NASA SECONDARY PAYLOAD PLANS, POLICIES AND REQUIREMENTS

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ABSTRACT

Whenever there is excess launch vehicle capacity on either the Space Shuttle or an expendable launch vehicle (ELV), a logical spinoff is to carry a secondary or piggyback payload and provide a relatively low-cost flight opportunity for small satellites, instruments or experiments. NASA typically deploys moderate to large spacecraft as primary payloads on either the Space Shuttle or ELV's in support of the Agency's scientific, planetary and technology objectives. NASA has flown over a dozen piggyback payloads on the Delta rocket in the past. The Small Expendable Deployment System (SEDS) experiment, originally baselined for launch on the Shuttle, is currently planned as the first in a series of small NASA space experiments launched as a piggyback on an ELV. Small research and commercial payload owners have a variety of ways to access space: on a dedicated small ELV, as a secondary payload on the Space Shuttle, or as a piggyback payload on an ELV. This paper provides an overview of the secondary flight opportunities available today along with an overview of NASA's secondary payload plans, policies and requirements. NASA's initiative to act as a clearinghouse for small payload launch requirements is also presented.

INTRODUCTION

A **primary payload** drives the overall mission launch schedule and orbital trajectory and is responsible for the costs associated with the launch service. A **secondary payload** can be an experiment, sensor, instrument or fully integrated payload whose mission objective is different than that of the primary payload mission objective. A secondary payload utilizes excess capability of a launch system after the primary payload requirements are satisfied. The secondary payload is constrained in weight, size, orbital trajectory and launch schedule by the primary payload. However, the secondary payload launch costs reflect integration to the launch vehicle, compliance with safety requirements, and possibly a very small fraction of the launch service costs. The terms primary and secondary are most descriptive of the relationships of payloads flown on the Shuttle.

Marketing of excess capacity on international ELV's for secondary payloads is in its infancy; hence a consistent set of terminology has not yet evolved. For example, General Dynamics is evaluating the market for "companion payloads"; Arianespace is offering launch of "auxiliary payloads"; while McDonnell Douglas and NASA are planning to continue

launching "piggyback payloads." For purposes of this paper, the terms dedicated launch and piggyback launch will be used to more aptly describe the relationships of payloads on ELV missions.

A primary payload purchases a **dedicated launch service** on an ELV to achieve the primary payload mission objective, which in turn drives the vehicle configuration, orbital trajectory, launch schedule and security requirements of the mission. The primary payload incurs the price of the launch service. An experiment, sensor, instrument or fully integrated payload whose mission objective is different than that of the primary payload may gain access to space as a **piggyback launch** on an ELV. As a piggyback launch the secondary payload utilizes excess capacity of an ELV once the primary payload requirements are satisfied. The secondary payload is constrained in weight, size, orbital trajectory, vehicle configuration and launch schedule by the primary payload purchasing a dedicated launch. The primary payload mission director retains the final authority to allow or disallow launch of a piggyback payload. However, the piggyback launch costs may include a very small fraction of the launch service price in addition to the cost of integrating the secondary payload onto the ELV.

SECONDARY PAYLOAD FLIGHT OPPORTUNITIES: NASA SPACE SHUTTLE

The Space Shuttle offers a range of payload accommodations for both primary and secondary payloads. Primary or dedicated payloads are those that require the total cargo-carrying capability and/or services provided by the Shuttle to support a single payload. Primary payloads flown on the Shuttle include the following types of payloads: NASA scientific spacecraft (e.g., Hubble Space Telescope, Ulysses); Spacelab; Tracking and Data Relay Satellites; Department of Defense (DOD) spacecraft; the commercial Spacehab module; retrieval/reboost missions (e.g., INTELSAT retrieval, Hubble reboost); and Space Station components and assembly.

Shuttle secondary payload flight opportunities are available for a variety of users: U.S. Government, domestic/international research and technology, and domestic/international commercial ventures. Flight assignments for secondary payloads can be made as much as 19-20 months or as late as 5 months prior to launch. The number of available secondary flight opportunities on any single Shuttle mission is highly variable and dependent on the primary mission objectives and requirements. Secondary payloads weighing as much as 8,000 pounds are manifested simultaneously with primary payloads; however, the secondary payload cannot modify or mandate Shuttle functions, such as orbit inclination and altitude. The secondary payload customer is responsible for the safety of the payload and any ground support equipment. To minimize any hazard associated with a given payload to the astronauts and Shuttle as well as the Shuttle ground facilities and crew, NASA's Office of Space Flight has issued the Safety Policy and Requirements for Payloads Using the Space Transportation System Handbook (NHB 1700.7). All primary as well as secondary payloads must comply with the Shuttle safety requirements.

