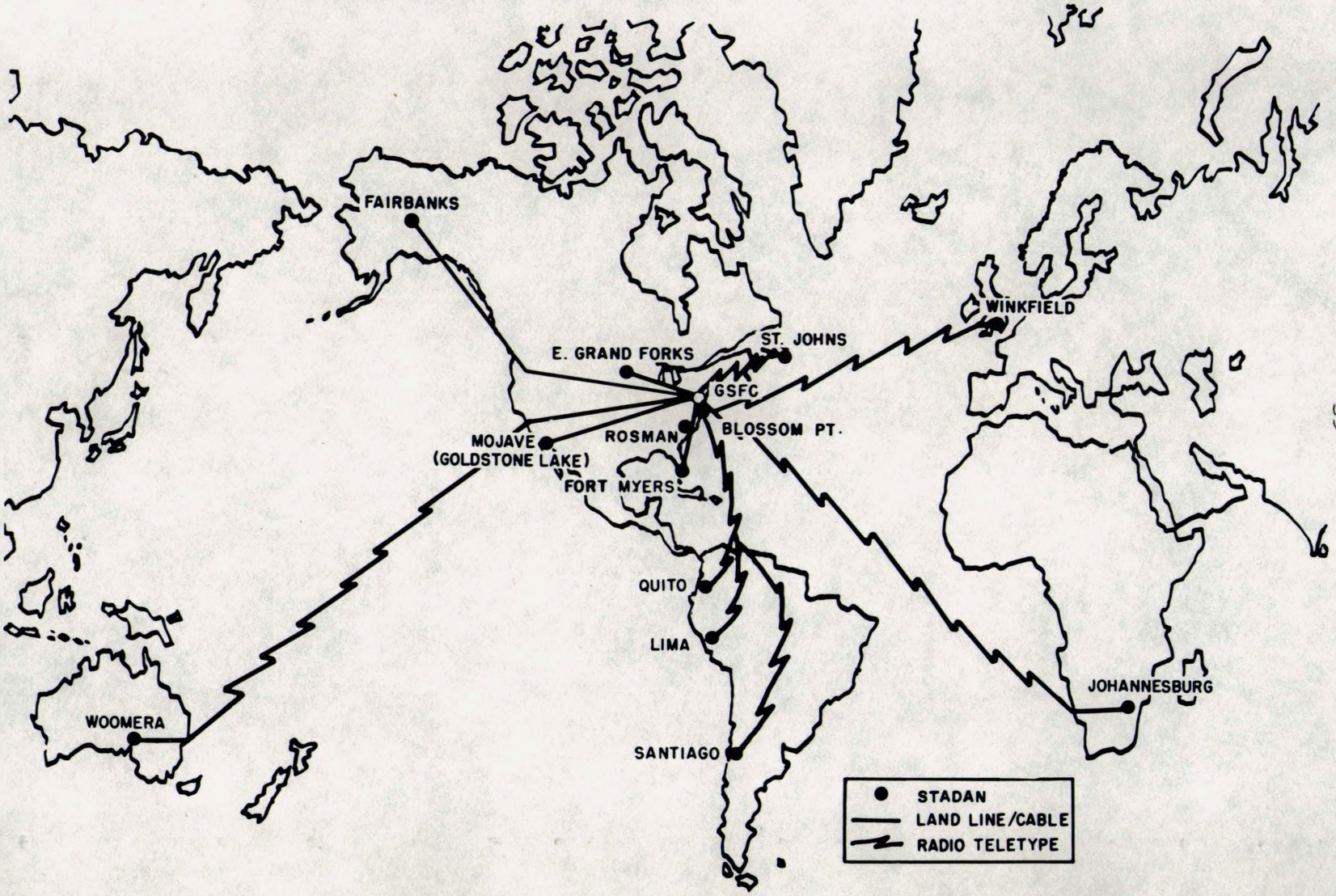

CAPE KENNEDY AND GRAND BAHAMAS LOS
BERMUDA LOS
NORTH ATLANTIC OCEAN
AGENA 1ST BURN CUTOFF
AGENA 1ST BURN IGNITION
BERMUDA ACQ
CANARY IS. ACQ. LOS
KANO
POINT ROSMAN
WTR
MOJAVE
ETR
FORT MYERS
PACIFIC OCEAN
EQUATOR
QUITO
LIMA
SOUTH ATLANTIC OCEAN
SANTIAGO
JOHANNESBURG
TANANARIVE
CARNARVON
WOOMERA
GRROOAL
INDIAN OCEAN
NOTE
TIME SPAN BETWEEN "X" IS TEN MINUTES.
SCALE AT EQUATOR 1: 60,000,000
FROM ARMY MAP SERVICE SERIES 1107-EDITION 2-AMS
T+3546 AGENA 2nd BURN IGNITION
T+3552 AGENA 2nd BURN C.O. & INJECTIONS
T+3580 ERECT SPACECRAFT SOLAR PADDLES
T+3605 ERECT INERTIAL BOOMS
T+3645 AGENA/OAO SEPARATION
T+3647 START OF AGENA YAW MANEUVER
T+3677 END OF AGENA YAW MANEUVER

After VECO the Agena/OAO separates from the Atlas and the Agena rocket engine ignites to place the Agena/OAO into a transfer orbit of approximately 86 miles perigee and 500 miles apogee. Agena/OAO coasts about 50 minutes to the apogee of the transfer orbit where the Agena rocket engine reignites to circularize the orbit. Agena then injects the OAO into a 500 mile circular orbit inclined 35° to the equator. After the OAO separates from the Agena, the Agena yaws to a heading 90° from the flight path.

OAO GROUND OPERATIONS

Ground control operations for OAO are directed from the OAO Control Center at the Goddard Space Flight Center and three remote-control stations at Rosman, North Carolina; Quito, Ecuador; and Santiago, Chile, which are part of the Satellite Tracking and Data Acquisition Network.

Each remote-control station, while performing its regular STADAN satellite tracking and data-acquisition functions, will also use specialized equipment and additional personnel to provide the special operational and control facilities required for OAO. This equipment includes an 85-foot parabolic antenna at the Rosman station, and 40-foot parabolic antennas at Quito, Ecuador, and Santiago, Chile.



OAO Tracking and Data-Acquisition Network

Functions of the OAO ground control system are to:

- Receive, record, and display OAO status and experiment data.
- Evaluate performance of the spacecraft and the experiment apparatus.
- Generate and transmit command information to the spacecraft.
- Provide a link between the spacecraft in orbit and the experimenter on the ground.

The OAO control center at Goddard is designed to coordinate and direct the overall operation of the OAO system on a round-the-clock basis. Its prime functions include:

- Checking the satellite for operational readiness.
- Preparing a predicted status of the spacecraft and experiment report for each pass over each remote-control station.
- Generating complete sequences of commands for transmission through each remote-control station to the satellite for proper execution of the experiment program.
- Transmitting the sequence of commands and predicted status data to the appropriate remote-control station.

- Receiving status and experimental data from the remote-control stations.
- Analyzing any portion of the OAO system and adapting the system to function even if deteriorated conditions exist in either the spacecraft or the ground equipment.

The ground operation system will be able to operate in any of four modes: (a) the initial stabilization and orientation mode, (b) checkout mode, (c) normal operational mode, or (d) backup mode. Duration of contact with the spacecraft during each orbit will average 10.4 minutes for any of the three data-acquisition stations.

DATA REDUCTION PROCEDURES

The data-reduction facility at GSFC will receive by mail all OAO-A1 data recorded at the remote stations. The Goddard facility will then decommutate, edit, and reproduce data in the proper format. Equipment used for OAO data processing includes a PCM synchronizer-decommutator, a computer format control buffer, an IBM-7094 computer, a small IBM-1401 computer, digital printers, plotters, and various quick-look instruments.

The purpose of the data-reduction facility is to provide services needed by experimenters for the first stages of data reduction.

