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0024-2 84

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 6595TH AEROSPACE TEST WING (AFSC)
VANDENBERG AIR FORCE BASE, CALIFORNIA 93437

REPLY TO ATTN OF: VWZAC

10 MAR 1967

SUBJECT: Commander's Summary

TO: VWCO

1. Operation: Giant Chief

2. Range Operations Number: 4477

3. Launch Time: 1505:00.02 PST from SLV-3E, Vandenberg AFB, Calif.

4. Countdown History: The first countdown (4 March) was aborted because of an SLV-3 P/U system anomaly. The second countdown was initiated at 0700 PST, 5 March. Two holds were imposed for downrange radar calibrations and an emergency hold at T -32 seconds for failure to observe a GD/C land-line function (operation of a slave vent on the launcher hold down release system). Total hold time was 81 minutes.

5. Flight Performance: SLV-3 performance was satisfactory. The SV-5D successfully demonstrated cross-range maneuverable flight and performance was satisfactory until recovery. The SV-5D was not in proper configuration on the main parachute, and air recovery was not attempted. Although the water flotation bag inflated, the vehicle separated from the bag, possibly because of being towed when the main chute did not collapse immediately after water impact. The C-band blackout regime (ion sheath) was much shorter than predicted. The ARIS and three EC-121 aircraft acquired and tracked the vehicle, No data was acquired by the range tracker (T-AGM). Predicted and actual event times were as follows:

Event	Predicted	Actual
Liftoff	1330-2100 PST	1505:00.02 PST
BECO Command	T + 128.56	T + 128.99
Staging	T + 131.66	T + 132.10
SECO Command	T + 300.90	T + 301.83
Shroud Jettison Command	T + 306.90	T + 307.85
VECO Command	T + 313.90	T + 314.83
Separation Command	T + 316.90	T + 317.83
Retrofire Command	T + 317.90	T + 318.16
SV-5D Terminal Guidance Initiate	T + 1319.	T + 1299.3
SV-5D Ballute Deploy	T + 1589.1	T + 1567.2
SV-5D Main Chute Sequence Initiate	T + 1673.6	T + 1647.2
SV-5D Water Impact	T + 3133.	T + 3060.

RICHARD W. PALMER, Lt Colonel, USAF
Chief, SLV-III Boosted Systems Office

Cy To: SSD (SPO)

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AF Wants New Lifting-Body Program

Funding okay sought for PILOT project that would call for two SV-5 vehicles launched from B-52's; Martin, Northrop bidding

THE AIR FORCE is seeking financial approval for a new program involving two manned lifting-body vehicles under the Spacecraft Technology and Advanced Re-entry Tests (START).

The program will cost somewhat less than $10 million and include a series of piloted low-speed tests (PILOT) in a lifting-body configuration tentatively called the SV-5.

This is the second major Air Force effort in the lifting re-entry area. The first is PRIME, Precision Recovery Including Maneuverable Re-entry, already under contract to the Martin Co., Baltimore. PRIME covers the regime from de-orbit to touchdown and involves an unmanned lifting body.

The PRIME vehicle will be launched by an *Atlas SLV-3* booster from Vandenberg AFB late in 1966. The re-entry vehicle will be parachute-recovered in the Kwajalein area and the PRESS network will be used. The vehicle will perform a straight cross-range maneuver in the initial test.

The PRIME program will cost in the neighborhood of $60 million and involve four separate flights. The heat shield for the vehicle is being developed by Martin and will be a silicone-type ablator. The basic structure will be aluminum with some high-temperature metals in certain heat-sensitive areas. The nose cap will be a carbon-phenolic developed by Martin.

A "water-wicking" environmental control system developed by Martin will be included in the vehicles. Control will be by cold gas jets. Honeywell of St. Petersburg, Fla., will handle the guidance system and Northrop-Ventura will develop the modified "stovepipe" parachute recovery system.

● **Rocket-powered**—the PILOT program will have two medium L/D vehicles, each containing a Reaction Motor Div., Thiokol Chemical Corp., XLR-11 rocket engine. Each engine is a four-barrel affair and the firing sequences will be controlled by toggle switches. The powerplant was originally developed for early experimental rocket planes and was used extensively in the *X-15* program before the larger, XLR99 engine became available.