Secondary payloads may be flown on the Shuttle in middeck lockers or on a variety of carrier systems developed by NASA to convert the Shuttle cargo bay into a space laboratory. A carrier is a standard set of equipment that serves as a host facility for user instruments. Summarized briefly below and in Table I are the payload accommodations and potential flights per mission of the four available NASA secondary payload carrier systems: Get Away Special Canisters (GAS CAN); Complex Autonomous Payload (CAP); Hitchhiker-G; and Hitchhiker-M along with the capabilities of Shuttle middeck lockers and the commercial Spacehab module. Sixty-five percent of available secondary flight opportunities for a given Shuttle mission are allocated for the use of NASA scientists and engineers to perform space reasearch and technology demonstration experiments. The remaining thirty-five percent of a mission's secondary flights are allocated to facilitate commercial endeavors. The Office of Commercial Programs is assigned thirty-two percent of a shuttle mission's commercial secondary flights to encourage a variety of U.S. commercial initiatives. The Office of External Relations, International Relations Division is allotted the remaining three percent of secondary flights to encourage commercial activities in space by foreign partners.

Get Away Special Canisters

Get Away Special is the popular name for NASA's Small Self-Contained Payload Program. Through the GAS CAN Program, both public and private individuals and organizations, domestic and foreign are provided an opportunity to fly scientific research and development experiments aboard the Shuttle for a moderate cost within an insulated NASA-provided cylindrical container. The GAS CAN launch queue has been closed to allow NASA to fly off the backlog of payloads that resulted in the aftermath of the Challenger accident. GAS CAN launch fees are based on the payload canister volume and weight. The GAS CAN backlog has been greatly reduced, allowing NASA to plan to begin accepting new launch reservations and to reevaluate the GAS pricing policy. GAS payloads must be self-contained and provide their own power, heat and command and data capabilities. GAS payloads do not rely on the use of Shuttle resources: 'power, data collection, or man-tending. The GAS payloads are typically manifested on a space-available basis late in the prelaunch time sequence. An aluminum GAS bridge, capable of holding a maximum of 12 canisters, fits across the Shuttle's cargo bay and offers a convenient and economic way to fly several canisters simultaneously.

Complex Autonomous Payload

The complex autonomous payload (CAP) is an outgrowth of the GAS CAN Program. Like GAS payloads, CAP payloads utilize the GAS pressurized container but in addition allow for more complex or potentially hazardous investigations to be conducted. A CAP payload should be primarily self-sufficient; however, some dedicated crew attention or mission consideration may be required. For example, a CAP payload may require an astronaut to switch on/off toggles at various stages of the experiment. Unlike the last-minute scheduling of GAS payloads, CAP

