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Development of Dual Use Launch Facilities On A National Range

Presented to the

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Technical Paper Session
Commercial: Current & Future Launch Capabilities

By

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Launch Site Development Philosophy

Traditional Launch Complex Development

The space launch industry has a heritage rooted in early research, development and test programs sponsored by the federal government. These programs had large budgets and a sense of urgency derived from national defense or scientific requirements. They were dedicated to achieving specific goals, emphasized vehicle performance, and demanded unique facilities. When a launch program was completed, the launch facilities were abandoned and new facilities built for the next program.

This heritage is easily recognizable today on the Eastern Range. Cape Canaveral Air Station contains 46 launch complexes. Of the 46 complexes, only five are approved for active launch vehicles. This includes one facility for small weather rockets. Each launch service provider typically has a unique launch site for each vehicle. Delta vehicles are launched from Launch Complex 17; Atlas vehicles from Launch Complex 36.etc. Only recently have launch providers been able to intermix launching different versions of the same vehicle from a common facility. The problems inherent in this approach are readily apparent when viewed from a commercial perspective. Each launch vehicle program must generate enough revenue to operate, maintain and amortize the capital cost of the launch site. Existing programs benefit from the government's investment. New launch vehicles find it difficult to enter the market and be competitive.

One answer to this problem is to eliminate competing launch vehicles. Thus there is a unique facility designed specifically for a single user with a standard launch vehicle or family of vehicles. This solution is an efficient use of capital at the expense of competition. The alternative answer is multi-user facilities. The Spaceport Florida Authority pioneered this concept for new small commercial launch vehicles using the same model for infrastructure development used by commercial airports.

Airport Model

The airport model is based on the concept of common use facilities, managed by a single entity, for the benefit of all users. The common infrastructure; runways, ramps hangers, etc., are sized for the class of aircraft expected to utilize the airport. Airports are licensed by state government and regulated by the federal government. User specific infrastructure is leased to specific airlines or airport users. The airport owner, usually a governmental airport authority, finances capital investment through bonding backed by leases or taxing authority, and

supplemented by federal and state grants. Operations and maintenance costs are usually recovered by user fees, concessions etc.

In adapting this model to a spaceport, the launch pad may be considered analogous to a runway: vehicle processing facilities considered analogous to hangars and payload processing facilities considered analogous to terminals. The launch pad is designed to accommodate multiple launch vehicles based on practical design parameters. Launch vehicles are processed in off pad facilities, brought to the pad, mated with encapsulated payloads and launched.

Market

Just as airports are designed for the expected user population, multi-use launch facilities must be designed with a particular market in mind. The Spaceport Florida Authority facility was designed to establish a capability on the Eastern Range for smaller vehicles ñ vehicles below the capability of Boeing's Delta vehicle. There were several launch providers interested in this market niche. Figure 1 depicts the target market.