Experimental data will be put into the form requested by the experimenter, using digital magnetic tapes and a format compatible with the 7094 computer.

At a minimum, the data will be reproduced in the form in which they were recorded on board the observatory.

The data-reduction facility will handle two types of data for the OAO: scientific experimental data and a status-data time history. Most of the work will be related to processing the experimental data. The data will be maintained in various categories with one category for each experiment and others for status data and for orbital data. Data will be forwarded to experimenters for analysis after preliminary reduction at Goddard. Scientific results will be reported to the scientific community by the experimenters.

FACT SHEET

ORBITING ASTRONOMICAL OBSERVATORY (OAO-A1)

SPACECRAFT

Weight	3,900 pounds, including 1,000 pounds of scientific experiment instruments.
Main Body	Octagonal cylinder, about seven feet wide and ten feet long.
Appendages	(a) Solar panels, six panels with three each mounted at 180 degrees on sides of main body, with 74,000 solar cells and total area of 114 square feet. Extended width of panels is 21 feet. (b) Two balance weight booms nine and one-half feet long which are extended after injection into orbit, mounted opposite each other. (c) One sunshade: Four feet, 10 inches long; four feet, three inches wide.
Power System	Spacecraft voltage is 28 volts, direct current; overall observatory power requirements are 405 watts average, with experiment average power requirements of 30 watts.

COMMUNICATION AND DATA-HANDLING SUBSYSTEM

Wideband telemetry (PCM/NRZ/FM)	(a) Two 7-watt, 400-Mc RF transmitters (redundant). (b) Two data-handling units.
Narrowband telemetry (PCM/PSK)	Two 1.6-watt, 136-Mc RF transmitters (redundant).
Radio Command	Four command receivers (dual redundant pairs with combiner in each redundant pair).
Tracking (CW)	Two 100-mw, 136-Mc RF transmitters (redundant).
Systems clock	Contains the logic circuitry providing timing and synchronization signals for observatory equipment.

STABILIZATION AND CONTROL SUBSYSTEM:

Sensors	
Sun Sensors	(a) Eight coarse sensors (four on pitch axis, four on yaw axis) used in initial stabilization. (b) Eight fine sensors (four on pitch axis, four on yaw axis) - used in initial stabilization.
Rate gyros	Three gyros, one for each axis, the voltage output for each being proportional to the angular rate about its sensing axis used during initial stabilization.
Star Trackers	(a) Six gimbaled trackers, each mounted on a 2-degrees-of-freedom gimbal system. (b) One boresighted star tracker aligned with the experiment optical axis.
Stellar TV Camera	One TV camera provides a backup system for determining spacecraft attitude.
Magnetic unloaders	Three torquing bars (one per axis) - Magnetic unloaders reduce inertia-wheel speed.
Actuators	
Reaction gas jets	
Primary jets	(a) Six high-pressure jets used during initial stabilization. (b) Six low-pressure jets used to remove momentum from the fine inertia wheels.
Secondary jets	Six high-pressure jets for backup during initial stabilization.
Inertia wheels	Three wheels, one for each axis, used to slew the spacecraft upon command.
Coarse wheels	
Fine wheels	Three wheels, one for each axis used to fine-point the spacecraft, capable of an accuracy within 0.1 second of arc.

-more-

TRACKING AND DATA-ACQUISITION STATIONS (operated under supervision of OAO Control Center, Goddard Space Flight Center):

Tracking Stations	STADAN network
Data-acquisition stations	(a) Rosman, N.C. (b) Quito, Ecuador (c) Santiago, Chile

LAUNCH PHASE

Launch Site	Complex 12, Cape Kennedy, Fla.
Launch Rocket	Atlas-Agena D.
Orbit	500-statute-mile, circular orbit inclined 35 degrees to the Equator.
Orbital Period	101 minutes nominal.

PROJECT MANAGEMENT-NASA Goddard Space Flight Center, Greenbelt, Md.