Table I

SHUTTLE : SECONDARY FLIGHT OPPORTUNITIES

CARRIER	PAYLOAD ACCOMMODATIONS	POTENTIAL FLIGHTS PER MISSION	ALLOCATIONS*
GET AWAY SPECIAL (GAS CAN)	• 3 SIZES (ALL 49.6 CM DIAMETER): Length / Volume / Experiment Weight 35.89 CM / 2.5 CU FT / 60 LBS MAX 35.89 CM / 2.5 CU FT / 100 LBS MAX 71.60 CM / 5 CU FT / 200 LBS MAX • MUST BE SELF-CONTAINED (REQUIRE NO POWER, DATA COLLECTION, OR EVENTS SEQUENCING FROM SHUTTLE POWER SYSTEMS) • REQUIRE MINIMAL CREW ATTENTION OR MISSION CONSIDERATION; NO DIRECT MAN TENDING • MANIFESTED ON "LAST-MINUTE", SPACE / WEIGHT AVAILABLE BASIS	12 CANS (USING FULLY LOADED GAS BRIDGE)	65% NASA 35% COMMERCIAL: - 32% DOMESTIC (Must be Sponsored by NASA Office of Commercial Programs) - 3% FOREIGN (Must be Sponsored by NASA Office of International Affairs)
COMPLEX AUTONOMOUS PAYLOAD (CAP)	• OPTIONAL HARDWARE ALLOWS MORE COMPLEX OR POTENTIALLY HAZARDOUS EXPERIMENTS THAN GAS • DIMENSIONS SAME AS GAS CAN		
HITCHHIKER - G	• CARRIER SYSTEM TO MOUNT SMALL PAYLOADS ON SIDE OF ORBITER PAYLOAD BAY • 750 LBS MAX FOR COMBINED PAYLOAD PACKAGE • PAYLOADS MOUNTED ON GAS ADAPTER BEAM BY VARIOUS METHODS: - GAS CONTAINER (2 MAX, 400 LBS MAX) - MOUNTED ON VERTICAL PLATE (250 LBS MAX) - DIRECT MOUNTED ON ADAPTER BEAM (750 LBS MAX) - COMBINATION OF THE ABOVE • CONNECTED TO SHUTTLE AVIONICS = DIRECT INTERACTIVE CONTROL FROM GROUND INVESTIGATORS • MAN TENDING, ORBITER POINTING, POWER, DATA RECORDING, THERMAL SYSTEMS AVAILABLE	UP TO 6 INSTRUMENTS	
HITCHHIKER - M	• CROSS-BAY CARRIER STRUCTURE FOR PAYLOADS WITH LARGER VOLUME, MOUNTING, SURFACE REQUIREMENTS THAN HITCHHIKER - G • 1200 LBS MAX TOTAL COMBINED WEIGHT • 2 AVAILABLE MOUNTING POSITIONS: - TOP (4 TOTAL, 36 X 28.2 IN, 380 LBS MAX EACH) - SIDE (2 TOTAL, 27.9 X 28.2 IN, 170 LBS EACH) • AVIONICS INTERFACES AND AVAILABLE SERVICES IDENTICAL TO HITCHHIKER - G		
MIDDECK LOCKER	• STORAGE LOCKERS IN MIDDECK AREA OF SHUTTLE CREW COMPARTMENT • 2 CU FT STORAGE VOLUME, 60 LBS MAX EACH • SINGLE PAYLOAD MAY OCCUPY MULTIPLE LOCKERS • SUITABLE FOR PAYLOADS REQUIRING PRESSURIZED ENVIRONMENT / DIRECT CREW OPERATIONS / POWER • LATE STORAGE / EARLY REMOVAL PAYLOAD FLEXIBILITY	UP TO 43 LOCKERS	
COMMERCIAL MIDDECK AUGMENTATION MODULE (CMAM) (SPACEHAB)	• AUGMENTATION MODULE, CARRIED IN PAYLOAD BAY, CONNECTED BY PASSAGEWAY TO CREW COMPARTMENT • LOCKERS SAME SIZE AS MIDDECK LOCKERS • 3000 LBS MAX PAYLOADS IN LOCKERS • SAME SERVICES AVAILABLE AS FOR MIDDECK LOCKERS • SPACEHAB COMMERCIALLY OWNED; LOCKERS COMMERCIALLY LEASED ON FIRST-COME, FIRST-SERVED BASIS • CONTRACT FOR 6 SHUTTLE FLIGHTS THROUGH 1994; 2 FLIGHTS / YEAR ENVISIONED THEREAFTER • MAX 4 FLIGHTS PER YEAR POSSIBLE	71 LOCKERS (DESIGN MAXIMUM); 50 LOCKERS IS NOMINAL CONFIGURATION	NASA OFFICE OF COMMERCIAL PROGRAMS HAS CONTRACT FOR 200 LOCKERS OVER FIRST 6 FLIGHTS 100 LOCKERS AVAILABLE FOR LEASE OVER FIRST 6 FLIGHTS

* REPRESENTS PERCENTAGE OF AVAILABLE WEIGHT AFTER MANIFESTING OF PRIMARY PAYLOAD

payload assignments are typically made a full year before a scheduled launch. During flight CAP payloads are typically located in the forward cargo bay. CAP payloads may also be mounted on the GAS bridge.

Hitchhiker

The Hitchhiker Program utilizes two carriers, one developed by Goddard Space Flight Center (-G) and one developed by Marshall Space Flight Center (-M), to accommodate experiments that require more services, weight, volume than those available in the GAS/CAP programs. In addition, the Hitchhiker carriers provide access to a substantial portion of the Shuttle avionics and data recording systems allowing experimenters to transmit commands and receive data real time from the ground.

The Hitchhiker-G carrier system is designed to mount small lightweight payloads, containing up to six instruments with a total weight of 750 pounds, to the side of the Shuttle orbiter. The Hitchhiker-G carrier may include a mounting plate, a GAS adapter beam, a GAS-like container and an avionics system. Small experiments which require real time interaction, Orbiter pointing, power, or data recording may want to consider this carrier.

Hitchhiker-M bears many similarities to the -G carrier, including identical avionics interfaces and services. Both offer standard electrical services including power, real time telemetry and commands. The Hitchhiker-M carrier utilizes the mission peculiar experiment support structure (MPESS), a cross-bay structure, and can accommodate up to six instruments having a combined weight of up to 1,200 pounds. The Hitchhiker-M carrier is a good candidate for experiments with large volume, mounting, surface and service requirements.

