SOUTHWEST REGIONAL

SPACEPORT

BUSINESS PLAN

FOR THE SOUTHWEST REGIONAL SPACEPORT

LIST OF TABLES AND FIGURES

EXECUTIVE SUMMARY

New Mexico has a history of leading the world into space. Goddard conducted early liquid fuel rocketry experiments in New Mexico. White Sands Missile Range in south-central New Mexico was selected as the site to launch the captured German V-2 rockets after World War II. The first true space exploration was conducted using those modified V-2 rockets. Now is an opportunity to build upon and enhance this legacy.

Commercial space represents the latest stage in the millennia-old evolution of transportation systems. And, as in times past, governments will have to invest in the requisite infrastructure for the industry to thrive and economies to grow. History teaches us that those who judiciously invest are rewarded, while those that do not are typically left to languish.

In scrutinizing the various indicators of market segment attractiveness, numerous sources point to the space tourism industry. This is the only space activity that can support a high number of flights which is essential to bringing costs down. And if costs are reduced, there should be opportunities for taking advantage of other benefits from space, such as developing the solar electricity industry. NASA and the U.S. Space Transportation Association have published a report acknowledging that space tourism was likely to start soon and could grow into the largest activity in space. It is estimated that space tourism will generate at least $1 billion a year within 20 years.

The Southwest Regional Spaceport currently is receiving attention as the home of the X Prize Cup Competition; however, the industry is far greater in breadth and depth than this event. It includes construction and operation of the spaceport itself, research and development and launch operations for the suborbital market, and research and development and launch operations for the orbital space market. Conservatively estimated, the cumulative economic impact of these activities over the first five years of operations will be $991.45 million, generating $296.62 million in earnings, and sustaining 2,284 jobs per year by the fifth year. Optimistically estimated, the cumulative economic impact of the commercial space industry in New Mexico after five years will be $1,194.45 million, generating $357.21 million in earnings, and sustaining 2,871 jobs per year by the fifth year.

As important as the business growth, the business development, and the economic development opportunities are, the educational benefits of the new space industry being located in New Mexico cannot be underestimated. The Southwest Regional Spaceport and ancillary industries surrounding the spaceport will provide local role models embodying the opportunities available to those with higher education in New Mexico and the country.

To realize this opportunity, New Mexico must have a roadmap for the Southwest Regional Spaceport. As reflected in the far-reaching, yet attainable mission and vision statements, the SRS is setting the stage for a new wave of economic development.

Mission

The Southwest Regional Spaceport will be the premiere American spaceport of the second space age.

Vision

The Southwest Regional Spaceport will be the vehicle to open the space frontier to all citizens, will bring new companies and jobs to New Mexico, increase tourism statewide and help brand New Mexico as the place to experience the future.

Specific marketing, legal, financial, and operational steps must be taken to realize the Spaceport vision and mission. For nearly 15 years, New Mexico has been positioned to take a leadership role in the space age of the 21st century. While there are obstacles to overcome and risks to be addressed, the time for waiting is over. The Southwest Regional Spaceport is an exciting educational resource, a prestigious landmark, and an economic development opportunity for the State of New Mexico.

PREFACE

The Arrowhead Center (AHC) at New Mexico State University was contracted by the New Mexico Economic Development Department to develop and deliver several reports and services relative to the Southwest Regional Spaceport. Foremost among them were a strategic analysis of the commercial space industry and a business plan for the spaceport to realize the opportunities inherent to the industry. In compiling both documents, the research team from Arrowhead Center conducted extensive secondary research, interviewed local businesses, and conducted two planning summits. The first summit, held July 8 and 9, 2005 in Las Cruces, was facilitated by and held in conjunction with a planning meeting of the X Prize Cup Foundation. Arrowhead Center especially appreciates the efforts of and input from Peter Diamandis at this meeting. Nearly two-dozen people, representing more than 10 companies and entities associated with the new commercial space industry, provided valuable insight. A second summit was held in Santa Fe from July 20 - 22, 2005. Over the course of two days, the Arrowhead Center research team heard from those in the industry about opportunities, threats, markets, regulatory issues, and risks that confront them and us. The information gathered from the summits (detailed separately), interviews, and bibliographic research formed the basis of the strategic analysis (detailed separately). The business plan, excerpted from and based upon this research, is presented herein.

1.0 INTRODUCTION

It is appropriate that the Southwest Regional Spaceport be built in New Mexico. New Mexico has a history of leading the world into space. Dr. Robert H. Goddard conducted his early rocketry experiments in New Mexico. White Sands Missile Range (WSMR) in south-central New Mexico was selected as the site to launch captured V-2 rockets after WWII. The first true space exploration was conducted using these rockets. WSMR is still one of the busiest launch facilities in the U.S.

