SCOUT VEHICLE DEVELOPMENT FLIGHT
(AIR DENSITY-DRAG MEASUREMENTS EXPERIMENT)

National Aeronautics and Space Administration will launch the third in a series of Scout research rocket vehicles from Wallops Station, Wallops Island, Virginia, in an orbital flight which has two scientific purposes.

The principal aim is to study the performance, structural integrity and environmental conditions of the 72-foot, 36,600-pound four-stage Scout research vehicle and the guidance-controls system.

The second objective is to inject into orbit an inflatable 14-pound, 12-foot-diameter spherical satellite, fabricated of mylar plastic film and aluminum foil, for use in studying the characteristics of space -- primarily to measure air drag to determine the density of the earth's atmosphere on the fringe of space. (For a detailed description of past experiments in this field, see Supplement No. 1 to this press kit.)

The launch, part of NASA's Scout development program to provide the United States with a small, reliable and flexible solid-fuel booster capable of deep space probes and of orbital missions, will be a pioneering venture in two respects:

1. This will be the first orbital attempt by the U. S. using solid-fuel rocket -- culminating two years of development work by
the NASA Langley Research Center's Scout Project Group, in cooperation with industry and other Federal agencies.

2. It will mark the first orbital attempt with any vehicle from NASA's Wallops Station, where more than 3,500 rocket-propelled aerospace research models have been launched since the facility was established in July 1945 on the Eastern Shore of Virginia.

3rd Test of Complete Vehicle

This will be the third flight test of the complete Scout launch vehicle in the development series, all conducted from Wallops Island. The first flight test of the complete Scout vehicle was made on July 1, 1960, on a ballistic trajectory. The second test was made just two months ago on October 4, 1960, when the four-stage vehicle reached an altitude of 3,500 statute miles and impacted 5,800 statute miles down range.

Experience gained during these launching operations and development flights is being applied to improve performance of Scout as a future space research vehicle. Wallops Island facilities completed earlier this year are being used in Scout launchings. These include a pad, launch tower, block house, and related ground support, electronics and tracking equipment.

The present determination of atmospheric density at satellite altitudes is inferred from calculations of tracking data obtained from numerous satellites of different sizes and shapes. The air density-drag measurements experiment will provide accurate infor-
mation on the characteristics of space between altitudes of about 400 down to 100 statute miles--giving scientists a firm basis for more accurately predicting the orbital life of satellites and other vehicles.

In the air density-drag measurements experiment, the orbiting spherical satellite will be the measuring instrument. As the satellite, an object with a known mass and frontal area and highly sensitive to drag, begins to descend and dip more and more into the earth's atmosphere, it will lose energy. Worldwide radio and optical tracking measurements of the resultant changes in orbit will allow computations of atmospheric density.

Payload Construction

Payload of the Scout vehicle weighs 87 pounds. This includes the 14-pound inflatable satellite and 73 pounds of satellite ejection and inflation equipment, the fourth stage telemeter system, and necessary hardware--including the metal container in the nose of the Scout fourth stage. The fourth stage rocket motor and the attached payload container which will follow the sphere into orbit will weigh about 130 pounds.

About twice the thickness of the cellophane on a cigarette package, the satellite is constructed of four alternate layers of mylar plastic film and aluminum foil. The fabrication sequence is a layer of plastic film on the inside, an outer layer of aluminum foil, another layer of plastic film, and a final layer of aluminum foil on the exterior surface. Each layer is 0.0005
inches thick, resulting in a total laminated satellite thickness of approximately 0.002 inches or two mils. The sphere was fabricated at Langley by bonding together 40 flat gores of the aluminum-mylar laminate.

A 2\frac{1}{4}-pound, 3 by 4-inch radio beacon attached to the satellite will be powered by 280 solar cells and miniature storage batteries. The storage batteries will supply the necessary power while the satellite is in darkness. The beacon's continuous wave crystal control transmitter will have a power output of about 15 mw and transmit on a frequency of either 136.470 or 136.610 megacycles. The satellite is separated by a thin equatorial gap constructed of an insulating material--permitting the resulting two foil-covered hemispheres to form the antenna for the tracking beacon transmitter. This will be the first use of the Minitrack frequency of 136 megacycles in a satellite.

