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AIRPORTS AND SPACEPORTS

A HISTORICAL COMPARISON

A Research Paper

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by

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The views expressed in this academic research paper are those of the author(s) and do not reflect the official policy or position of the US government or the Department of Defense.

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Preface

Before arriving at Air Command and Staff College, I served as the Chief, Commercial Space Operations at Air Force Space Command (AFSPC). In this role, I worked at garnering Air Force support to make the commercial spaceports a reality.

AFSPC did a good job of obtaining support for the spaceports; however, we lacked clear guidelines defining our relationship with our new commercial tenants. In March 1996, the Department of Defense (DOD) formed an Interagency Integrated Product Team to make recommendations to help fill this void. In October 1996, I pulsed Lt Col Victor Villhard, a key member of this team, to determine if there was an area that I could research to help them with their task. He asked if I would perform a historical study on the evolution of airports to determine if there are any lessons learned that could be applied to the development of guidelines to support the emerging spaceports.

I want to acknowledge Lt Col Vic Villhard who provided me with the topic and a wealth of information on the current status of spaceports. I also thank Mr Neilson Bertholf, Chairman of the American Association of Airport Executives (AAAE), for granting me an interview and graciously providing me with much needed guidance, sources, clarification and direction on the evolution of airports. Finally, I thank Major Edward F. Greer for his support as my research advisor. Major Greer was solely responsible for keeping me on track.

Abstract

This study attempts to determine if there are any inferences that can be gleaned from the evolution and operation of airports that can be applied to the current group of spaceports. The author lays the foundation of the study by examining the history of the commercial space industry and the US government's role in supporting that industry. Next, the study focuses on the evolution of airports. Specifically, it traces the roots of the airport back to the early 1900's, describes the impact of WWII on the development of the US airport system, and concludes with the most current trend towards airport privitization. With the historical foundation on which to base inferences complete, the author then focuses on the emergence of the commercial spaceport sector. He describes the economics influencing the sector and the DOD grant program which provided much needed seed money for spaceport development. He then provides a description of the three spaceports—California, Florida and Alaska. Finally, the author provides background on key issues (ownership, planning, certification, and governmental roles), discusses "the airport way," and then makes inferences and recommendations to address the issues.

Chapter 1

Introduction

The purpose of this study is to determine if there are any inferences that can be gleaned from the evolution of airports to the emerging concepts of spaceports. Over the past two years AFSPC has focused on operationalizing and normalizing its warfighting capabilities. Normalization means to properly organize, train, and equip in accordance with Air Force policy in order to be prepared to carry out assigned missions. Operationalization is described as knowing what the mission is, for whom it is executed and how it fits into the overall operational scheme. Most of all, General Joseph Ashy, then USCINCSPACE, described it as "keeping your head in the game."[1] This study will attempt to normalize US government policy towards commercial spaceports.

Background and Significance of the Problem

In an attempt to normalize the US government's relationship with commercial spaceports it is important to understand the history of the commercial space launch industry. In reviewing this history, it will become obvious that the US space launch policy shifts of the 1980s nearly crippled the US competitiveness in the industry.[2] From 1963-1980, the US government (NASA) launched 100 percent of the western world's commercial satellites—no one else was in the launch business. In 1980, this changed

when the European Space Agency (ESA) entered the competition with the goal of launching 50 percent of the market aboard the Ariane expendable launch vehicles (ELVs). By 1984, the United States had shut down expendable launch vehicle production and implemented a policy to launch all satellites, both government and commercial, on the Space Shuttle. When the Challenger accident occurred in 1986, commercial launches halted, and the US was forced to reverse its policy. It eliminated commercial satellites from future shuttle flights and encouraged the startup of the ELV production lines again. It wasn't until 1991 that a true commercial space market existed when US commercial launch providers, General Dynamics and McDonnell Douglas, came on line with the commercial Atlas and Delta launch vehicles, respectively.[3] By then, with no US launch alternative, Ariane was able to capture a significant number of launch contracts. In 1994, non-market launch providers, first China, followed shortly by Russia, entered the international competition making it even tougher for the US fledgling industry to compete. The US space policy of the 1980's crippled its international competitiveness and provided Ariane with a six year head start on commercial launch vehicle development.

Since 1984, the Commercial Space Launch Act (amended in 1988 and codified in 1994) has provided consistent guidance for facilitating and encouraging support to US commercial space activities.[4] The Act established the Department of Transportation (DOT) as the lead agency responsible for overseeing and coordinating the conduct of commercial launch operations. It calls for the Secretary of Transportation to:

> encourage, facilitate, and promote commercial space launches by the private sector and to take actions to facilitate private sector involvement in commercial space transportation activity, and to promote public-private partnerships involving the United States Government, State governments,

> and the private sector to build, expand, modernize, or operate a space launch infrastructure.

However, DOT does not own or control the space launch infrastructure that they are tasked to facilitate and encourage the commercial use of—the DOD does. Therefore DOD's main responsibilities under the Act are to provide:

> launch property of the United States Government that is excess or otherwise not needed for public use; and launch services, including utilities, of the government otherwise not needed for public use.

The Act goes on to say that the Government:

> must consider the commercial availability on reasonable terms of substantially equivalent launch property or launch services from a domestic source.

Additionally, the Government can only charge:

> actual costs that can be associated unambiguously with a commercial launch effort; and the Government would not incur if there were no commercial launch effort.[5]

Today, the commercial launch industry is thriving. For the first time ever, in FY 1995 and 1996, the number of commercial vehicles launched from Cape Canaveral exceeded the number of DOD and NASA expendable launches combined. In FY 1997, the commercial operators at Vandenberg will reach this milestone.