The SV-5 vehicles are not under contract, but both Martin and Northrop are bidding. Both vehicles will be launched from the *X-15* B-52's at Edwards AFB, Calif., in a joint test program coordinated with the NASA lifting-body programs.

The total test project, involving NASA's HL-10 and M-2 vehicles with the two PILOT vehicles, will require a third B-52 in addition to the two already in use at Edwards on the *X-15* program.

Both SV-5 vehicles will be essentially the same. The choice of two vehicles is based on program expediency and a commonsense attitude in running such a research program. Any number of things can happen in a manned test program and a second vehicle procured initially is substantially cheaper than a later buy.

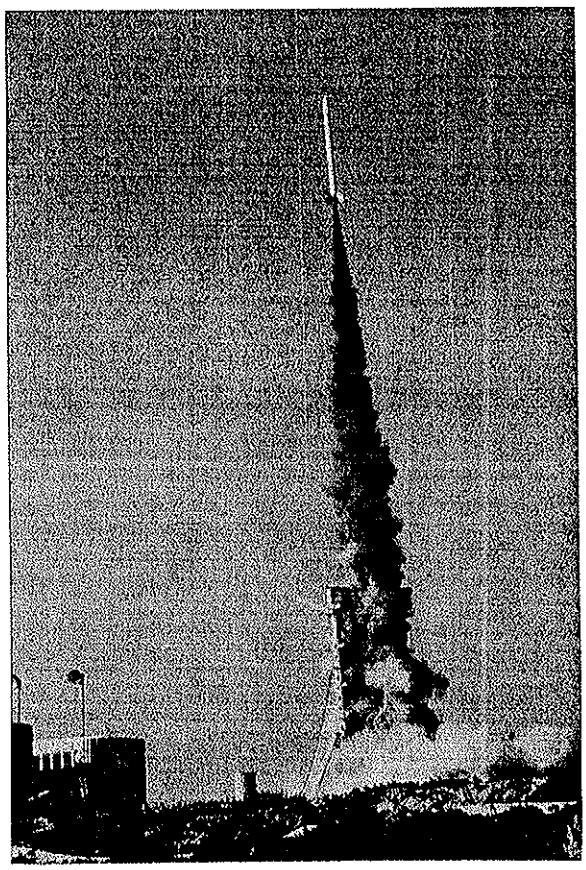
● **Beckoning door**—Air Force officials emphasize that the entire START effort is designed to quickly and efficiently establish the usefulness of lifting-re-entry concepts. If feasibility can be demonstrated, the area is wide open for orbital return approaches.

Lifting re-entry gets operational flexibility into orbital returns and substantially increases the range of landing areas. This has a direct effect in reducing manned and unmanned recovery costs.

In addition to the two major vehicle programs, there are studies into other forms of lifting re-entry methods. These preliminary design efforts cover the cost, weight and mission flexibility of high L/D unmanned vehicles.

Air Force experts do not anticipate problems in the high-temperature re-entry areas with respect to materials or methods of fabrication. There probably will be minor headaches but the technology and materials are said to be well in hand. One Air Force official told MISSILES AND ROCKETS the contractor responses to the SV-5 PILOT program have been remarkably low in their cost estimates. ■

First Photo—French Hybrid Launches



ONE OF THREE French hybrid rockets launched last June by the Office National d'Etudes et de Recherches Aerospatiales at the C.E.R.-E.S. range, Ile du Levant, France. The motors operated exactly as they had in previous ground tests, with thrust variation of 5 to 1, during the 32-sec. firing. The test launches delivered an 11-lb. payload to altitudes of 43 mi., with an all-up launch weight of 170 lbs. The hybrids used a pressurized liquid oxidizer and a rubber-based solid-propellant grain. In the words of the official French announcement, ". . . the supply of oxidizer is obtained by pressurization by means of a gas expanding naturally from a tank, without any regulation equipment."

The Aerospace Week

Burner II Studied for Minuteman Fourth Stage

A leading contender for the fourth stage of the *Minuteman I* ICBM when reconfigured as a spacecraft launch vehicle is the Air Force's new *Burner II* solid propulsion system, according to Air Force sources.

