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Paper Session II-B - The Department of Defense Space Test Program

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THE DEPARTMENT OF DEFENSE SPACE TEST PROGRAM

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HISTORY

The Department of Defense (DOD) Space Test Program (STP), a tri-service activity under the executive management of the Air Force, is chartered and funded to provide spaceflight opportunities for DOD research experiments and agencies that are not authorized their own means of spaceflight. In its 25 years of existence, the program has flown over 170 experiments on over 50 missions. Experiment sponsors include the Navy, Army, Air Force, DARPA, DNA, NSA, NASA, and other government agencies.

In the mid 1960s, high level management in the DOD recognized the need for an on-orbit research and test capability for the timely, cost effective development of technology. At that time, basic research of the space environment was being pursued by the Air Force Office of Aerospace Research (OAR), although spaceflight support, (selecting high-quality payloads and providing prompt spaceflights), to developmental and proof-of-concept payloads were not available. It was recognized that this capability had to be a low cost, rapidly responsive, and flexible program.

In 1965 the Director of Defense Research and Engineering (DDR&E) authorized the establishment of the Space Experiment Support Program (SESP) which was to be tri-service in nature. The Air Force was designated the executive agency and a Program Office was established at Space Systems Division. Originally chartered to support advanced development and engineering development payloads, SESP's scope was increased in 1968 to include basic research and exploratory development payloads previously supported by OAR. In 1971 the program was designated the Space Test Program, and is now managed by the Space Test and Transportation Programs Office (ST&T) (Fig. 1). ST&T, located at Los Angeles AFB, CA, also has a detached operating location at the NASA Johnson Space Center, Houston, TX.

The first SESP mission, P67-1, was launched from Vandenberg AFB, CA, on 29 June 1967. The Thor/Burner II carried two experints, one Army and one Navy, into a 2100 nm orbit. On 7 August 1967, three Air Force experiments, S67-3, were carried aloft on the aft rack of an Agena spacecraft. These initial payloads space qualified a prototype operational system and investigated space and earth environments, the two major areas of experiment objectives flown by STP.

With the advent of the National Space Transportation System (STS), a new realm of opportunity became available to the STP community. Although on-orbit time may be limited for non-deployed experiments, the Space Shuttle offers the advantages of small payload accomodations in various configurations, the opportunity for human operation and intervention, and the ability to return experiments, some of which may be flown again.

PROGRAM MANAGEMENT PROCESS

Each spring, the three military services conduct separate experiment review boards to select and prioritize projects submitted by various DOD laboratories and research agencies. In May of each year, a tri-service prioritization board is held to consolidate these submissions. A panel of senior representatives of the three military services and DARPA are presented with briefings given by the principle investigators of the experiments. The panel, which is also consulted by representatives of NASA, the Space Test and Transportation Programs Office, the Aerospace Corp., and Anser Corp., vote on the priority of experiments according to the following criteria:

-Military Relevance - 50%

-Support and Funding from Sponsor - 15%

-Service Priority - 15%

-Readiness for Flight - 10%

-Quality of Proposed Experiment - 10%

Two lists of experiments emerge from this process:

1. Primary experiments: Experiments requiring a dedicated satellite bus and/or launch vehicle.

2. Secondary Experiments: Experiments capable of being attached to host satellites/vehicles. This also includes Space Shuttle middeck locker and cargo bay small payload accomodation.

(A subcategory of secondary experiment has been designated Military-Man-In-Space (MMIS). The objectives are to exploit the Space Shuttle capability of providing a manned laboratory, and to serve as a pathfinder in fully defining man's military role in space.)

Following approval of the consolidated lists, the Space Test and Transportation Programs Office then begins the mission development process (Fig. 2). Besides searching for the optimum access to orbit, this process includes an assessment of experiment requirements and objectives to determine if a synergism exists between experiments. Factors such as weight, volume, power, attitude and pointing, environmental constraints,launch vehicle performance margin, altitude and inclination, etc., are considered in selecting an optimum payload "mix".

A Spaceflight Plan and Memoradum of Agreement(s) are generated and forwarded to the Air Staff for approval. Upon approval and funding authorization, ST&T manages the entire process of integration, contracting for satellite bus acquisition (if required), coordination of launch vehicle procurement, integration of experiment(s), launch, operations, and data retrieval. This process is illustrated in Fig. 3.

STP: A RECORD OF SUCCESS

The Space Test Program has enjoyed a remarkable record of significant contributions to space technology. Fig. 4 illustrates this success story, and the various sponsoring services, for experiments flown prior to the Space Shuttle Challenger accident. Since then, a restructuring of DOD launch vehicle policy and programs temporarily halted the availability of access to orbit. But with the STS Return to Flight, STP has been able to successfully fly no less than 14 secondary experiments on both NASA and DOD Space Shuttle missions. There are also STP programs approaching readiness for launch now scheduled on two expendable launch vehicles, as well as the Space Shuttle, in 1990.