Middeck Lockers

Middeck lockers are located in the middeck area of the crew compartment, with a limit of up to 43 lockers potentially available for secondary payloads on a given mission. Each locker provides 2 cubic feet of storage space and can accommodate a payload of up to 60 pounds. A payload of up to 120 pounds can be accommodated by using two locker spaces. However, the more lockers a payload requires, the longer it may take for that payload to be manifested. Middeck lockers may be a consideration for payloads requiring the environment of the pressurized crew compartment or the availability of direct crew operations. Another benefit of the lockers is the limited opportunity for late stowage and early removal of the payload. Up to 115 watts of continuous power up to 8 hours from the Orbiter is available for middeck locker payloads.

Spacehab

The Commercial Middeck Augmentation Module, commercially owned by Spacehab, Inc., is carried in the cargo bay and contains a design maximum of 71 additional middeck lockers. Services available for the commercial lockers are similar to those provided for NASA lockers. Spacehab will lease the lockers on a first-come first-served basis, with initial flight opportunities beginning in late 1992. Spacehab has a contract with NASA for six Shuttle flights through 1994 and plans to continue on a two mission per year basis thereafter.

SECONDARY PAYLOAD FLIGHT OPPORTUNITIES: ELV'S

Dedicated Launch

ELV's offer the small payload owner a variety of ways to access space: either as a dedicated launch on a small ELV or as a piggyback launch on a larger ELV. Currently there are a number of domestic ELV companies interested in servicing the small launch service market. These include, but are not limited to, the following companies: LTV Missiles and Electronics offering the Scout and an improved Scout II; Orbital Sciences Corporation offering the Pegasus and Taurus; E'Prime Aerospace offering the EPAC S series; Space Services offering the Conestoga; and Lockheed Missiles and Space Company offering the Poseiden. Of the aforementioned launch service providers, only Scout and Pegasus have any orbital flight history. Scout has had 113 flights to date and Pegasus a single demonstration flight in 1990. Although there has been much industry interest in offering commercial services in this class, a real commercial customer base has not yet materialized. A dedicated launch service on one of these small ELV's ranges from between $10 to $20 million dollars. A dedicated launch at this price is a luxury few scientists, universities, radio amateurs, or other commercial entrepreneurs can afford, particularly when the payload cost is often under $10 million dollars.