In gathering data for use in the drag measuring experiment, the satellite will be tracked through the small beacon by the Minitrack Receiving Station Network of the NASA Goddard Space Flight Center at Greenbelt, Maryland. Optical tracking of the highly-reflective satellite will be accomplished by the Smithsonian Astrophysical Observatory (SAO) of Cambridge, Mass., through use of Baker-Nunn camera stations and cooperating optical tracking teams. SAO also plans to optically track the fourth stage.
Three Baker-Nunn camera stations are in the United States-- at Jupiter, Florida; Maui, Hawaii, and Oregon Pass, New Mexico. Those in foreign countries are located at Olifantsfontein, South Africa; Woomera, Australia; San Fernando, Spain; Tokyo, Japan; Naini Tal, India; Arequipa, Peru; Shiraz, Iran; Curacao, Netherlands West Indies; and Villa Dolores, Argentina.

Scientists at the Langley Research Center will analyze the satellite tracking data for the determination of the atmospheric density.

The deflated mylar-aluminum foil satellite is folded accordion-fashion and scientifically packaged inside a metal tube 8\frac{1}{2} inches in diameter and about 19 inches long-- mounted on the front end of the fourth-stage rocket. The satellite and its attached tracking beacon components are inserted inside the front end of the tube to occupy a space approximately 8\frac{1}{2} inches in diameter and 11 inches long. Behind the folded satellite is an ejection bellows, a steel inflation bottle containing nitrogen gas under a pressure of about 1,800 pounds per square inch, followed by a fourth-stage telemeter and its batteries.

Orbital Data

The spherical satellite will be launched in a southeasterly direction on an elliptical flight path. The perigee will be about 410 statute miles and apogee about 1,275 statute miles. The belt covered by the initial orbits will extend 38 degrees north and
south of the equator. The satellite is programmed to travel at a velocity of approximately 16,600 mph as it is injected into orbit and at perigee. Satellite speed at apogee will be about 14,000 mph. Time of the satellite's initial orbital period is estimated at 112 1/2 minutes.

The first orbit will carry the sphere across the southern part of Africa and mid-Australia, and it begins its first pass over the United States on the initial orbit near San Francisco. It will cross the lower half of the country before passing over the east coast and the Atlantic Ocean above Charleston, South Carolina. During twilight and evening the sphere, when overhead, will be visible to the naked eye at perigee but will be only barely visible at apogee without the use of binoculars or telescopes.

Sequence of Events

After launch, Scout's first stage remains attached to the vehicle until it is blasted off at second stage ignition at 130,000 feet. The burned out second stage coasts with the vehicle to 315,000 feet and is blast-separated as the guidance programmer ignites the third stage rocket motor and the drag and heat fairings on the third and fourth stages are jettisoned. The spent third stage, with its guidance and control system operating, coasts to the injection altitude attached to the fourth stage. The fourth stage is then spun to about 150 rpm by small spin rockets, ignited, and separated from the third stage. The velocity increment gained during fourth stage burning places the payload and fourth stage into orbit.
Injection into orbit is scheduled to occur about 10½ minutes after liftoff -- about 1,325 statute miles down range approximately at 52 degrees west longitude and 35 degrees north latitude. A squib in the payload container is ignited and activates the inflation mechanism-- opening the inflation bottle valve and permitting the inflation gas to flow into the ejection bellows. The bellows expand immediately and push the folded satellite out of the front end of the container. The satellite remains attached to the bellows by a disconnect mechanism during the inflation process. After it is fully inflated, the sphere is released by the disconnect mechanism and a separation spring pushes the satellite ahead of the combination payload container-fourth stage. The small tracking beacon becomes operative for the first time automatically upon the satellite's ejection from the payload container. It requires 4½ minutes to eject, inflate and separate the satellite from the rocket.

The combination fourth stage rocket motor-payload container and the inflated sphere are expected to become increasingly separated in orbit because of differences in drag. Since the sphere is hundreds of times more sensitive to atmospheric drag than the heavier satellites which have been launched, it is expected to remain in orbit from a few weeks to possibly a year before spiraling into the lower atmosphere and burning up. The predicted orbital lifetime of the spent rocket motor is much longer.