The *Burner II* upper stage, which was declared operational earlier this month (TW, March 6, p. 14), uses a Thiokol Chemical Corp. motor and is designed to fit a variety of service launch vehicles.

The Air Force's Space Systems Div. last week officially announced that studies were now under way to evaluate use of surplus *Minuteman I* ICBM's as space launch vehicles. The prospect of such a program had been apparent for some time (M/R, May 30, p. 26).

The two principal funded studies on the project are being carried out by Boeing Co., *Minuteman* prime contractor, and TRW Systems, systems engineering contractor. Both firms have $150,000 contracts to study engineering design, support requirements and flight test plans. Officially, the studies are to be completed in May; however project sources indicate they may be in hand a few weeks early.

It is believed that Ling-Temco-Vought, Inc., is also teamed with TRW on the studies. Also believed to be under consideration as a fourth stage contender is the United Technology Corp.'s FW-4 engine, used as a fourth stage in LTV's *Scout* booster.

Air Force spokesmen report that the addition of the fourth solid-propellant stage to the ICBM would be the most extensive change involved in the new mission. The missile's basic three-stage solid propulsion system would remain unaltered.

There is also some speculation that the chief potential user for the augmented *Minuteman* would be NASA, since the principal Air Force scientific satellite effort, carried on under the Office of Aerospace Research Support Programs, is already well stocked with surplus *Atlas* missiles.

The beefed-up *Minuteman*, according to the Air Force, could place "substantial payloads" into a 500-n.mi. circular orbit or smaller loads into an orbit as highly elliptical as 150 by 50,000 n.mi.

If the study shows the concept to be feasible, two converted *Minutemen* will be launched from the Eastern Test Range, probably in 1968, to place instrumented payloads into circular orbits.

Earlier studies of the upgraded *Minuteman* concept by the Air Force's Ballistic Systems Div. reportedly showed that a 300-lb. satellite could be placed in an 800-n.mi. circular orbit or a 250 by 10,000-n.mi. elliptical one.

PRIME Flight Good; No Recovery

Air Force has had a second successful flight of the *PRIME* SV-5D lifting body re-entry vehicle, but, to the service's chagrin, it has also failed to recover the vehicle for the second time.

Preliminary study of data indicates that excellent telemetry was recovered in flight, as was the case with the first *PRIME* launch (TW, Jan. 2, p. 14).

The craft also successfully accomplished pre-programmed cross-plane maneuvers, a very significant first for the program. The Martin-built *PRIME* vehicle is believed to be capable of cross-plane maneuvering from its nominal ballistic flight path to a distance of between 300-500 miles; however, the craft may not have been fully exercised to this range because of flight-test range restrictions.

Failure to recover the vehicle is believed to be due to a breaking away of the spacecraft from the flotation gear once the craft hit the water. The parachute, part of the recovery system, apparently did deploy successfully to slow the descent into the target area just off Kwajalein.

The second *PRIME* flight was launched March 5 from Vandenberg AFB, Calif., on its 30-min. flight. Two more flights are scheduled, with the next one believed to be two or three months away.

DOD Supplemental Vote Due

Final action was expected from the Senate late last week on the Dept. of Defense FY 1967 supplemental authorization bill, which provides $81 million more than the Administration requested.

Conferees from the House and Senate earlier agreed upon the House amendment which added funds for the EA-6A aircraft. The House passed the bill March 8.

The conferees also agreed to accept a Senate amendment that directed the Secretary of Defense to formally advertise all contracts and award them on a competitive-bid basis to the lowest responsible bidder.

TW Editors Win Two ABP Neal Awards

Floyd G. Arpan, Indiana University professor and chief of Jesse Neal Award selection board, congratulates TECHNOLOGY WEEK Editor William J. Coughlin on occasion of presentation of two awards to Coughlin and Executive Editor Michael Getler. The American Business Press organization honored a series of articles written by the two editors after a visit to Vietnam and presented Coughlin with a special award for a series of editorials related to the Vietnam coverage.

Second PRIME Flight Readied

The Air Force finished preparations last week for the second in the series of four launches of its PRIME (Precision Recovery Including Maneuvering Reentry) test vehicle and the first to be fully maneuverable.