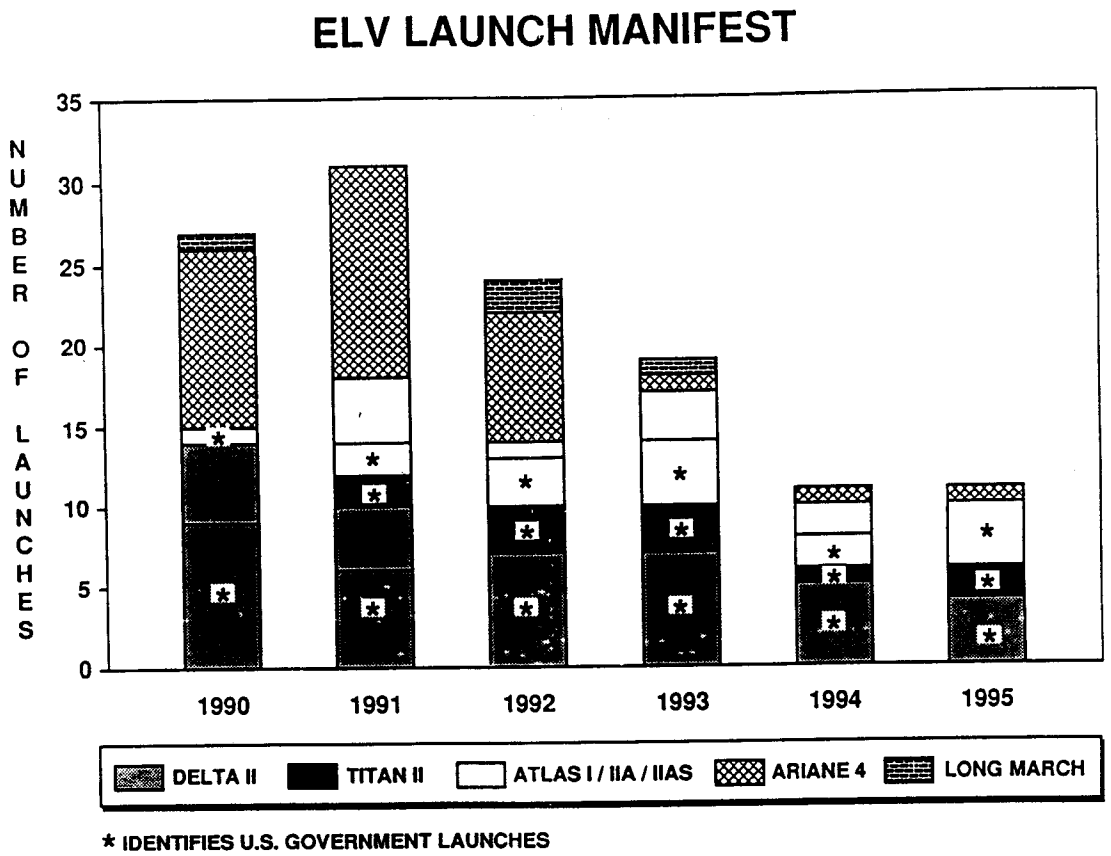
Piggyback Launch

Small secondary payloads may consider a piggyback launch on any ELV for those missions where excess performance has been identified. The policies and procedures affecting piggyback launches is continuing to evolve as each individual ELV operator's launch contract base stabilizes. The current manifest of ELV launches under contract for U.S. Government and commercial missions through 1995 is provided in Table II. The manifest clearly identifies the substantive base U.S. Government launches provides to the U.S. ELV industry.

A viable and highly competitive international market does exist for dedicated launches on larger, established ELV's, specifically: the McDonnell Douglas Delta II; the General Dynamics Atlas I/IIA/IIAS; the Martin Marietta Titan III; the Arianespace, Inc., European Ariane 4; the

Great China Wall Corporation Chinese Long March; and the Space Commerce Corporation Soviet Zenit. In addition, Martin Marietta manufactures and launches Titan II and Titan IV launch vehicles for the DOD. A summary of each of the aforementioned vehicles' maximum flight rate, launch site location and available orbits is provided in Table III.

Table II



Each of the ELV operators has a different approach to the concept of secondary payloads. McDonnell Douglas and NASA are working together on piggyback payloads; Arianespace plans to continue to offer launch opportunities for small secondary payloads while developing a new auxiliary payload platform; while General Dynamics continues to assess the market viability of companion payloads. Martin Marietta possibly could initiate a Titan III secondary payload policy if additional missions materialize since at this time Martin Marietta has only one remaining launch scheduled. Secondary payload flight opportunities on the Long March or Zenit, although not discussed in this paper, may be viable options for small payload owners to consider and explore. A brief description of existing secondary payload policies and plans is provided for McDonnell Douglas, Arianespace, and General Dynamics.

Table III

ELV
PIGGYBACK FLIGHT OPPORTUNITIES

LAUNCH VEHICLE	MAXIMUM FLIGHT RATE / YR	LAUNCH LOCATION	AVAILABLE ORBITS
TITAN II	3	WSMC	LEO / POLAR
DELTA II	10-12	ESMC / WSMC	LEO / GSO / POLAR
ATLAS I / IIA / IIAS	8	ESMC	LEO / GSO
TITAN III	2-4	ESMC	LEO / GSO
TITAN IV	4-10	ESMC / WSMC	LEO / GSO / POLAR
ARIANE 4	9-15	KOROU, FR. GUIANA	LEO / GSO / POLAR
LONG MARCH	TBD	CHINA	LEO / GSO / POLAR
ZENIT	TBD	USSR / AUSTRALIA	LEO / GSO / POLAR
H-II	4	JAPAN	LEO / GSO/POLAR