Two reasons exist for the growth in commercial activity. First is DOD's stewardship of US commercial space launch support. This support includes:

1. Operating Expenses: $160M to operate Cape Canaveral and $75M for Vandenberg
2. Range Modernization: $750M programmed over the next 10 years to increase the ability to support even greater number of launches
3. EELV: $2B programmed over the next 10 years to reduce launch costs
4. Facilities: Over $1B worth of DOD launch infrastructure provided at marginal costs
5. Personnel: 5300 Air Force men and women supporting commercial operations, on an excess capacity basis, without cost to commercial operators[6]

However, the biggest reason for the growth in the commercial industry is the emerging small satellite technology. This technology uses large constellations, of distributive networks of small satellites, to provide worldwide messaging, voice and data communications, and remote sensing. Motorola planned to start launching their Iridium constellation of 66 satellites (the largest US constellation currently in use is GPS with 24 satellites) in January 1997. This launch is currently on hold until the Delta booster is cleared to fly after the January 1997 Global Positioning Satellite launch anomaly. Iridium, along with other systems that are planned with even greater number of satellites, will revolutionize the launch business as much as the communications business.

Herein lies the problem. Air Force Space Command mans, budgets and configures its two launch wings to carry out the government missions that it is tasked to do. The conflicting trends of increased commercial activity (25 new commercial programs in the last 2 years) and decreased manning, budgets and an aging launch infrastructure, limit the Air Force's ability to support the commercial operator. The AFSPC Vice Commander, in a letter to the Assistant Secretary of the Air Force for Space, wrote, "As these trends continue to diverge, our ranges' excess capacity is approaching zero-margin."[7]

In 1993, a new sector of the commercial industry started to emerge—the commercial spaceport. Theoretically, these spaceports would increase the commercial launch capacity, while reducing the amount of government oversight required. A win-win situation. Currently, there are several spaceports in various phases of development throughout the United States (and many more internationally). The similarity ends there. The current group of US spaceports are diverse in the way they are formed, financed, operated, and in their views on interaction with the federal government and concept of

operations. The US government, specifically, DOD and DOT, must come to grips with the spaceport concept and define guidelines for their operations. This study attempts to glean inferences from the historical evolution of airports that may help in the federal guideline development.

Limitations to the Study

Although there are numerous spaceports in various phases of development—this study is limited to spaceports that are focusing on supporting the launches of ELVs. Specifically, this study is focused on the three spaceports that have completed their environmental analysis and have started or will soon begin construction. These include the spaceports being constructed in California, Florida and Alaska.

Notes

[1]Guardian Magazine, Air Force Space Command, 1995 Stakeholders Report, February 1996, 27.

[2]Briefing, subject U.S. Commercial Space Launch History and Projections, 30 May 1996.

[3]Ibid.

[4]Air Force Talking Paper, Lt Col Victor Villhard, Office of the Assistant Secretary For Space, subject: Main Points for DUSD (SPACE) Testimony to HSC Regarding Spaceports, 12 June 1996. 29 May 1996.

[5] Commercial Space Launch Activities, sec, 70111

[6]Dr Shiela E. Widnall, Secretary, US Air Force, address to Space Transportaion Association, Washington, D.C., 8 May 1996.

[7]Lt Gen Patrick P. Caruana, Vice Commander, Air Force Space Command. To Assistant Secretary of the Air Force—Space. Letter. Subject: Adequacy of 30 and 45 SW Resources to Support Commercial Space Activities, 11 June 1996.

Chapter 2

Airport Evolution

An airplane can do almost everything that a bird can do, except build its own nest.

—William G. Shepherd
noted American journalist

The Early Years

Shortly after the Wright Brothers' maiden flight in 1903, the need for an airport materialized. Historically, civilian airports were considered a local responsibility and although operational airports existed as early as 1909, they could hardly compare to the airports that are in existence today. All were privately owned and by 1912, there were 20 operational airports in use throughout the United States.[1]

The development of civil airports throughout the United States has been closely linked with the military and war requirements. Aviation first developed in Europe during World War I (WWI). It was used as an instrument of war to break the deadly stalemate characteristic of trench warfare. Just in the United States alone, sixty-seven new military airports were constructed during WWI.[2]

After WWI, airmail service grew and became the impetus for airport development. By 1920, communities quickly became aware of the need to have an airport connecting them to the rest of the country; there were 145 municipally owned airports on record.[3]

With the end of WWI commerce became the driving factor in the development of aircraft, airports, and an airway system. On 20 May 1926, Congress passed the Air Commerce Act to "encourage and regulate the use of aircraft in commerce, and for other purposes."[4] The Act authorized the Secretary of Commerce to "establish, operate, and maintain along such airways all necessary air navigation facilities except airports." It also directed that, "the Secretary of Commerce shall grant no exclusive right for the use of any civil airway, airport, emergency landing field, or other air navigation facility under his jurisdiction." Therefore, prior to 1933, the development and operation of airports was delegated to local governments or the private sector. However, beginning in 1933, the Civil Works Administration, in response to the Great Depression, spent approximately $11.5 million establishing 585 new airports in small communities.[5]

In 1938, Congress passed, and President Roosevelt approved, the Civil Aeronautics Act superseding all statutes governing aviation to that point. The Act created the Civil Aeronautics Authority, placing all functions of aviation under that authority, and removed the barriers against federal involvement in airports.

The War Years

Just fifteen months after the Civil Aeronautics Act was passed, World War II broke out in Europe. In 1940, Congress authorized $40 million be appropriated for airport construction and improvement projects. Airport sites were chosen to meet both the needs of the military and postwar civil aviation.[6] In 1941, work began on 200 airports on land donated by a political subdivision such as a municipality. Additionally, the municipalities agreed to maintain, operate and improve the airport once constructed. As the war

progressed, so did the number of federally-funded airports. When the United States entered the war in 1941, work had begun on 668 airports, and by 1944, work had begun on 986 airports at a cost of over $2 billion.[7]

Post War Airport Development

After the war had ended, the focus once again shifted back to the development of a robust civil aviation capability. In May 1946, Congress passed the Federal Airport Act which provided the framework for federal aid for the development of public airports.[8] This Act directed the annual preparation of a National Airport Plan. Only public airports were included in the plan. One exception to this rule was that if a private airport, already in existence, was providing adequate support to a community, it would also be included in the plan. The Act also appropriated $500 million for airport aid over seven years. To receive grant money Section 11 of the Act mandated that the airport:

1. be open to the public and without discrimination
2. be adequately operated and maintained
3. have safe aerial approaches
4. have controls of the land adjacent to the airport
5. be open for military use
6. have standardized accounting records on project amounts
7. make records available for inspection by the administrator

Within 18 months, the Administration had granted $13.3 million to 133 sponsors marking the beginning of the federal government's present participation in airport construction.