The first flight made Dec. 21, 1966, returned significant data, according to the AF, but was not considered fully maneuvering. That initial flight followed a straight-line lifting re-entry path (TW, Jan. 2, p. 14). The second flight will fly "a different profile," probably in-plane only, according to an AF official.

Despite a malfunction during the final phase of descent that prevented recovery of the PRIME SV-5D vehicle, the Air Force reported that data were telemetered from 204 of the 205 measuring points carried by the spacecraft to monitor subsystems, structure, heat shield materials and performance.

The first vehicle (shown at right being checked out after mating to the Atlas booster at Vandenberg AFB, Calif.) was said to have confirmed seven technological developments:

(1) The heat shield specifically developed for this type of re-entry vehicle performed as expected.

(2) The guidance system performed with the required accuracy.

(3) The environmental control system developed specifically for the vehicle performed as expected.

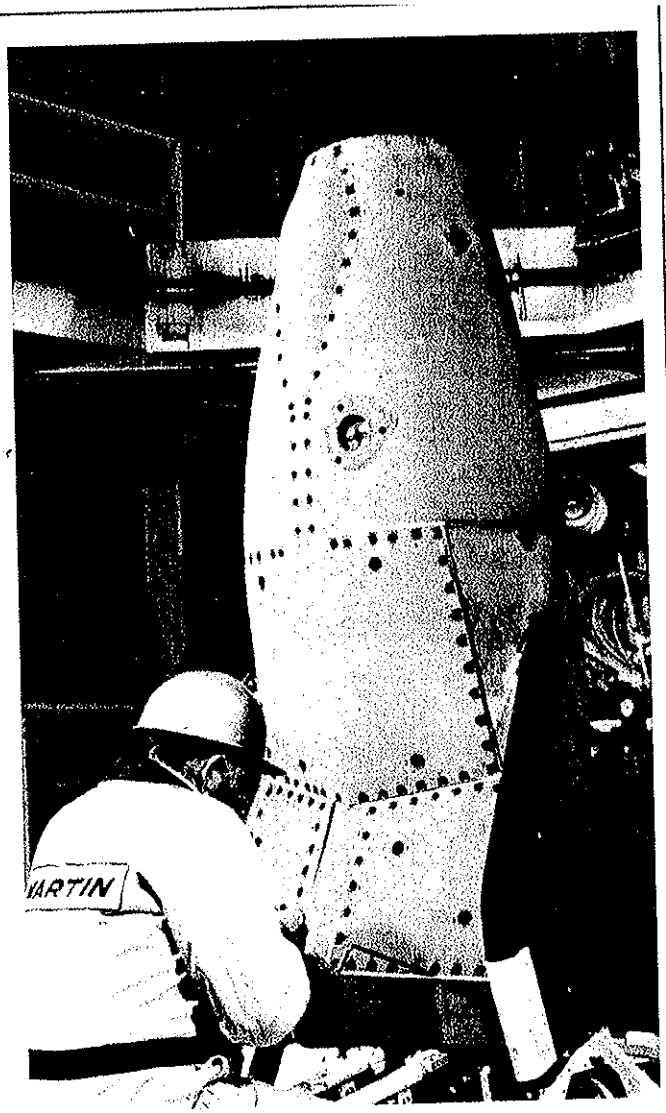
(4) Controls for both exospheric and atmospheric flight performed as expected.

(5) Instrumentation and electrical subsystems met all requirements.

(6) The vehicle was aerodynamically stable throughout the flight.

(7) The vehicle was maneuverable.

PRIME is the second phase of the AF program known as START (Spacecraft Technology and Advanced Re-Entry Tests). Martin Marietta's Baltimore Div. is the builder of the SV-5D used in PRIME.



Nimbus Telemetry Ordered

An advanced telemetry system known as Versatile Information Processor (VIP) will be supplied for the *Nimbus D* weather satellite by Radiation, Inc., Melbourne, Fla.

The firm was selected by NASA's Goddard Space Flight Center for a cost-plus-fixed-fee contract expected to exceed $1 million and covering one engineering test model, one prototype and two flight models. *Nimbus D*, a 1,400-lb. satellite carrying 11 meteorological sensors, is scheduled for launch in 1970.

Goddard engineers designed the VIP and built and tested a laboratory model. The device measures 8 x 6 x 13 in. and processes and formats scientific data obtained from the sensors while recording data on spacecraft performance.