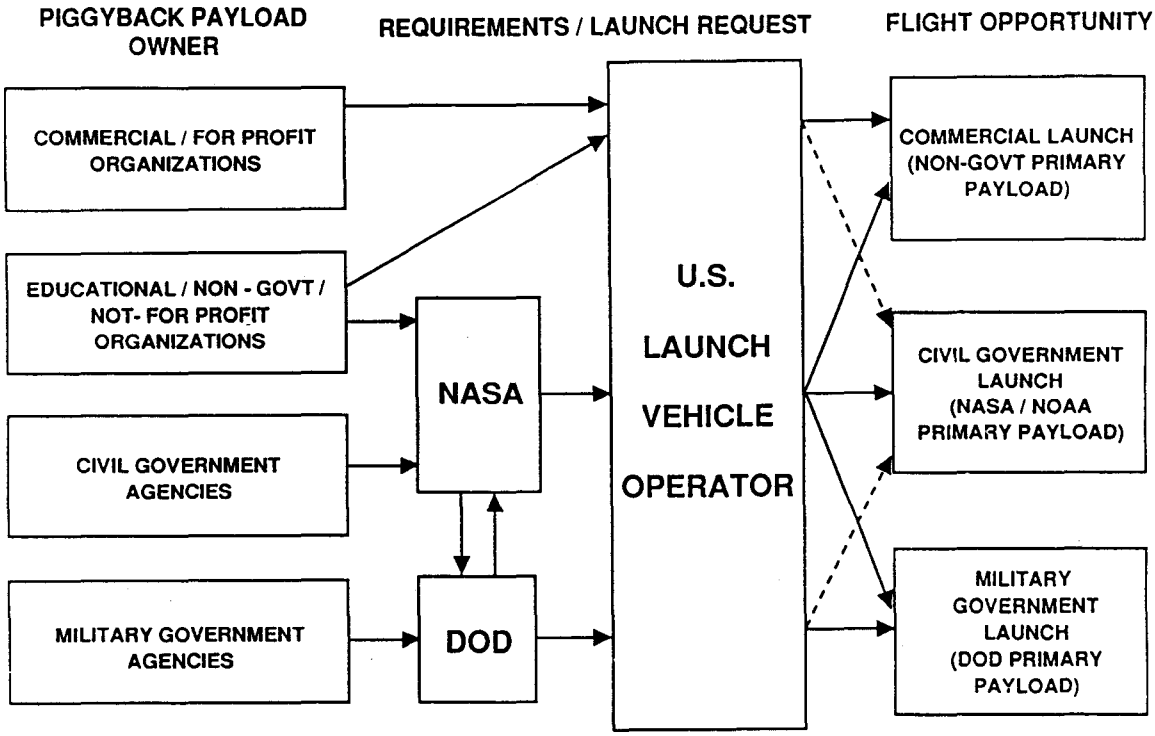
McDonnell Douglas: Delta II

McDonnell Douglas is offering piggyback flight opportunities for experiments/payloads that are small and light enough to fit on the Delta II second stage. The Delta II second stage avionics package can provide limited command, power, telemetry and attitude control services to the secondary payload. Based on current contracts, secondary flight opportunities are available on the model 7925 of the Delta II developed to launch the U.S. Air Force Global Positioning Satellites, beginning in late 1990. Sufficient excess performance margin is not available on any of the commercial Delta launches currently under contract, hence the only flight opportunities are on government launches.

The process whereby small payload owners may request a Delta II secondary flight opportunity as stated in the US Air Force Policy for Secondary Payloads Flown on Delta II's is depicted in Fig. 1. In accordance with Department of Defense (DOD) policy, commercial secondary payloads cannot be flown on DOD flights. NASA is identified as the appropriate point of entry for any non-DOD civilian/educational/ nonprofit organization interested in reserving an available secondary flight opportunity. Costs to the secondary payload owner include integration costs, additional range support and any costs associated with additional security requirements. NASA's plans to launch a series of small experiments as piggybacks on Delta II GPS missions will be described in greater detail later in the paper.

Fig. 1

ELV: PIGGYBACK FLIGHT OPPORTUNITIES
REQUIREMENTS PROCESS: DELTA II PARADIGM



Arianespace: Ariane 4

Arianespace, Inc., is offering secondary flight opportunities for up to six satellites, each weighing up to 110 pounds, on a Matra-developed circular platform called Ariane Structure for Auxiliary Payloads (ASAP). Since the ASAP carrier has been designed for use on Ariane missions with a single primary payload, the carrier will be primarily used to place satellites into a polar low Earth orbit. Approximately five Ariane 4 missions currently scheduled through the mid-1990's offer the potential use of the ASAP carrier into polar orbits. Arianespace has set a price of $600,000 for launch of the ASAP platform; this cost may be split among as many as six different small satellite customers. Arianespace has already identified a number of candidate secondary payloads interested in taking advantage of the ASAP carrier.

In addition, Arianespace is assessing launch opportunities for secondary payloads weighing between 880-2,200 pounds. These flight opportunities would be matched with a single primary payload targeted for launch into a geostationary transfer orbit, of which five such potential missions are currently scheduled. Arianespace estimates the price for this type of secondary flight opportunity in the range of $16-24 million dollars.

General Dynamics: Atlas IIA

General Dynamics has identified a concept for providing secondary flight opportunities for small satellites as companion payloads on the Atlas IIA. The concept assumes a primary payload weight of between 3000 to 4000 pounds with a requirement for a geostationary transfer orbit which would allow for the following three types of secondary payload flight opportunities: small satellite weighing under 2000 pounds to a geostationary transfer orbit; and two configurations offering accommodations to payloads of 1000 pounds or up to 3000 pounds to low Earth orbit. The Atlas IIA is only launched from Cape Canaveral Air Force Station in Florida; hence polar orbits are not available. General Dynamics has not yet committed to offer secondary payload flight opportunities. It is probable that a policy/process for providing secondary launch requirements on Atlas government launches will be similar to that developed for Delta II government launches.