In 1956, the "big sky" theory was tested when a TWA Super Constellation and a United DC-7 collided over the Grand Canyon killing 128 passengers. Two years later a military jet collided with a civilian transport plane—suddenly the skies were crowded.

The outcry over air safety led Congress to enact the Federal Aviation Act of 1958.[9] The purpose of this act was:

> to continue the Civil Aeronautics Board as an agency of the United States, to create a Federal Aviation Agency, to provide for the regulation and promotion of civil aviation in such manner as to best foster its development and safety, and to provide for the safe and efficient use of the airspace by both civil and military aircraft, and for other purposes.[10]

Airport Development in the 1970's, 80's and 90's

All segments of aviation experienced tremendous growth in the late 1960s. The strain that this growth put on the system manifested itself by causing aircraft delays, congestion in parking areas, terminal buildings and in the skies. To keep pace with the growth, a capital infusion would be required. As a result, Congress enacted the Airport and Airway Development Act of 1970. Borrowing from ideas in the interstate highway program, a trust fund was created funded by airport and airway user charges. These charges included an 8% tax on ticket fares, a $3 international fare surcharge, aircraft registration fees and gasoline taxes.[11] The bottom line was that this act was very successful. When it expired in 1980 (the Act had a ten-year sunset clause), the Act had raised $13.8 billion dollars with $4.5 billion dollars being distributed to 8,809 grant recipients.[12] After the Act expired Congress passed the Airport and Airway Improvement Act of 1982 which carried on the grant programs of the 1970s. This Act was amended in 1987 and again in 1990 with the focus shifting to safety and capacity. Included in the 1990 Act was language on the conversion of excess military air bases for civil or joint use. Specifically, it stated that:

> special emphasis should be placed on the conversion of appropriate former military air bases to civil use and on the identification and improvement of additional joint-use facilities.[13]

It also provided for:

> not less than 1.5 percent of the funds made available...shall be distributed during such fiscal year to sponsors of current or former military airports designated by the Secretary...for the purpose of developing current and former military airports to improve the capacity of the national air transportation system.

Additionally, this Act authorized airports to charge a $1, $2, or $3 Passenger Facility Charge (PFC) on enplaning passengers. Airport executives are currently using these fees to help fund additional capital improvements. According to Mr Nielson Bertholf, Chairman, American Association of Airport Executives, all airports are charging the $3 PFC.[14]

Privatization

It is evident that the current system of airports in the United States was built through federal policies and grant programs designed to foster and encourage the development of civil aviation. However, the current worldwide trend in aviation is to privatize airports. There are several forms of privatization. The most common are: (1) contracting a private company to manage it for the government; (2) long-term leases which allow private companies to construct and operate an airport which when the lease expires reverts back to the government; and (3) the outright sale of the airport to private owners.[15] Over the next few years, major airlines around the world will be operating out of privatized airports. Major airports in Europe (Heathrow, Frankfurt, Schipol), although owned by the state, are organized as government corporations. They do not receive government grants or subsidies.[16] In an interview with Mr. Bob Pool, President of the Reason Foundation, (the Reason Foundation is a Los Angeles public policy institute that has conducted

extensive research into airport privitization, and has presented their analysis to Congress) he stated that historically the US policy has not allowed for the privatization of airports. Airports are owned by municipalities, county governments and a couple of states (Hawaii and Maryland).[17] Mr Poole gives three reasons why the interest in privatization is growing. First, there is not enough infrastructure capacity to meet air transportation demands. Another reason is that since the advent of deregulation, there is decreasing airline competition at certain airports. Privately run airports may do better at attracting more competition, thus expanding capacity. Finally, airport sponsors invest a large amount of capital and are not earning any return from their investment.[18]

Although the US is lagging behind in airport privatization, the 1996 FAA Authorization Act, signed by President Clinton on 1 October 1996, contains a "Pilot Program on the Ownership of Airports." This program will allow waivers from restrictions placed on the airport when excepting grants, and will allow the city or county to use airport revenue for other than city government activities which is currently prohibited. Any airport sponsor may apply for the program, but only five airports in the US will be accepted. According to Mr Pool, two airports, Allegheny and Stewart, have already applied. Even before this pilot program was enacted, Los Angeles made a move to "defederalize" LAX. The city has refused federal funds over the past two years to gain autonomy over the use of airport revenues.[19]

Privatization has its critics as well. Smaller airports may not be able to operate in a free market system. If the grant money disappears, so will they. Airlines are concerned that cities will use private airports as "cash cows" for their treasuries. Privatization may not be the answer for all airports, however, the rest of the world is moving in that

direction. The Reason Foundation calls for the US government to allow for greater flexibility for airports to try out new operating methods.[20]

Notes

[1]Alexander T. Wells, *Airport Planing & Management.* (New York, N.Y.: McGraw-Hill Co., 1996), 4.

[2]Ibid.

[3]Ibid.

[4]Air Commerce Act of 1936, U.S. Statutes at Large 44 (1926): 2119.

[5]Wells, 7.

[6]John H. Frederick, *Airport Management*. (Chicago, IL.: Richard D. Irwin, Inc., 1949), 115.

[7]Ibid., 114.

[8]Federal Airport Act of 1946, U.S. Statutes at Large 60 (1946): 170.

[9]Wells, 15.

[10]Federal Aviation Act of 1958, U.S. Statutes at Large 72 (1958): 131.

[11]see note 9.