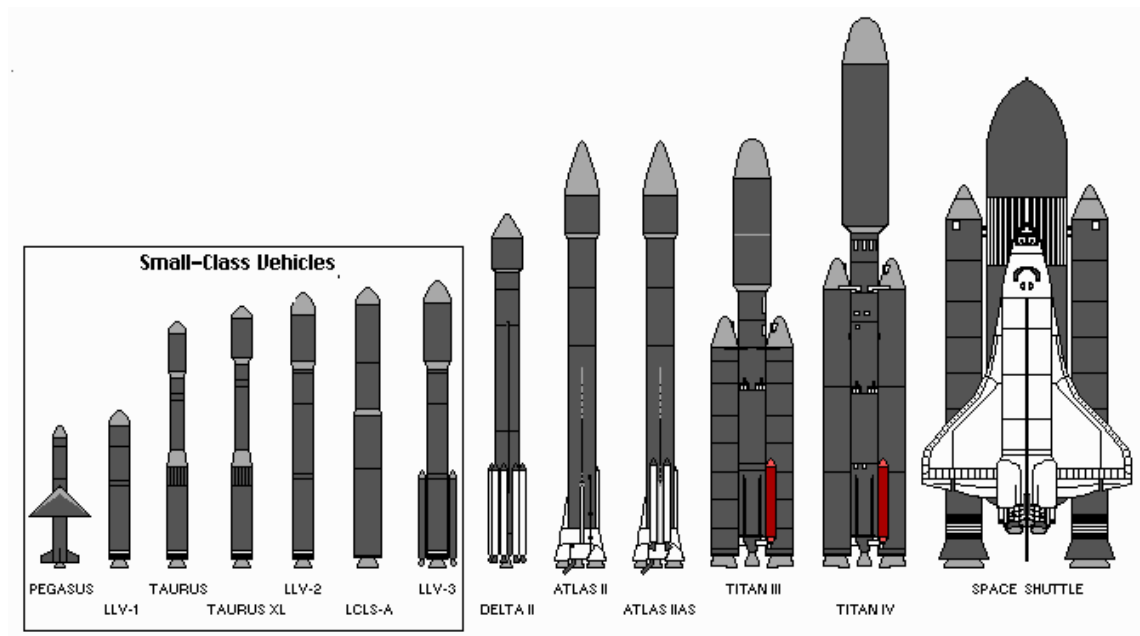


Figure 1

Dual Use

Launch Site Availability

At first glance, Cape Canaveral Air Station seems to have an abundance of potential launch sites that could be converted into dual use or commercial facilities. A glance at Attachment 1 shows 46 numbered launch sites (excluding Space Shuttle Pads 39A & 39B). However, further investigation reveals that only eight are active. The remainders have been abandoned for years and many have environmental problems. In addition, the Cape's industrial areas have expanded over time and potential vehicles have grown so that safety's quantity distance numbers and launch danger areas impinge on inhabited or high value structures.

Another constraint to establishing a new launch site is cost. If we accept the premise that new users can share facilities and operate at significantly lower costs, then sharing with an

existing on-going activity reduces the cost even more. Therefore, facilities that are still active or have been recently utilized are prime candidates for dual use.

Dual Use Requirements

As used in this paper, the term "dual use" means commercial use of facilities owned by the Federal Government or built on federal property. Since this paper deals only with federal range property, which is administered by the Air Force, Air Force policies, requirements and regulations will be the primary backdrop for dual use discussions.

The authority for dual use is found in the Commercial Space Launch Act (49 U.S.C.70101-70119) Presently under the CSLA, Congress does not give guidance to the Government on how commercial use of "excess capacity" resources should be defined and distributed. In the event that the Government has a facility that is currently not in use or is not scheduled for use in the future; the Government deems this property "excess capacity." If a commercial company requests use of the facility, the Air Force has a process to determine whether that resource can be allocated to the commercial firm. If the resource is "launch property", the Air Force may give the new user a real property license which contains the conditions of use. In addition, the user is required to sign a Commercial Operations Support Agreement (CSOA) which defines the relationship between the user and the Government.

Launch Complex 46 - An Example

Background

During the early 1990s it became evident that there was a market niche for smaller launch vehicles. The enabling technology of miniaturization, planned constellations of small satellites and the advent of commercially manufactured new boosters are driving forces. The Spaceport Florida Authority solicited inputs and formed a team to establish a small launch vehicle capability on the Eastern Range. The initial partners included:

- Thiokol who manufactures the Castor 120 rocket motor.
- Orbital Sciences Corporation, a launch provider utilizing the Castor 120 in their Taurus Launch Vehicle.
- Reynolds Smith & Hills, an A&E firm
- BRPH, an A&E firm
- Johnson Controls World Services
- Tactical Technical Solutions, who specializes flame effects and acoustical analysis
- Honeywell

Later, Lockheed Missiles and Space Company now part of Lockheed Martin, and Allient TechSystems joined the team.