The success of the STP low-cost approach to one-of-a-kind spacecraft design and test is noteworthy. One of the main features of this approach is the judicious application of redundancy. Redundant hardware is applied to subsystems considered to be fragile, such as command, data storage, and data return systems. Sometimes operational back-ups are provided, instead of redundant hardware, to maintain reliability. Another feature is the extensive use of existing hardware. In such cases, a pedigree search and evaluation of parts are always conducted before their use. A unique feature is the fact that STP builds only one set of hardware, with spares of selected critical components only, which is used for both testing and flight. For cost savings, STP does not build qualification units as commonly done for other programs. Such an approach ceased to be a novelty when MIL-STD 1540B (Test Requirements for Space Vehicles), published in 1982, incorporated a "protoflight" section modeled after the longstanding STP practice. A recent initiative is the Space Test Experiment Platform (STEP), now in source selection, intended to serve as "generic" busses for a wide range of experiments.

The benefits of STP to the DOD, as well as the civilian space community, have been as varied as the payloads which have been flown. Some have been research oriented and obtained data which may not be immediately utilized by existing programs. A large number of STP payloads have produced data applicable to the next generation of systems, or actually tested these systems. The area of greatest contribution is the understanding of the dynamics of the near-earth space environment. Some examples of the unique programs STP has flown include:

P78-2, Spacecraft Charging At High Altitude (SCATHA), launched in 1979 and observed differential spacecraft charging as high as 10,000 volts. It recorded electrical property changes of commonly used spacecraft materials, discharge phenomena, and contamination. The dynamic events observed, when correlated with anomolies experienced on other space vehicles, have served as a diagnostic tool for investigating these anomolies.

P78-1, also launched in 1979, demonstrated advances in surveillance technology. A white light coronagraph built by the Naval Research Laboratory also observed and recorded for the first time a comet colliding with the sun.

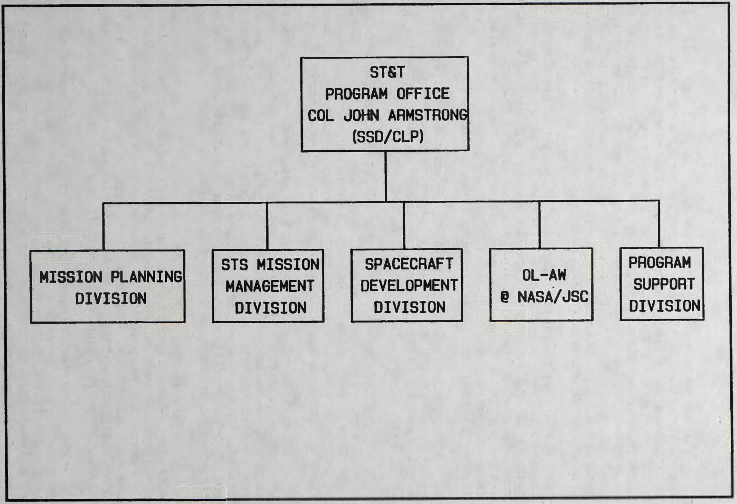
P83-1, launched in 1983, was equipped with experiments from the Defense Nuclear Agency and the Air Force Geophysics Laboratory. Data were successfully acquired on the distorting effects that structural plasmas have on communication and radar signals. Simultaneous ultraviolet auroral measurements were made.

An example of STP's resourceful approach to rapid and inexpensive acquisition is P87-1, the Polar Beacon and Auroral Research Experiment (Polar BEAR). A complement of DOD experiments was integrated onto a Navy Transit satellite bus that had been on display in the Smithsonian Institution for eight years. STP acquired the satellite in 1984, refurbished it, and successfully launched it on a Scout booster in 1986.

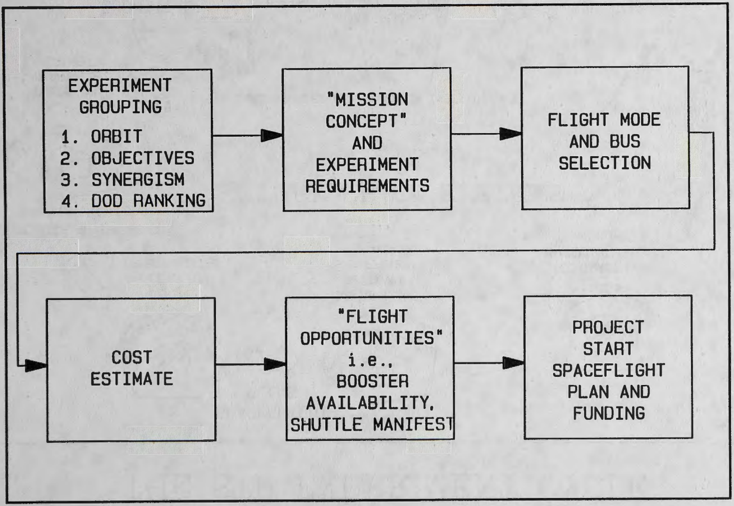
A truly unique STP flight was accomplished in January 1988 with the P87-3 mission. The Gamma Ray Advanced Detector (GRAD), previously scheduled for a Space Shuttle flight, was rapidly reintegrated in response to a once-in-a-lifetime opportunity to observe a supernova, visible only from the Southern Hemisphere. GRAD was "launched" on a high-altitude balloon from McMurdo Station, Antarctica, and recovered after a two-day flight.