[12]Laurence E. Gesell, *The Administration of Public Airports.*3d ed. (Chandler, AZ.: Coast Aire Publications, 1993), 142.

[13]Ibid., 143.

[14]Neilson Bertholf, interview by author, Montgomery AL, 26 November 1996.

[15]Gesell, 244.

[16]Pool, Robert. "Viewpoint—US Lags In Letting Airports Go Private."Aviation Week & Space Technology, 23 September 1996, 66.

[17]Robert Poole, telephone interview by author, 18 November 1996.

[18]Gesell, 246-247.

[19]Michael A. Dornheim, "Los Angeles Moves to Defederalize LAX." Aviation Week & Space Technology, 28 August 1995, 49.

[20]see note 16.

Chapter 3

Spaceports

If you build it they will come.

—[Movie] Field of Dreams, 1989

Emergence of the Spaceport Sector

Historically, commercial space operations focused on commercial communication satellites and the medium sized launch vehicles that boosted them into geosynchronous orbit. This orbit was required because of the mission of these satellites. The US launches satellites into this orbit from Cape Canaveral. As mentioned in the introduction, after the Challenger disaster, the United States reversed its space launch policy and all but forbid commercial satellites to fly on future Space Shuttle flights. Expendable launch vehicle production was jump started with the Atlas and Delta launch vehicles emerging as the US workhorses. This remained the case until the early 1990's when a new technology emerged utilizing small satellites in distributed networks to provide space-based paging, data and voice transmission worldwide. This new emerging technology had several impacts to the commercial industry. First, numerous companies began to plan, finance, design and launch satellite constellations to capitalize on this new technology. Because these small satellites are in distributed networks, they require much larger constellations to

perform their mission. Listed in the table below are the many US programs in various stages of development.

Table 1. Examples of Small Satellite Programs

Type	System	# of Satellites	Mass	Inclination	1st Launch
Mega	Sativod	64	1540	50	2001
LEOs	Teledesic	840	1760	88	1999
	AMSC	12	5000-5500	50	1998-99
	Constellation	46	1160	64	1998
	Ellipso System	16	1430	elliptical	1998-99
	Globalstar	48	990	50-55	1997
Big	ICO	10	5500	45	1999
LEOs	Inmarsat P	10	5500	24	1997
	Iridium	66	1500	88	1996
	Odyssey	12	4800	50	1999
	Signal (Glonass)	48	680	Unknown	1996-97
	E-SAT	6	250	100	1997-98
	FAISAT	26	220-250	65-70	1997
	GE Americom	24	33	98	1997-98
	GEMNET	38	99	50	1997-98
	Leo One	12-24	330	80	1997-98
Little	Leo One USA	48	274	50	1997-98
LEOs	Orbcomm	36	95	45	1995
	Starsys	24	165	55	1997
	Vitasat	2	198	80-85	1995
	Elekon	7	Unknown	85-90	1996-1997
	Gonets	12-36	500-550	85	1996
	IRIS	2	Unknown	85	1997
	SAFIR	6	132	85-90	1997

Source: Practical Innovations. Cost Benefit Analysis of the U.S. Spaceports. Study for the U.S. Air Force, November 1996.

With large constellations another impact to commercial industry is an increased need to replenish satellites upon degradation. It's not surprising that commercial operators soon began to focus on developing small launch vehicles that could be used for replenishment missions. The Lockheed Launch Vehicle, Taurus, Pegasus, and Delta Lite are examples of small launch vehicles in various stages of development. Additionally, many of these satellites (but most importantly, Iridium) require a low earth, polar orbit to provide world wide coverage. That shifted the focus to Vandenberg AFB in California

where the United States conducts polar launches. Historically, commercial operations at Vandenberg AFB were minimal. This is not the case today, with over 17 commercial operators working with the 30th Space Wing to conduct commercial operations.[1] Commercial payload processing facilities were built in hopes to capture the potential high demand for satellite processing. Finally, in 1993 the commercial industry came full circle with the commercial spaceport concept.

Dual Use Grant Program

Just as it had done with the ELV sector, DOD played a pivotal role in breathing life into the spaceport sector of the commercial space industry. DOD provided ten million dollars in seed money in 1993, and another ten million in 1994 in the form of matching grants for the development of dual use space launch infrastructure. The FY 93 Defense Appropriations act stated:

> the funds appropriated in this paragraph, $10,000,000, shall be available only for grants to be made for the development of dual use space launch facilities to support Department of Defense and commercial space launch requirements, consistent with the terms of National Space Policy Directive[2]

The grant program mandated that grant money could only fund seventy-five percent of the proposed project (industry had to provide 25 percent). Grant review criteria also required that the proposed project must be dual use in nature (benefiting both the commercial and government space sectors), have a positive impact on the competitiveness of the US industry, and be usable by multiple commercial operators. The spaceports did very well in the grant selection process with $6.70 million of the 1993 and $7.24 million of 1994 total monies being awarded to the spaceport projects in California, Florida, Alaska and another spaceport that is focusing on reusable launch vehicles (and therefore not part

of this study) in New Mexico.[3] Although the dollar figures included in the grant were relatively small, political interest was extremely high. During the grant selection process the Secretary of the Air Force received more congressional correspondence concerning grant proposals than she had on big budget items like the MILSTAR program. The program was very successful in providing a big boost to space launch infrastructure development, specifically to the spaceport projects detailed below.