Site Availability

As discussed earlier, the ideal dual use launch site would be one currently in use by the government. The Authority was fortunate to secure the cooperation of the United State Navy in using excess capacity on their Trident Test Launch Facility Launch Complex 46 (LC-46). This is an ideal facility located at the tip of Cape Canaveral and, it is still an active Navy facility. It was built in the 1980's, activated in 1985 and used for active Trident II launches until 1989. The Navy still has a contingency requirement to test Trident Missiles and actively performs other

associated work on the site. However, the Navy has a deep interest in commercial activity and agreed to allow the Authority to utilize excess capacity on the site. What this meant was that the Authority could build and utilize commercial launch infrastructure on a non-interference basis. The Navy, for its part, agreed to schedule their activities around commercial operations unless there was a compelling military need for the site.

Funding

LC-46 was funded via a joint federal, state and industry partnership which was based upon grants and matching funds. There were two competitive federal grants matched by State of Florida Department of Transportation and Spaceport Florida Authority funds. In addition industry was required to participate. What is interesting about the industry match requirement is that a minimum of 10% of the total project was required to be paid in cash, in advance. The total value of the project is approximately \$8 million with a 75%-25% share ratio between federal and matching funds.

Agreements

This project was complicated by the number of organizations involved, and each organization had its own legal requirements. There were four separate sets of agreements involved ; grant agreements, partnership agreements, agreements concerning site use with the Navy and operating use agreements with the Air Force. After the site was completed additional agreements with the Federal Department of Transportation were required for a site operator's license.

The Air Force's Space and Missile Center, (SMC) administered the grants from Los Angeles Air Force Base, CA. Unfortunately each grant was administered by a separate organization within SMC which made coordination more difficult.

Agreement with the Navy took the form of a Memorandum of Agreement between the Spaceport Florida Authority the Navy's Director, Strategic Programs. This agreement allowed the Authority to build commercial infrastructure on a Navy assigned site, placed indemnification and insurance requirements on the Authority, and spelled out financial requirements and technical limitations. The Authority became the sole scheduler of commercial activity on the site and is responsible to ensure that commercial users comply with all federal and state requirements.

Partnership agreements were awarded to industrial partners who selected by a competitive process involving an advertised solicitation for participation in the grant process. Partners who performed the actual construction were awarded contracts under the State procurement system.

Air Force agreements have been a continuous problem. As the end of January 1998, Air Force operational agreements have not been completed. The State has been operating under a Right of Entry Agreement that allowed the construction to be completed. During this period the Air Force began the process of issuing real property licenses for access to Federal launch property. These licenses require a Commercial Operation Support Agreement in lieu of the previous commercialization agreement used in the past. To date no major launch company or range user has signed these agreements because of certain changes in liability and indemnification required by the Air Force. The recent launch of Lunar Prospector from LC-46 was done by special exception to the Air Force agreements policy.

Design Process

The LC-46 design effort kept multiple-use and design to cost as prime objectives. This necessitated accommodation of Navy requirements, an environmental assessment that covered more than one vehicle, common infrastructure and cost trades. Figure 2 shows the modified LC-46 site plan.