The Space Test Program has successfully demostrated its goal of providing a responsive, cost effective on-orbit research and test capability. Experiments have supported a wide array of mission areas (Fig. 5). Since its first launch in 1967, the Program has steadily grown in technical expertise and innovative management practices. STP is expected to continue to be an important science and technology window to space in the future.

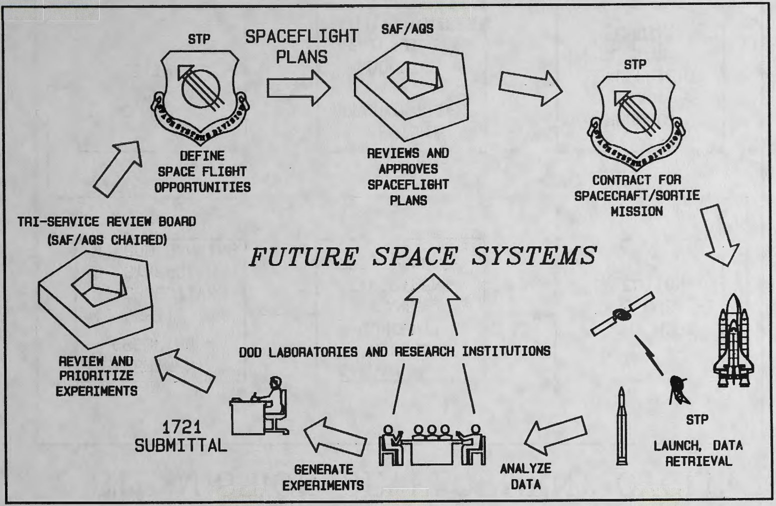
SPACE TEST & TRANSPORTATION (ST&T)



STP MISSION DEVELOPMENT CYCLE



THE STP EXPERIMENT CYCLE



STP Primary And Secondary Missions Experiment Mix								
Flight Designator	Success?	---- Experiment Origin ---- USAF	USN	USA	DARPA	NSA	DNA	Total
P67-1	Y		1	1				2
S67-3	Y	2						2
S68-2	N			1				1
P68-1	N	5	2	2	1			10
P67-2	Y	14						14
P69-1	Y	7	4					11
S69-2	Y			1				1
S68-3	Y	3						3
S69-4	Y		1					1
S70-3	Y			1				1
S70-4	Y		1					1
P70-1	Y	2						2
P70-2	Y	7	1	1				9
P71-2	Y	2	1			1		4
S71-3	Y	2						2
S71-5	Y	2						2
P72-1	Y	2	1	1	1			5
S73-7	N				1			1
P73-3	Y		1					1
S73-5	Y	3						3
P72-2	N	2	1				1	4
S75-1	Y	1						1
S73-6	Y	7						7
P74-1	Y	1	1					2
S74-2	Y	5	2					7
S76-1	Y	Clas'd						1
S76-5	Y						1	1
P76-4	Y		1					1
S77-1	Y	Clas'd						1
S77-2	Y	2	2					4
P78-2	Y	3						3
P78-1	Y	2	4		1			7
S78-1	Y	Clas'd						1
S81-1	Y		2					2
P269	Y	6	1					7
S83-1	Y		1					1
P83-1	Y	1					1	2
S82-1	Y	1						1
S84-5	Y	1						1
S80-1	Y	3	1					4
S85-1	Y	1	1					2
S84-1	Y		1					1
S85-6	N				1			1
S84-4	Y		1					1
S85-6	Y				1			1
S84-6	Y	1						1
S85-4	Y	1						1
S86-1	N	1						1
P87-1	Y	3					1	4
P87-3	Y				1			1
Total		3 93	32	8	7	1	4	148

Of the 47 missions where the experiment source is not classified, 27 of these carried more than one experiment. Of these 27 missions, 15 (or 55%) carried experiments from more than one service or government agency.

MISSION AREAS SUPPORTED BY STP

- O SURVEILLANCE TECHNOLOGY
- O BALLISTIC MISSILE DEFENSE
- O COMMUNICATIONS
- O NAVIGATION
- O WEAPON EFFECTS
- O SPACE OBJECT IDENTIFICATION
- O ATMOSPHERIC RESEARCH
- O RADAR CALIBRATION
- O GEODESY
- O PARTICLE AND RADIATION STUDIES
- O ORBIT PREDICTION
- O SPACECRAFT SUBSYSTEMS
- O MATERIALS RESEARCH
- O SPACE EFFECTS ON MATERIAL PROPERTIES

References

The documents, revisions, and issue dates of these references were up to date as of 1 July 1989. When referring to these documents, the experimenter is advised to use only the latest issue.

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