Spaceport Concepts

> *While the spaceport projects may sound like they have similar goals, the current group of spaceport organizations is characterized more by diversity than by similarity.*
>
> —Mr Bob Davis, Deputy Under Secretary of Defense for Space,
> Testimony before the House Subcommittee on Space and Aeronautics

Western Commercial Space Center

General Information. The Western Commercial Space Center (WCSC) is a *nonprofit corporation, designated* by the state of California, Section 15333.3 of the CA Government Code, as the California Spaceport Authority. As the designated California Spaceport Authority, they:

1. shall be the official recipient of federal grants
2. are the advocates for support of commercial space businesses
3. promote regulatory changes that will enhance the commercial industry
4. promote the optimum utilization of defense conversion funds[4]

In early 1993, WCSC began developing a concept for a commercial spaceport located on Vandenberg. In 1993, WCSC submitted a Dual Use Grant Program proposal to obtain necessary funds to begin work on their spaceport. As stated earlier in this report, the

grant program required matching industry funds. Unable to obtain the necessary matching funds, WCSC founders formed a for-profit company called California Commercial Spaceport Inc. (CCSI), and took out a loan to obtain the matching funds. In 1994, ITT and CCSI entered into a joint venture forming Spaceport Systems International (SSI). ITT guaranteed over $30 million dollars to complete the spaceport. This joint venture makes the California Commercial Spaceport a privately run for-profit business.

Facilities. The California Commercial Spaceport facilities are located on South Vandenberg AFB. They include:

1. an Integrated Processing Facility (IPF) for payload processing. This facility was existing Air Force launch property that was in mothball status since the deactivation of the west coast Space Shuttle program. The IPF is operational.
2. a new Spaceport Launch Facility currently under construction on 100 acres of land just south of Space Launch Complex-6, the planned Space Shuttle launch facility. Original plans call for one Stack and Checkout Facility (SCF), a Mobile Launch Platform (MLP), and a single launch pad. As demand grows, the spaceport plans on constructing a second SCF on the opposite side of the launch pad. As the name implies most of the booster stacking and checkout will be done in the SCF. Shortly before launch, the MLP will move the booster to the launch pad for launch. Initial operational capability is planned for mid-1998. The spaceport does not have any missions manifested to date.

Space Launch Market Niche. The California Commercial Spaceport started out focusing on the small launch vehicle market (Minuteman II, Taurus, Lockheed Martin Launch Vehicles). They have expanded their niche by redesigning their spaceport in the hopes of capturing the US and international medium class of launch vehicles as well as the small.

Interaction with DOD. With its facilities located on Vandenberg AFB the spaceport has a lot of interaction with the 30th Space Wing. After a lengthy environmental review

process, the Secretary of the Air Force, in a speech given on 28 October 1994 to the Air Force Association convention in Los Angeles, California, stated,

> I'm happy to announce an Air Force policy for the dual use of Vandenberg AFB which will open it in an exciting new way for commercial space launches. We hope to negotiate a long-term lease with the Western Commercial Space Center, allowing for development of a commercial "spaceport" at Vandenberg Air Force Base. The lease will represent a landmark decision for the Air Force. It is the tip of the iceberg for military/commercial space cooperation on the West Coast.[5]

On 16 March, 1995, a 25 year lease was signed with WCSC granting them exclusive use of 100 plus acres on South Vandenberg (for fair market value) and the excess Integrated Processing Facility (for direct costs incurred by DOD). WCSC in turn signed a sub-lease with SSI. Additionally, the Air Force signed a Commercial Space Operations Support Agreement with WCSC. This agreement specifies the terms and conditions under which the Air Force will provide launch services to the spaceport. All launches conducted from the spaceport will utilize the DOD launch range for telemetry tracking, optics, and command destruct.

Spaceport Florida Authority

General Information. In 1989, the State of Florida passed legislation creating the Spaceport Florida Authority (SFA). The authority is chartered to support space-related economic development, and to assist in the development of the space transportation industry.[6]

In 1992, SFA began developing their spaceport concept for a small launch capability on Cape Canaveral. In 1993, and again in 1994, they received a total of $4.89 million dollars to begin work on their concept. The spaceport has also received state and industry funds to help raise the $7.2M needed to reach IOC.[7]

Facilities. Like the California spaceport, Florida's spaceport facilities are located on Air Force property. This dual use launch capability uses a combination of federal and state facilities. These facilities are:

1. LC-46. Launch Complex (LC) 46 is a site assigned to the Navy for Trident launches. The actual launch mount is excess capacity because the Navy's land based Trident testing is complete. Spaceport Florida will use the Navy's launch pad, flame duct, ordnance checkout building and utility room and the existing rail structure for commercial operations.
2. Launch mounts for each class of vehicle, Mobile Access Structure, umbilical mast foundations, communication trenches and utility aprons which will all be provided by the state.[8]

LC 46 will be operational in 1997 with their first launch manifested for late 1997. A second launch is manifested in 1998.

Space Launch Market Niche. Like the California Spaceport, Florida's original concept also focused exclusively on capturing the small (Castor 120 rocket motor based) vehicles. It too has a second phase planned which would allow them to capture the medium class market as well. Rather that modifying LC-46 for larger boosters, Spaceport Florida is looking at obtaining a second excess Air Force launch facility, to conduct medium class launches.

Interaction with DOD. SFA plans on operating their spaceport on a shared use basis (for direct costs) with the Navy. DOD and SFA will enter into a real property license; the appropriate real property instrument for granting shared use. Additionally, a Commercial Space Operations Support Agreement will also be used for the launch service provisions. All launches conducted from the Florida Spaceport will be conducted safely using DOD's Eastern Test Range. Therefore, similar to the California Commercial

Spaceport, all launch vehicle operators will be given two bills: one bill for use of the spaceport, and a DOD bill for direct charges incurred by the Air Force for launch services.

Alaskan Aerospace Development Corporation

General Information. In 1991, the State of Alaska under Alaska statute AS 14.40.821, formed a public corporation called the Alaskan Aerospace Development Corporation (AADC). The purpose of the AADC is to develop:

1. the Kodiak Launch Complex (KLC)
2. a satellite ground station industry in Alaska
3. a Challenger Learning Center

Similar to both the California and Florida Spaceport Authorities, Alaska submitted a Dual Use Grant proposal in 1993 and 1994 and received a total of $1.85 million to accomplish the necessary environmental studies required for the spaceport. In late 1995, the Alaska state legislature appropriated $25 million dollars for the spaceport and has authorized AADC to issue bonds for further funding as required.[9] In 1996, NASA provided AADC a grant for $830 thousand dollars for spaceport development. In October 1996, AADC received a "Finding of No Significant Impact" issued by the FAA regarding the environmental assessment of the Kodiak Launch Complex[10].