Supplemental Hiked $81 Million

The House Armed Services Committee added $81 million to the FY 1967 defense supplemental authorization bill it reported out last week. The funds are to go to procurement of EA-6A Intruder aircraft. Total of the bill as reported by the committee is $4,548,200,000.

Ocean Group Assigned Review

First task of the newly formed Marine Resources Commission will be to review the present Federal structure for oceanography.

Before the 15-man commission, headed by Dr. Julius Stratton of the Ford Foundation, turns to its job of studying future U.S. oceanography efforts, it must evaluate present Federal activities in the field in order to recommend the best possible structure.

The commission will report to the President through the Marine Resources Council, headed by Vice President Hubert Humphrey. Humphrey outlined the commission's duties at its first meeting Feb. 24-25 in Washington, D.C.

Whether the results of the commission's first job will be included in its final report is not clear. It is felt that the group will have to step on some toes to do the job properly and that early publication of their findings and recommendations could hamper their work in the second phase of the effort.

Humphrey urged the commission to cooperate and collaborate with the council, pointing out that the two groups are complementary and not competitive. The council is a coordinating body of existing Federal machinery and the commission "is directed to pioneer, to experiment, to look to the future," the vice president said.

Humphrey also emphasized that the private sector of the U.S. oceanographic effort should have a voice in the major planning for the future.

Beryllium Filament Cost Cut

Scientists at United Aircraft Research Labs are nailing down a process for the production of beryllium filament at a cost of less than $100/lb.

The metal filament is now made by conventional wire drawing techniques and a pound of the reinforcement runs over $3,500. A research team directed

the design of component structures.

The data base generated will closely reflect the materials configuration and properties of greatest interest to the designer. This base of data will be supplemented by specialized tests. A program is being planned to develop nondestructive test procedures and techniques for effective collection, collation, analysis and, finally, dissemination of all data generated to the aerospace industrial community.

The approach taken by the Materials Lab planners has many facets. All are interrelated. The essential task is to compress centuries of normal progress into a few years of intelligently planned effort. Materials progress had always been sporadic until the recent explosion spawned by space activities. The spillover into other areas such as aircraft and naval vehicles is now visible.

LAUNCH VEHICLE RECOVERY

The *Titan* program may soon be expanded to encompass a project to define some of the cost problem[s] ciated with recovery and refurb[ishment] of booster stages.

Military space experts are [study]ing a Martin Co. proposal to [recover] three *Titan* first-stage core vehic[les]. proposed effort is cumulative—[the] aspects are exactly the same in [all] cases but the first core will be [lost] destruction.

Information from this port[ion] feed into a second recovery, [and] the reclaimed stage will be refur[bished] static-fired and then examined. [If] results are good, the third elem[ent] involve recovery, refurbishment [and] launch, followed by recovery.

The basic idea is to define [what] involved and finally achieve a re[liable] hard set of data points through [a] tively economical program. [We] do not have enough informa[tion] intelligently approach the recove[ry] tion with present launch vehi[cles]. furbishment cost projections [are] cially soft.

Elements included in the [study] approach start with a *Titan* [II] (*Titan II* first stage), a Sikor[sky] 54A Flying Crane helicopter, [Para]rop's Cloverleaf gliding parach[ute], American Engineering's aerial [snatch] equipment, and commercial [ocean] barges or a Navy mothballed [aircraft] carrier. Total cost for all three [phases] of the program is about $3.6 mil[lion].

Cost savings seen—If the [program] proves itself and Martin/Ae[rospace] furbishment estimates prove [out], the potential net savings per [launch] vehicle is $800,000—including [both] vehicle and recovery costs.