NASA ELV PROGRAM PLANNING

NASA's Mixed Fleet Launch Strategy, established in early 1987, capitalizes on the unique attributes of the manned reusable Space Shuttle and unmanned ELV's to assure access to space for civil government spacecraft. A formal Flight Assignment Board, chaired by the NASA Associate Administrator for Space Flight, assigns primary civil government payloads to launch on an ELV unless the payload requires the unique capabilities of the Shuttle, manned intervention, or other compelling circumstances warrant use of the Shuttle. Likewise commercial and international primary payloads are only flown on the Shuttle if they require manned intervention, the unique capabilities of the Shuttle or national security, foriegn policy interests warrant launch on the Shuttle.

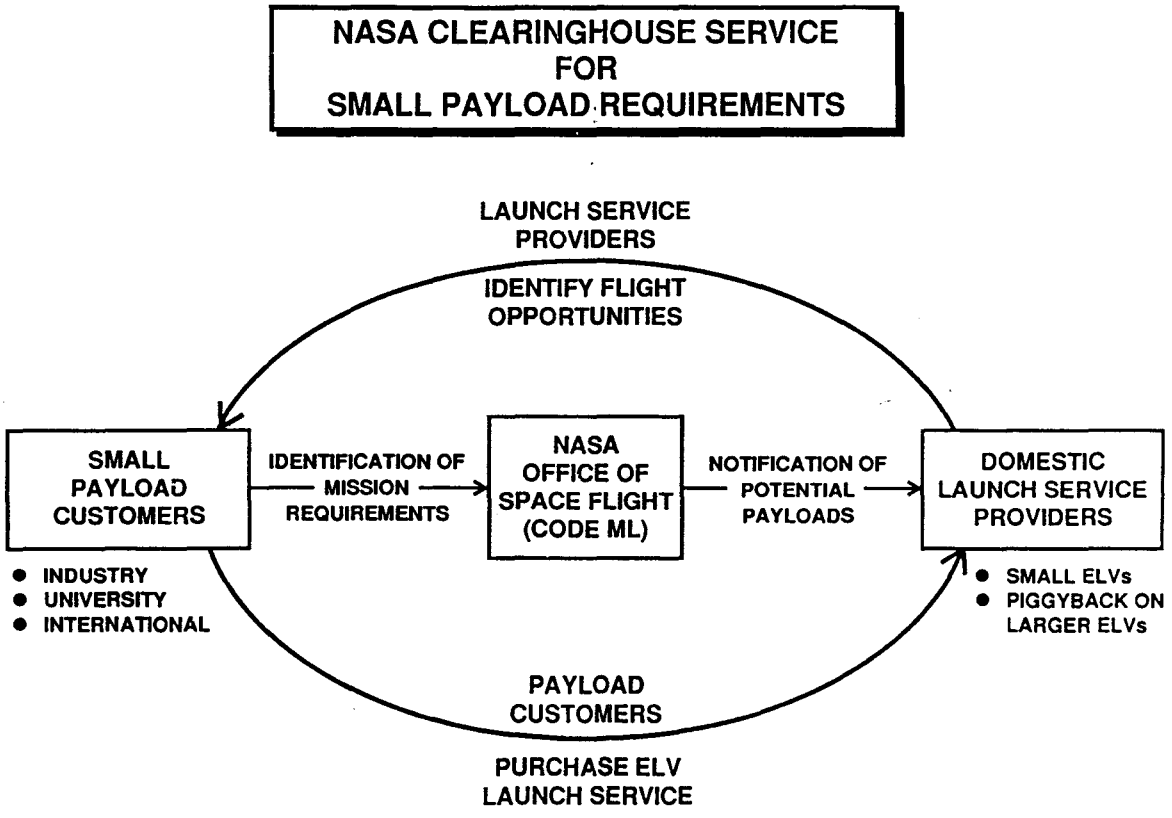
NASA has aggregated civil government requirements for missions which require launch on a small (Scout/Pegasus class) or medium (Delta class) performance ELV. Payloads in the intermediate ELV performance class (Atlas I/Titan III) are procured on an as-needed basis. Payloads in the large ELV performance class are manifested for launch on the U.S. Air Force Titan IV. NASA procures launch services, rather than launch vehicles, from the private sector to the maximum extent feasible for all ELV requirements in the small, medium and intermediate performance class. There has been an increasing international interest in identifying and initiating strategies which will result in reliable low cost access to space. A fresh look at expanding secondary payload opportunities is part of this initiative.

NASA's current program planning encompasses a requirement for two to three dedicated small launches per year and one to two dedicated medium class launches (Delta II) per year beginning in 1993 and continuing through the end of the decade. In addition, three piggyback launches on Delta II's are under development: the Small Expendable Deployment System (SEDS) targeted for launch in November 1991; SEDS II targeted for launch in April 1992, and Plasma Motor Generator (PMG) targeted for launch in November 1992.