The stated goals of the KLC spaceport concept are: (1) to develop an economically feasible spaceport; (2) to develop a dual use spaceport providing low costs, minimum bureaucracy and flexibility, and (3) to transition KLC to the private sector.[11]

Facilities. The KLC is the only spaceport in development in the United States which will not be built on land obtained from the Federal Government. AADC received a 30 year lease from the State of Alaska for 3100 acres at Cape Narrow. The spaceport

facilities to be built on this land consists of a: (1) Launch Control and Management Center; (2) Payload Processing Facility; (3) Integration and Processing Facility; (4) Spacecraft and Assemblies Transfer Facility; and (5) Launch Pad and Service Structure. The KLC launch facility will be an all-weather, indoor processing and launch facility. These facilities provide AADC with a year-round operational capability.[12]

Space Launch Market Niche: The KLC is focusing on the same small launch vehicle market as the other spaceports.

Interaction with DOD: Unlike the other spaceports, KLC is not located on a DOD installation, and, therefore, will have minimum interaction with DOD. Not being collocated on an Air Force base is both a positive and a negative. On the positive side, KLC will have added flexibility because they are not depending on using DOD excess property and services. However, KLC does not have the benefit of having an existing range infrastructure in place to provide range and flight safety services. KLC plans to use one of NASA's Mobile Range Safety Systems (on an excess capacity and direct cost basis) and trained personnel for the conduct of launch operations.

Notes

[1]Paul Klock, telephone interview with author, 29 January 1997.

[2]Briefing, Assistant Secretary of the Air Force (Space), subject: FY 93 & 94 Dual Use Space Launch Infrastructure Grant Program, 30 May 1996.

[3]Ibid.

[4]Western Commercial Space Center, Overview Briefing, faxed to author on 17 January 1996.

[5]Ibid.

[6]Edward A. O'Connor, Executive Director, Spaceport Florida Authority. Remarks before the House, Subcommitee of Space and Aeronautics, Hearing on Commercial Space. As presented on 12 June 1996.

[7]see note 1.

[8]Air Force White Paper, 45th Space Wing Plans and Programs Office, subject: LC-46 Operations, May 1996, 2.

Notes

[9]see note 1.

[10]Alaskan Aerospace Development Corporation. Kodiak Launch Complex, Kodiak Island, Alaska, Corporate Marketing Brochure

[11]Ibid.

[12]Ibid.

Chapter 4

Issues, the Airport Way and Inferences

Spaceport Ownership

Issue

Should spaceports be public or privately owned? The current group of spaceports are very diverse on this issue. Spaceport Florida, *a state agency*, plans on operating the Florida Spaceport on a non-profit basis. They plan to charge a fee to use the spaceport so that it can be self-supporting. The California Spaceport, on the opposite end of the ownership spectrum, is a for-profit operation. Although DOD's formal relationship is with the California designated spaceport, the joint venture with ITT to operate the spaceport makes this a private enterprise with a $30 million dollar bill to pay. AADC falls somewhere in between. As a public corporation created by the state, the AADC operates closer to the public end of the spectrum. However, their goal is to eventually turn it over to the private sector.

The Airport Way

As outlined in Chapter 2 of this paper, there has been distinct phases of airport ownership throughout its evolution. Prior to WWI, all 20 recognized airports in the United States were private.[1] With the onslaught of WWI, and later WWII, the federal

government had a rationale for direct assistance—supporting the war effort. If the nation's airport needs could have been satisfied by the private sector it would have been. However, because it was not viewed as profitable, the government had to step in to meet the nation's needs.[2] In the post-war years the military turned over excess airports to the local authorities which had a large impact on the network of airports. Since that time federal grant money was provided to accommodate the rapid expansion of the airline industry. Our current network of airports was built in the 1940's, modified in the 1950's, and enlarged in the 1960's all using federal dollars[3]. The current trend is to privatize these airports already built with federal dollars. Those that argue against privatization say that there is a fundamental government role to invest in transportation infrastructure today that will be required in the years to come.[4] One just has to look at the development of the railroad or the interstate highway system to find a precedent.

Inferences

The spaceport industry of today can be characterized just like air transportation was characterized in its infancy. It is a fledgling industry with little capital, engaged in reckless competition, and highly dependent for its survival on federal government subsidization (either through the use of existing excess DOD capacity or federal grant money).[5]

In studying the evolution of airports it is clear to see that a vital national need (national defense) and the economic situation drove federal dollars being used to construct airports. Although the federal government's need for a small launch capability is not vital, there is a need for which we currently do not have a capability. Commerce (commercial communication satellites and remote sensing satellites) is currently the primary driver for this industry. Although the list of potential small satellite programs (and more importantly

the size of the constellations) as shown in Table 4.1 is significant, the number of small vehicle launches to support this industry is not. Obviously, not all the proposed systems are going to become reality. The programs that do materialize plan on using medium class launch vehicles to launch multiple satellites at one time. Based on DOT's 1996 Low Earth Orbit (LEO) Commercial Market Projections that only three Big LEO and two Little LEO systems will materialize, the GRC estimates that between CY 1996 - 2005 there will only be 12 launches a year needed to sustain these constellations. GRC also projects the spaceport capacity for that same period to be 468 launches. Obviously, supply significantly outweighs demand, and, therefore, not all spaceports will be profitable.[6]

Like the precedent set with airports, DOD excess launch pads should be turned over to the state to operate (as they see fit) for the following reasons: (1) It is in DOD's interest to have a commercial launch vehicle capability—we currently have a need with no matching capability. That need is the main reason why DOD gave millions of dollars in the form of "Dual Use" grant money to the state spaceport projects. (2) The current satellite launch projections make it unsure at best if even these state spaceports will survive, much less the other privately owned spaceports that would like to operate on our launch bases. (3) The need for additional spaceports has not yet materialized. By opening up additional excess capacity to private companies that are also interested in operating on DOD facilities, DOD will assist in over saturating a market that is currently shaky at best. (4) We must alleviate the current strain being placed on DOD launch bases for their excess capacity. Current economic projections support that states that choose to develop a private, for-profit spaceport do so at their own risk. Obviously, states that spend relatively smaller dollars to modify an excess DOD launch pad will be positioned to be

more self-sustaining than states that choose to build a launch pad from the ground up using large amounts of capital.