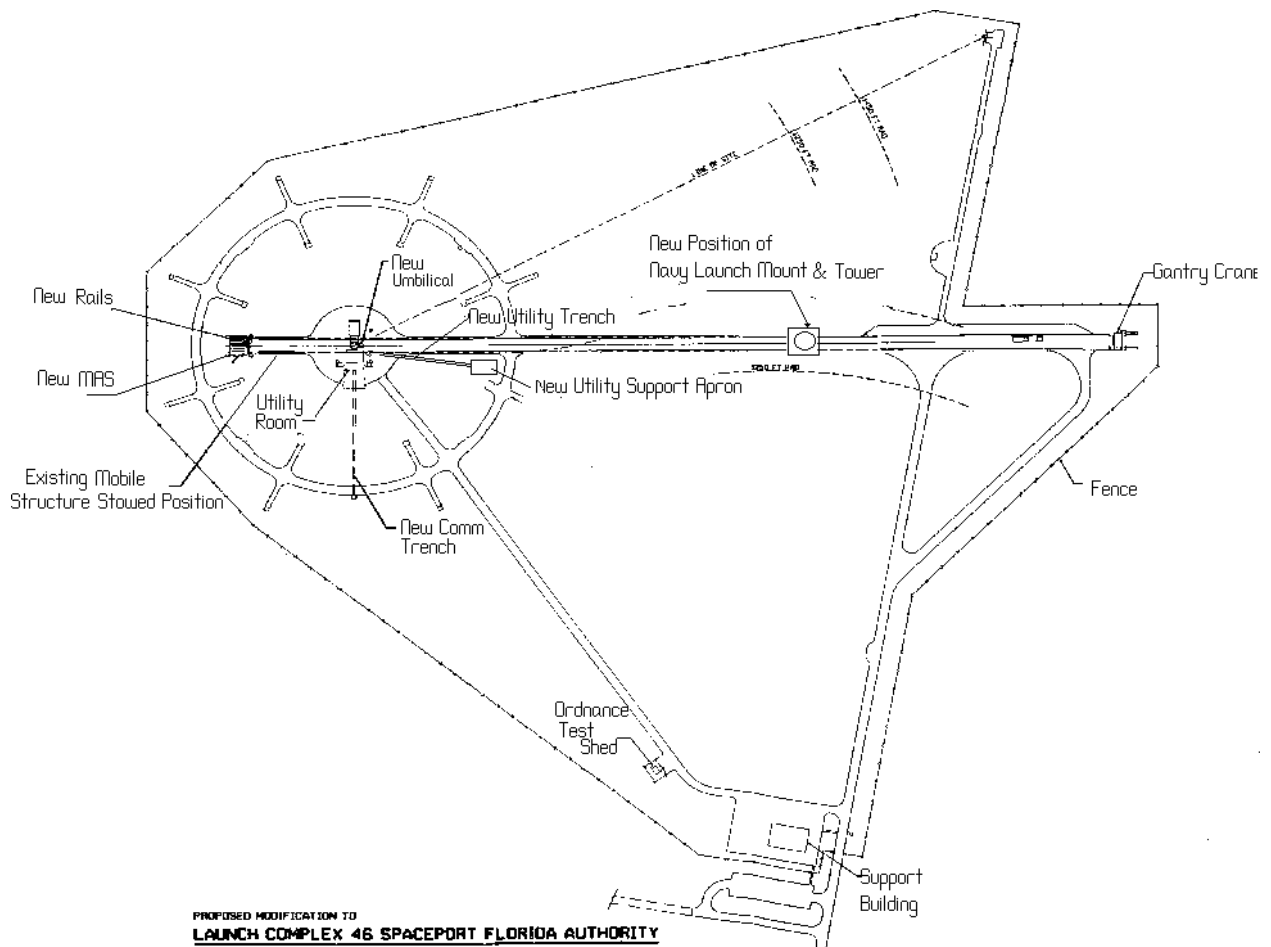


Figure 2

The basic Navy requirement is the preservation of the capability to launch a Trident II with reasonable notice. After reviewing LC-46 assets, the Authority decided to utilize the existing flame duct, underground utility room and concrete apron and crane rails around the site. This allowed the Navy launch mount and environmental shelter to be moved toward the south end of the site. The Navy's electrical connections between the utility room and the launch mount were cut and connectors/junction boxes installed.

In order to accommodate all candidate vehicles, a flexible infrastructure was required. The concept that evolved was to use removable launch mounts sized for the flame duct, a mobile access structure (MAS) with movable work platforms, trenches and cable ducts for communications/data. In order to facilitate the design, the engineering team hypothesized a reference launch vehicle. This vehicle was based on worst case assumptions i.e. the most

stressful vehicle the existing infrastructure was capable of handling. Once that vehicle was sized, all known user interfaces from candidate were incorporated. The reference vehicle was then used as the basis for environmental permitting, explosive siting and cost estimating.