SEDS, originally planned for launch on the Shuttle, was transitioned to a piggyback launch on a Delta II in the aftermath of the Challenger accident in an effort to afford a launch opportunity as early as possible. Follow-on SEDS missions that are more complex tether missions are anticipated if SEDS-I is successful. The PMG experiment, originally designed as a GAS payload, will also be transitioned from the Shuttle to a Delta II.

NASA anticipates a continuing requirement of at least two piggyback launches per year. Candidate NASA piggyback payloads include follow-on SEDS missions, in-space technology experiments, in-step demonstration ELV carriers, chemical release canisters and a range of scientific and technology application experiments. A comprehensive survey of candidate secondary payloads interested in piggyback flight opportunities is being initiated with NASA's field centers.

Fig. 2



SMALL PAYLOAD CLEARINGHOUSE SERVICE

NASA is initiating a small payload clearinghouse service as a practical assistance to the domestic ELV operators as well as satellite manufacturers. Small experiment, instrument and payload owners launch requirements are being requested from industry, university researchers and nonprofit organizations. A catalog of the aggregated launch requirements will be compiled and forwarded to domestic ELV operators for assessment and independent marketing action. Once assessed, the objective of the initiative is for ELV operators to contact the individual payload customer with notification of available flight opportunities, either as dedicated or piggyback launches. The payload customer will then have a basis upon which to assess at least one and possibly a number of flight opportunities which best serve the mission's overall objectives. Fig. 2 depicts the process whereby information will flow between the payload customer through NASA to the ELV industry and hopefully back to the payload customer. The ELV Launch Service Requirement Data Base form is provided in Table IV. All small instrument, experiment and payload owners should complete the form and return it to NASA.

The final catalog of requirements will be segregated into free-flyer payloads; instruments/experiments requiring a bus; and instruments/experiments requiring a piggyback launch and released to industry in mid-December 1990. The catalog may provide an opportunity for spacecraft bus manufacturers to aggregate individual instrument/experiments into a single payload for launch on a dedicated ELV or as a secondary payload on the Shuttle or an ELV.

The clearinghouse service is aimed at encouraging and facilitating reliable low-cost access to space for small experiments, instruments and payloads while also serving to provide a market base for the development and growth of the U.S. spacecraft and launch industry.

Table IV

ELV LAUNCH SERVICE REQUIREMENT DATA BASE

TO: _____ FROM: _____

NASA HEADQUARTERS
UNMANNED LAUNCH VEHICLES
AND UPPER STAGES
MAIL CODE: ML
WASHINGTON, D.C. 20546
FAX: (202) 755-3233

PRINCIPAL
CONTACT: _____
TELEPHONE: _____

PAYLOAD NAME: _____

ESTIMATED PAYLOAD COST: _____

PAYLOAD OBJECTIVE: _____

_____

_____

FLIGHT TYPE:

_____ Shared
_____ Secondary
_____ Dedicated
_____ Single Instrument / Experiment

SUPPORT TYPE:

_____ Self Sufficient Attached
_____ Self Sufficient Free-Flyer
_____ Payload Requires Support from Vehicle
_____ Exp. Requires Free-Flyer Bus

PAYLOAD CHARACTERISTICS : (The Term Payload Refers To All Customer Provided Equipment And Associated Bus)

	WEIGHT (LB/KG)	MAX DIAMETER (IN/CM)	MAX LENGTH (IN/CM)	CG (IN/CM)
LAUNCH	_____	_____	_____	_____
RECOVERY	_____	_____	_____	_____

PAYLOAD ORBIT REQUIREMENTS:

_____ GEOSYNCHRONOUS
_____ LOW EARTH ORBIT
_____ GEOSYNC TRANSFER
_____ POLAR

_____ NM APOGEE ALTITUDE
_____ NM PERIGEE ALTITUDE
_____ DEGREE INCLINATION
_____ DEGREE ARGUMENT OF PERIGEE

ATTACHED PAYLOAD MISSION DURATION REQUIREMENTS:

_____ HOURS / DAYS
_____ NO REQUIREMENT

UNIQUE PAYLOAD CONSTRAINTS: (e. g., Launch Window, Late Servicing, Thermal Conditioning)

_____

_____

PAYLOAD LAUNCH DATE(S) REQUESTED (MONTH / YEAR)

NUMBER OF LAUNCHES: _____
FIRST LAUNCH: _____
SUBSEQUENT LAUNCH(ES) _____
MINIMUM INTERVAL BETWEEN LAUNCHES: _____