This is now the opportunity to build upon and enhance this legacy. Commercial space represents the latest stage in the millennia-old evolution of transportation systems. And, as in times past, governments will have to invest in the requisite infrastructure for the industry to thrive and economies to grow. History teaches us that those who judiciously invest are rewarded, while those that do not are typically left to languish.

From the earliest years of the nation, governments (state, local, and federal) have invested in the development of transportation systems in partnership with the private sector. The construction and sometimes the operation of early 19th century canals and harbors in what is now the Eastern U.S. were often paid for by state and municipal governments.

By the 1840s, states and cities were subsidizing the construction of railroads. In 1862 Abraham Lincoln (a lawyer and lobbyist for the railroads in an earlier career) signed the Act that ultimately resulted in the construction of the trans-continental railroad system. Lincoln understood that the federal government would never be fully repaid for the millions of acres of federal land given to the railroads. Instead, Lincoln understood that the construction of the railroads was crucial to economic development. The construction of railroads required an efficient iron and steel industry which in turn required a massive coal industry and many other industries. If government helped finance the railroads, the other industries would grow on their own. Not only that but the railroads would open up new markets for many other industries and make all industries more efficient. Lincoln was relying on what economists now refer to as forward and backward linkages. Economic historians recognize that railroad building was one of the most important factors in U.S. economic development in the 19th century.

The construction of railroads was not the end of government involvement in transportation systems. In the 20th century states and municipalities subsidized the development of the automobile and trucking industries by constructing roads at public expense. Government recognized that a system of private roads (toll roads) would hinder the development of the economy while public roads would help provide efficient transportation for all. Today, the National System of Interstate and Defense Highways is generally regarded as one of the most successful public works projects in history, fostering economic development and enhancing the national defense of the United States. On August 10, 2005, President Bush signed a $286 billion transportation bill to provide subsidies for the construction of public transportation systems including highways, commuter rail systems, and other forms of transportation. Bush signed the bill in Chicago at a Caterpillar plant to emphasize the forward and backward linkages of spending on transportation!

Government also played a vital role in the development of commercial air service. Early airports were often constructed by cities in the hope that they could attract air service to their localities. The cities understood that they would not directly receive enough money from air carriers to pay for these investments, but would instead recoup their investment by the attendant economic development. Recognizing its economic and defense capabilities, the federal government subsidized early airlines through contracts to provide mail service as a means of encouraging improvements of technology and nurturing the fledgling industry. Even now, the airline industry is highly subsidized by government. Small commuter airlines are often subsidized directly to provide service to smaller markets by a combination of federal, state and local governments. Perhaps more importantly, the development of aircraft technology has been highly subsidized since World War I.

In short, governments at all levels in the U.S. have always invested in transportation systems. The commercial space industry will require an investment in necessary infrastructure no matter where the most active spaceports are located. New Mexico has an opportunity to be in on the industry from the start. The commercial space industry could, like the railroads a century and a half ago, transform the economy. And, as in times past, New Mexico must evaluate investing in and managing spaceport infrastructure as a development proposition.

2.0 DEVELOPMENT OPPORTUNITY

2.1 MARKET

In scrutinizing the various indicators of market segment attractiveness, numerous sources point to the space tourism industry. At present, tourism is a large business, exceeding $400 billion yearly in the U.S. alone and serving as the second largest employer. There is a general public interest in space from the sheer volume of people who patronize space museums, attend space camps, visit launch sites, and purchase space related merchandise. This is the only space activity that can support a high number of flights, which is essential to bringing costs down. And if costs are reduced, there should be opportunities for taking advantage of other benefits from space, such as developing the solar electricity industry. For new space companies, it is difficult to cope with the inherent risks which arise. Without cash flow, no company can stay in business. It is vital to build up activities which generate large cash flow as soon as possible. The most effective way to do this appears to be tapping large scale consumer markets using the techniques of successful commercial activities. NASA and the U.S. Space Transportation Association have published a report acknowledging that space tourism was likely to start soon and could grow into the largest activity in space.

Studies ranging as far back as 1994 suggest that large numbers of potential tourists are interested in the space tourism industry. It is estimated that space tourism will generate at least $1 billion a year within 20 years. Several very successful entrepreneurs including Richard Branson (Virgin) and Jeff Bezos (Amazon.com founder) have made commitments to this industry. Virgin wants to be the world's leading space tourism company and has signed a contract to license the technology behind Space Ship One. Jeff Bezos plans to build a spaceport for suborbital vehicles on a range near Van Horn, Texas and construct a three person ship that would take off, go suborbital, and land vertically. Generally, the Space Ship One accomplishment has opened up the market for space tourism because it has indicated that such endeavor is possible at a reasonable cost and probably within an acceptable range of risk.