Each participating launch company input their own site requirements. As a result, the projected cost of these requirements significantly exceeded the budget available. The team then spent several months scrubbing requirements, looking for commonality validating cost elements and finally arriving at a configuration that was acceptable.

As designed the site has the following capabilities:

- Exchangeable launch mounts for Castor(120 vehicles, Allient TechSystems vehicles and others. Launch mounts designed for vehicles up to 600,000 pounds
- A Mobile Access Structure with 4 movable work platforms that can be positions at 1-foot intervals. The MAS can accommodate vehicles up to 105 feet in length
- Inserts for vehicles 50 inches to 120 inches in diameters.
- Mobile cranes to handle all vehicles (furnished by NASA)
- Fiber connectivity to the range network



Figure 3.

Construction

The site was constructed utilizing the services of the Florida Department of Management Services (DMS). DMS is the construction manager for state construction and has streamlined procurement procedures in law. DMS, Range Safety and the Range Civil Engineer participated in all design reviews. The site was actually built under a DMS guaranteed maximum price contract. Both Range Safety and the 45th Space Wing accomplished construction inspections and acceptance.

Operations

The Spaceport Florida Authority is not a launch operator but is a provider of launch facilities. The launch companies are best qualified to operate the site with support from the Authority. In essence, the Authority says to a qualified launch company: "Here's the key to the site. Complete your operations and give the site back in the same condition you found it in."

The Authority is responsible for scheduling site use with the Navy, configuration management and routine maintenance. The launch user is required to utilize the Air Force range services just as any other range user. The 45th Space Wing provides ground and flight safety, tracking, data analysis, range contractor support, and all other services available for commercial customers. Pad users must meet have a Department of Transportation launch license, be accepted as a range user and operate in accordance with approved procedures and agreements.

There are costs associated with launch. In the case of LC-46, the Authority charges a use fee to cover a portion of site maintenance. There is no capital recovery costs. Of course the user also is responsible for direct costs incurred by the Air Force in supporting his launch.

Current Status

The end result of the Authority's dual use project on LC-46 is a fully functional launch site. Lunar Prospector launched from LC-46 on January 3, 1998. Two additional Athena vehicles are on the manifest and other programs have expressed serious interest.



Figure 4

The Future

New Dual Use Projects

The Spaceport Florida Authority has two additional dual use launch programs underway. First, the Authority is reactivating Launch Complex 20 (LC-20) as a pathfinder project. LC-20 is an abandoned Titan II facility that was reactivated in the early 1980ís for rail launched BMDO programs. The Authority intends to refurbish the blockhouse and launch pads for commercial use and to pioneer a Quick Reaction Program. This programís objectives are to generate a launch ready sortie in 72 hours and launch within 6 hours of a callup. Requirements to establish this capability include dedicated launch points, minimal range interfaces, launch vehicles & payloads in ready status, pre-approved trajectories, and RSA implementation. If these capabilities can be achieved, the market for satellite replacement, DOD testing and rapid scientific response will develop.

The Authority is also partnering with NASA KSC to build a Reusable Launch Vehicle Facility. The State of Florida has contributed \$4 million to establish a ramp and RLV hanger adjacent to the tow-way at the Shuttle Landing Facility. The facility should be ready to support east coast X-34 flights in 1999.

Vision of Things to Come

As population encroaches on launch facilities, the future will be decided by our ability to maximize the use of available resources. Communications technology, GPS and common facilities can the Eastern Rangeís place a true spaceport. This spaceport will provide common infrastructure under a single manager. It will have the capability of having both expendable and RLV vehicles in count, each with a flight plan using pre-approved standard space departures. Flight plans and flight safety will be provided by, the FAA or perhaps the FSA (Federal Space Authority).

This vision of the future is currently that- just a vision. How it turns out is our challenge.