PRIME OAO CONTRACTOR	Grumman Aircraft Engineering Corporation, Bethpage, N.Y.
LAUNCH VEHICLE CONTRACTORS	General Dynamics/Convair, San Diego, Calif. Lockheed Missiles and Space Co., Sunnyvale, Calif.

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OAO-A1 EXPERIMENTS

Principal Investigators	Experiment Title	Brief Description
Professor Arthur Code and Dr. T. E. Houck, University of Wisconsin, Madison, Wis.	University of Wisconsin Experiment Package	Broad-band ultra-violet photometry device with seven independent observing instruments to view spectral energy distribution and varying intensities of selected stars and nebulae in Angstrom regions from 1100 to 3000.
Dr. W. L. Kraushaar, Massachusetts Institute of Technology, Cambridge, Mass. (now at the University of Wisconsin)	MIT Gamma Ray Experiment	Same high-energy cosmic gamma ray device as flown on Explorer XI, April 27, 1961. Will measure intensity and arrival direction of gamma rays.
Dr. P. C. Fisher, Lockheed Missiles and Space Co., Sunnyvale, Calif.	Lockheed X-Ray Experiment	A series of detectors designed to study sources of X-ray emissions in the sky. Originally developed for sounding rocket flight.
Mr. Kenneth Frost, Goddard Space Flight Center, Greenbelt, Md.	Goddard Gamma Ray Experiment	A series of detectors designed originally for flight on board sounding rockets to survey the celestial sphere for sources of photons in the two to 180 Kev range.

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THE OAO-A1 TEAM

NASA HEADQUARTERS

Dr. Homer E. Newell	Associate Administrator for Space Science and Applications
Jesse L. Mitchell	Acting Director, Physics and Astronomy Programs Division, OSSA
Dr. Nancy G. Roman	Chief of Astronomy
C. Dixson Ashworth	Program Manager, Astronomical Observatories
Allan H. Sures	Associate Program Manager, OAO
Joseph B. Mahon	Agena Program Manager

GODDARD SPACE FLIGHT CENTER

Dr. John F. Clark	Acting Director
Dr. John W. Townsend, Jr.	Deputy Director
Robert E. Bourdeau	Assistant Director for Projects
Robert R. Ziemer	OAO Project Manager
Dr. James E. Kupperian, Jr.	OAO Project Scientist
Albert G. Ferris	OAO Tracking Scientist and Project Operations Manager
Robert W. Stroup	Experiment Systems Manager
Dale H. Scott	Spacecraft Systems Manager

KENNEDY SPACE CENTER

Robert H. Gray	Assistant Director for Unmanned Launch Operations

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LEWIS RESEARCH CENTER

Dr. Seymour C. Himmel	Assistant Director for Launch Vehicles
H. Warren Plohr	Agena Project Manager
Richard P. Geye	Agena Project Engineer for OAO

PRIME CONTRACTOR - GRUMMAN AIRCRAFT ENGINEERING CORPORATION

Dr. Ralph Tripp	Program Director
Donald A. Imgram	Project Engineer

MAJOR OAO SUBCONTRACTORS

Ground Operations and Tracking Site Equipment, Westinghouse Electric Corp., Air Arm Division, Baltimore, Md.

Spacecraft Guidance and Control Subsystem, General Electric Co., Missiles and Space Vehicles Division, Philadelphia, Pa.

Star Trackers (subcontract to General Electric), Kollsman Instrument Corp., Elmhurst, N.Y.

Spacecraft Data Processing Subsystem, International Business Machines, Federal Systems Division and Space Guidance Center, Owego, N.Y.

Television Camera, Radio Corporation of America, Astro-Electronics Division, Princeton, N.J.

Wisconsin Experiment Package, Cook Laboratories, Chicago, Ill.

Communications, Hughes Aircraft Co., Santa Monica, Calif.; Data Handling, Radiation, Inc., Melbourne, Fla.;

Solar Array, Spectrolab, Sylmar, Calif.;

Battery, Gulton Industries, Metuchen, N.J.

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