There are indicators of demand for space tourism. Many airlines have received thousands of letters from people asking about the availability of trips to space (Collins,1991). A statistic of interest is that 2.8 million visitors entered the Florida spaceport in 2000 (Florida Space Authority, 2005). Worldwide, consumers spend in excess of $3 billion annually in space related products and services (Good, 2005). Peter Diamandis, a space travel entrepreneur, recently launched commercial zero gravity flights. These take place on 140 minute parabolic flights aboard a Boeing 727-200 that has been modified by Diamandis' firm. The fare is $3,000 and 600 tickets have been sold (Stern, 2004). Eric Anderson heads a firm which has flown 2,000 customers on suborbital flights for $19,000 in a MiG-25 Foxbat. His revenues in 2004 were $15 million, netting $1.5 million. Richard Branson has forecasts suggesting that his firm could carry 3,000 passengers in the first five years of flying. Some experts venture the opinion that his firm-Virgin-has the best technology in the industry.

One team of space researchers has conducted estimates of future demand for space tourism. From surveys of the U.S., Japan, and Europe, they propose that if the price of a ticket to low earth orbit could be reduced to between $10,000 and $20,000 per person, about 100 million people would wish to make such a trip. The world-wide demand would reach one million passengers per year or more, generating revenues of $10 billion or more. In order to make this possible, the economies of scale possible from accessing the entire global market would be very important. Business competition between tourism operators could be expected to progressively increase demand and decrease costs. Knowledgeable persons in the industry have indicated that when the next generation technology becomes available, the cost per person for trips should fall into the level of tens of thousands of dollars. Critical advances have been made during the past decade in many of the technologies that can enable non-astronaut human space travel to become both technically and economically feasible and more are.

Projections of the industry to 2030 suggest substantially increased growth. One authority indicates that this growth would occur as a result of rising incomes and growing middle classes around the world. On this basis, passenger numbers traveling to low earth orbit of 5-10 million per year in 2030 would imply average growth rates of 18% to 26% a year as feasible. Also possible are scheduled daily flights to supply as many as 100 hotels (with 30,000 to 80,000 guests) and 20 specialized sports centers, comprising of accommodations and a stadium, for both users and spectators, in orbit.

2.2 ECONOMIC IMPACT ANALYSIS

2.2.1 MEASURABLE ECONOMIC IMPACT

The direct impact of spending in the space industry generates a multiplier effect on the rest of the state economy. These multiplier effects can be estimated using input output programs such as IMPLAN and RIMS II, two widely used programs. The RIMS II program for New Mexico indicates that for every one dollar of additional spending in the guided missile and space vehicle manufacturing sector an additional .7079 dollars of spending occurs in the rest of the economy. The amount of earnings that is generated is equal to approximately forty-two percent of the initial spending. And for every one million dollars in initial spending in the sector, 11.58 full time equivalent jobs are created.

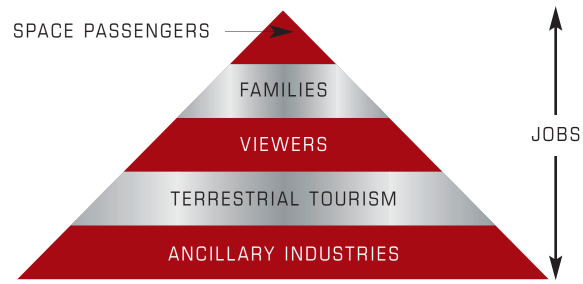

Figure 1 - The Commercial Space Pyramid

2.2.1.1 *Space Commercialization Pyramid*

Figure 1: The Commercial Space Pyramid illustrates the impact that would occur if the space tourism market is in fact realized. As one moves down the pyramid the number of jobs that would be created to support each segment of the market gets larger.

At the top of the pyramid are those customers that are actually going to pay to go into space. The cost to the consumer is estimated to be about $200,000. While the industry hopes that the number of individuals going into space is large, from the viewpoint of the state, these individuals represent only a small portion of the industry.

Those individuals going into space will have to go through training before the flight. That flight training does not have to be at the spaceport. In fact it may take place somewhere else in the state. More than likely family members will be accompanying the person taking flight and the location of training must provide amenities to those family members. Of course amenities will also have to be provided at the spaceport because the whole family will be located there for the flight itself.

The third section of the pyramid indicates that there will be those who want to view launches. Thousands of people have watched the launches of the space shuttle. However many come to watch what happens at this spaceport, they will be traveling through the state, spending on food and lodging and visiting other sites and cities throughout the state. This is in addition to what must be provided to them on site.

At least in the beginning the number of flights may not be very frequent. However there will be those that want to experience the idea of space flight and be willing to come to the spaceport just to see what it looks like. That is the next level of the pyramid. Again visitors to the spaceport may be visitors to other sights around New Mexico. This experience could be enhanced by attractions on site and provision of activities that would simulate space flight. The spaceport can be used to anchor New Mexico's position as the place to visit space; even terrestrially.