Commercial Space Planning

Issue

There is no plan in existence that spells out the commercial capability required to support this industry.

The Airport Way

Historically, FAA's role in planning the national airport system has been to make projections about future demands, take stock of existing capabilities and then discourage the development of redundant systems.[7] Specifically, the FAA creates the National Plan of Integrated Airport Systems to forecast capital requirements to meet current and future needs.[8]

Inferences

Although the current commercial space system is not nearly as robust as the national airport system, there is a need for some centralized planning. In the past DOT has provided forecasts to help project future commercial markets. This needs to be expanded into an integrated plan for commercial space activities. This plan should include satellites, launch vehicles, spaceports and other commercial launch sites, such as payload processing facilities. This plan would also assist DOT in lobbying for more federal grant money. Additionally, DOD could use the plan to back up future decisions to accept or reject

future requests for additional excess capacity. This would help save scarce DOD excess resources, allowing them to be used to support a needed capability.

Licensing/Certification

Issue

Federal Law requires that a license be issued or transferred for a citizen to launch a launch vehicle or operate a launch site in or outside the United States.[9] Existing Code of Federal Regulations state that, "The Office of Commercial Space Transportation may issue and transfer licenses authorizing launches, the operation of launch sites, or both."[10] However, there is debate over the need to license commercial launch sites operating on a DOD range, and what specific activities are actually covered under a license. This debate has been going on for over five years. Recently, the FAA has been under fire because they have taken too long to develop guidelines for the industry. Representative Dave Weldon (R-Fla) leveled the sharpest attack when he stated, "despite five years of discussion, I was dismayed to learn that no regulations have been issued, yet some spaceports, such as Spaceport Florida have launches scheduled in less than 12 months."[11] Congressman Weldon went on to say that he will, "encourage the transfer of licensing authority to the states wanting that authority."

The Airport Way

To adequately understand how the FAA manages the safety of the entire airport system it is necessary to look at three separate pieces: airport certification, aircraft certification and the airspace structure and navaids.

Airports

The Airport and Airway Development Act of 1970 amended the Federal Aviation Act of 1958, adding a section which authorizes the FAA Administrator to issue operating certificates to airports. [12] This law prohibits a person from operating an airport without a certificate or in violation of a certificate. Under the current Code of Federal Regulations (14 CFR, 139) a certificate of operations is required to operate an airport serving aircraft that have a seating capacity of more than 30 passengers. In order to obtain an airport operating certificate, an applicant must prepare an airport certification manual for approval by the FAA. This manual spells out the airports' normal and emergency operating procedures. Elements of the airport certification manual include:

1. line of succession of responsibilities
2. grid map
3. system of runway and taxiway identification
4. maintenance procedures for paved and unpaved areas, marking and lighting systems, traffic and wind indicators
5. emergency operations plan
6. description of emergency and rescue equipment
7. hazardous material control procedures
8. any other item which the administrator finds necessary or to be in the public's interest[13]

Airlines. Air carriers operating planes carrying over 30 passengers must comply with CFR 14, 121 certification requirements. The application for certificate requires that the air carrier: provide financial information, have significant management personnel experience, and spell out their proposed concept of operations. Each certificate issued contains:

1. the holder's name
2. description of authorized operations
3. the date issued

4. termination date
5. the kinds of operations authorized
6. types of aircraft authorized to fly
7. special airport authorizations
8. special airport limitations
9. procedures for control of aircraft weight and balance
10. any other item deemed necessary by the administrator[14]

Airspace structure and navaids. By statute the FAA is required to ensure the safety of air traffic at and between airports. The airspace system is almost entirely an FAA function. The FAA provides the facilities, equipment, and trained and certified air traffic controllers to manage that system.

Inferences

This area of licensing and certification is ripe with inferences that can be applied to the operation of spaceports, launch vehicle operators, and the range. Licensing/certification should remain at the federal level. In 1995, DOT's Office of Commercial Space Transportation (a direct reporting agency to the Secretary of Transportation) was realigned under the FAA. This realignment should have a positive impact on the normalization of spaceports.

Spaceports. Like airports, all spaceports, whether operating on or off of federal property should be licensed. Additionally, those commercial operations such as payload processing facilities, should also be provided a launch site operator's license. Recently, the FAA issued its first ever launch site operator's license to Spaceport Systems International, L.P. This license authorizes SSI to operate the California Spaceport. Although heralded as the first ever license—it misses the mark. The license is four pages long and does little more than mandate that SSI, (1) enter an agreement with the Air Force

(a foregone conclusion for them to acquire launch services and property on a DOD installation), (2) is responsible for operating the spaceport in a safe manner, (3) shall maintain records, (4) report mishaps, (5) allow for monitoring, and (6) not transfer the license.[15] The launch site operator's license should be closely aligned with the airport operating certificate detailed above. It should include:

1. grid map
2. launch profiles
3. maintenance procedures for paved and unpaved areas, marking and lighting systems, wind indicators, and optic devices
4. emergency operations plan
5. description of emergency and rescue equipment
6. hazardous material control procedures
7. explosive siting plan
8. description of public protection
9. a maximum probable loss study for the types of vehicles and launch profiles that the spaceport plans to accommodate
10. insurance requirements
11. any other item which the administrator finds necessary or to be in the public's interest

Additionally, spaceports and other launch sites should be required to build a certification manual that is maintained on the site. This manual would be a valuable tool for managing day-to-day operations.