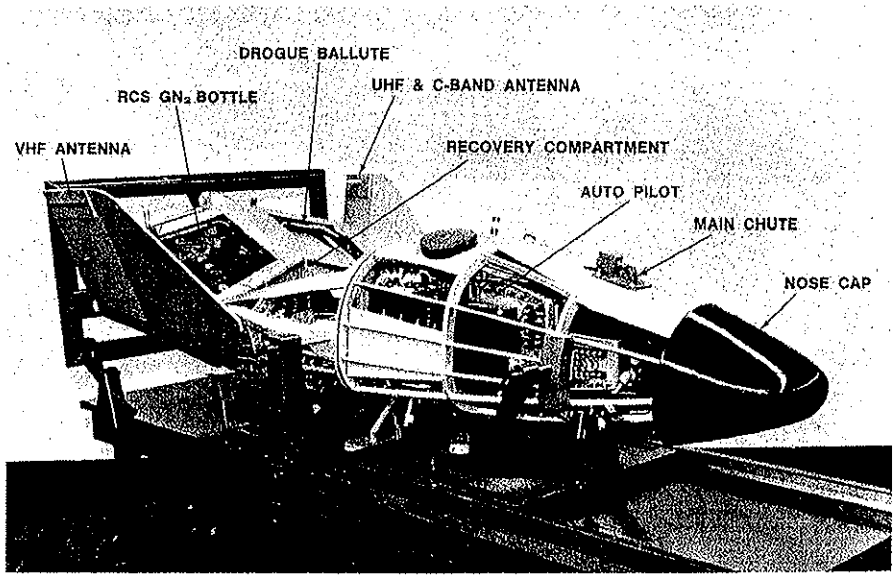
The recovery effort will not [affect] the primary missions in any way. [There] will be some structural changes [to the] *Titan* first stage including addi[tion of] new external ring frame and [two] longerons, and an external [pod] taining the recovery compon[ents].

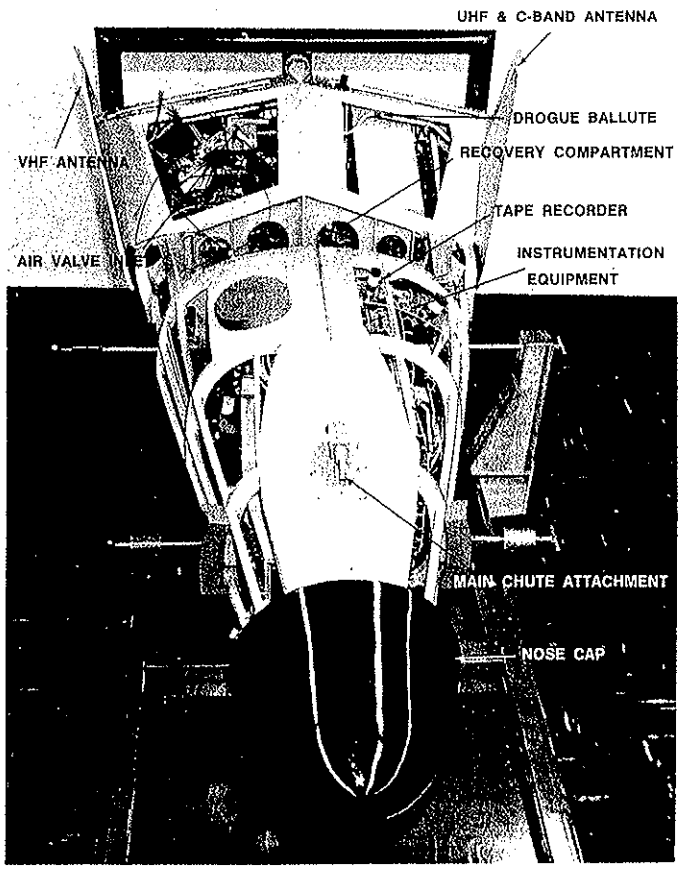
There is no change in second [stage] or *Agena* payloads, no effect [on] booster payload environment, no [change] in vibration and boost dynam[ics] sure, and no change in control [system] and staging.

There will be no calculable [change] in primary mission reliability. [There] will be an 18% increase in [drag] aerodynamic drag and a payload [weight] degradation of 193.7 lbs. [These] not appreciable effects on total [vehicle] performance.

The recovery would be [made] via helicopter. Current booster [impact] predictions have proven [accurate] enough to allow Martin planners [to] point almost exactly the helicopter [recovery] cation area.

The program calls for practice [recoveries] by the Chinook over [the]





Boilerplate models of Martin's PRIME vehicle showing position of all associated components necessary for the four PRIME launchings from Vandenberg AFB. The vehicle itself is part of a technology program designed to establish flight and other operational characteristics needed for the functional design of a manned maneuvering re-entry vehicle.