Launch License. Currently, the evaluation of launch license requests involve a mission review and a safety review. The mission review focuses on our national security interests, foreign policy interests, or international obligations which may be impacted by the launch. The mission review has no such parallel upon which to draw inferences. This section will focus on the safety review. The safety review should align closely with the types of areas evaluated by the FAA when granting a airline certificate under CFR 14, 121. Examples of safety review items include:

1. the holder's name
2. description of authorized operations
3. the date issued
4. termination date
5. insurance requirements
6. financial requirements
7. the kinds of operations authorized
8. management personnel
9. satellite limitations
10. orbits authorized
11. any other item deemed necessary by the administrator

Range. The range is analogous to the airspace structure and navaids system employed for the safe operation of air traffic. The FAA needs to develop standards for what range instrumentation is required for commercial launches. DOD has range safety standards it requires for launches off of DOD ranges. However, the Alaskan Spaceport will not operate on an existing DOD range. The FAA should clearly define what instrumentation is required to ensure the safe launching of launch vehicles. Additionally, similar to air traffic controllers, all range safety personnel used in support of a launch should be trained using FAA guidelines and certified under the FAA.

DOD/DOT Division of Responsibilities

Issue

What is the proper division of responsibility between DOD and DOT in regulating the commercial space operations? This jurisdiction issue is complicated by the fact that most US spaceports being planned today are located on Air Force or NASA property, the Alaska Spaceport being the sole exception. Currently, there are no clear boundaries that

divide the DOD and DOT responsibilities for regulating activities occurring on DOD installations. Because of this discrepancy, there is duplication of effort.

The Airport Way

DOD complies with CFR 14, 139 to the extent required for military operations. However, DOD airports, not jointly used, do not receive an airport operating certificate under CFR 14, 139. For joint use airfields, the military holds an airport operating certificate under the military exemption to Part 139.[16] All costs to bring the military airport up to Part 139 standards are borne by the county.

DOD airfields may or may not be controlled by FAA air traffic controllers. All DOD air traffic controllers are trained according to FAA standards and are certified by the FAA to control air traffic.

Inferences

The DOD and FAA need to look at ensuring all commercial space operations are conducted in a safe manner and reducing duplication of effort between the two governmental agencies.

As mentioned above, pure commercial launch sites, on or off of DOD installations, should obtain DOT launch site operating certificates. Just as DOD airfields are not licensed, DOD launch sites are not and should not be required to obtain operating certificates. For dual use launch sites, on, or off of DOD installations, a commercial launch site operator's license should be obtained for those sites being operated commercially (an example being a government launch off of SFA's spaceport). For DOD launch sites that also support commercial launches of the same launch vehicle (such as the

Atlas and Delta launch sites at Cape Canaveral and Vandenberg), DOT operating certificates should not be required because the launch site is primarily a DOD launch site being used on an excess capacity basis for commercial launches of the same launch vehicle.

All commercial launches no matter where they are launched from should be launched under the auspices of a DOT launch license. However, for commercial launches occurring from a DOD installation, DOT should conduct the mission review and the Air Force should conduct the safety review. For launches that do not occur from a DOD range, DOT should accomplish both license reviews.

The FAA should certify all DOD range safety and control officers, just as our DOD air traffic controllers are certified. Then all launches occurring from a DOD installation, either government or commercial, would be controlled by DOD trained and FAA certified range personnel. For launches not occurring from DOD launch bases, DOT should provide the range safety oversight and control.

Notes

[1]Wells, 4.

[2]Gesell, 244.

[3]Ibid., 128.

[4]Charles M. Barclay, "America's Future in Airport Infrastructure." American Association of Airport Executives Report, n.p. On-line. Internet, 2 November 1996. Available from http://www.airportnet.com, 4.

[5]Gesell, 10.

[6]General Research Corporation International Inc., Small Launch Vehicle Briefing, Developed for and presented to, The Deputy Assistant Secretary of the Air Force—Space, 1996.

[7]Wells, 48.

[8]Ibid., 22.

[9]U.S. Public Law 103-272. 103rd Congress, 2nd session, 5 July 1994. Commercial Space Launch Activities, sect 70105.

Notes

[10]Code of Federal Regulations. Aeronautics and Space, 14 Parts 200 to 1199. Revised as of 1 January 1996, 606.

[11]Warren Ferster, "Office Urged To Finish Commercial Spaceport Guidelines." Space News, 6-12 May 1996, 6.

[12]Gesell, 327.

[13]Code of Federal Regulations. Aeronautics and Space, 14 Part 60-139. Revised as of 1 January 1996, Part 139.205.

[14]Ibid. 121.25.

[15]US Department of Transportation. Federal Aviation Administration, Office of Commercial Space Transportation License. License Number: LSO-96-001, Issued to Spaceport Systems International, 19 September 1996.

[16]US Department of Defense. Department of the Air Force. Joint Use Agreement Between St Clair County, Illinois and The United States Air Force, 17 September 1991.

Chapter 5

Conclusions

This study attempts to determine if there are any inferences that can be gleaned from the evolution of airports that can be applied to the current group of spaceports. A historical review of airports lays the foundation for the study. Three spaceports were then analyzed (California, Florida, and Alaska) to illustrate the diversity among the current spaceports and to focus the comparison on which to make inferences.

The study concludes that there are inferences that can be applied to the operation of spaceports. These areas include ownership, planning, certification, and governmental division of responsibilities. Like the precedent set with airports, excess DOD launch sites should be turned over to the state to operate on a for-profit or not-for-profit basis—economics should dictate. The study also recommends that the FAA should create an integrated plan similar to the FAA's National Plan of Integrated Airports, for commercial space activities. The study next identifies the issue of spaceport certification as the issue with the most inferences to be applied. It recommends that the FAA develop spaceport, space launch vehicle and the launch range certification procedures that parallel the procedures contained in the Code of Federal Regulations for the certification of airports, airplanes and airspace. Finally, the study recommends clear division of DOD and DOT responsibilities.

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