The base of the pyramid represents the number of ancillary industries that need to be present to support the commercialization of space. These represent the forward and backward linkages that must exist for the success of the operation. Design, fabrication and testing facilities must be built. Security, safety, food and lodging services must be provided. Fuel stations must be built and contracts for provision and delivery need to be negotiated.

The result of this process is that a wide variety of jobs will be generated, not only on site but across the state. Furthermore, the jobs sustained and created through the evolution of commercial space will cut across a broad spectrum of New Mexico's work force.

This is only one part of the industry. At least initially the space tourism model is built on low orbit flight. While some in the industry believe this will take place very soon, it may take three to five years before flights take place. Before that time design, testing and evaluation must take place. A similar pyramid can be constructed to illustrate the types and number of jobs that would be generated through this process. The realization of job creation under this scenario begins one to three years from the present.

The actualization of high orbit flights is further in the future. Two more pyramids could be constructed. One of the pyramids would illustrate the research, design and testing part of the industry and the second would illustrate the tourism and commercial part of the industry. The tourism and commercial aspects may be realized ten to fifteen years in the future. It is possible that the research, design and testing phase could start as early as six months from the present. In essence the spaceport should have an operation plan that would take advantage of both low and high orbit flights.

The educational value of the spaceport will be an important by-product. Interest in science, technology, engineering and mathematics was at its highest during the Apollo era. The commercial space industry and the SRS could have a positive effect on the state's attempts to improve education and retention rates in K-16.

It is difficult to estimate the impact of the spaceport and talk about the level of economic activity it may generate. It is clear that there is tremendous potential and if even a part of the potential is realized, New Mexico could become the place to be to take advantage of the commercialization of space

2.2.1.2 *Construction and Operations Impacts*

Even before being operational, the Southwest Regional Spaceport will have a positive economic impact on the State. Construction, by itself, will not be trivial. Using accepted impact models, we can forecast that for every $60 million in construction spending, the total impact will be over $120 million, with earnings multiples in excess of $40 million and supporting more than 1,450 new jobs.

Although being built out in phases, it is not unreasonable to suspect that over the next five years, more than $250 million will be spent to build out the spaceport, funds coming from a variety of sources, which could mean more than $480 million in total economic impact, with earnings multiples in excess of $160 million, creating and supporting an average of 1,450 jobs each year during buildout of the spaceport.

It has been estimated that the operational cost of the spaceport would be between one and two million dollars. This would also have an economic impact on the state. For every one million dollars of operational expenditures an additional spending of $708,000 will occur, $421,000 of earnings will be generated and 11.6 jobs will be created.

2.2.1.3 *X-Prize Cup Impact*

The New Mexico Spaceport primarily is receiving attention, at least for now, as the home of the X Prize Cup Competition. For the first year of the X Prize Cup Competition the estimated operating expenditures are $10.488 million. This would generate additional spending of just over $8 million and generate total earnings of about $4.4 million. By year five the estimated expenditures increase to almost $21 million and therefore the impact is approximately $16 million of additional spending and $8.8 million in earnings.

With the Countdown to the X Prize Cup Competition week recently concluded, these numbers seem easily achievable. The First International Personal Spaceflight Symposium drew more than 300 people. Next year, the Symposium will expand to two days with a target audience of 400 people, with at least one quarter coming from out of state. In addition, events at the airport, this year a single day event, which drew 20,000 to the Las Cruces International Airport, is scheduled to expand to two days with a target audience of 30,000. Education Day activities associated with the Countdown to the X Prize Cup Competition drew another 2,000 people to Alamogordo.

The Countdown to the X Prize Cup Competition is illustrative of the potential economic impact of the commercial space industry in New Mexico; catalyzed by the New Mexico Spaceport. While its immediate impact is impressive, it can grow very quickly in years to come, and it is not restricted to Las Cruces alone. Although precursory, it is possible to estimate the economic impact of the commercial space industry in New Mexico even more broadly.

2.2.1.4 *Suborbital Operations Impact*

The owners of one of the companies that has been considering locating at the Southwest Regional Spaceport has stated that they would spend about $250 million over a ten year period on research and development for suborbital flight. If in fact this company locates at the SRS and assuming that one tenth of this amount would be spent each year and that one half of the spending would occur in New Mexico, then this research and development spending would have a total impact of $213 million, would generate $52.5 million in earnings, and sustain 144 jobs per year as shown in Table 1: Impact of Sub-orbital Research and Development.

The FAA/AST has estimated the number of suborbital launches that will take place through the year 2010 ("The Economic Impact of Commercial Space on the U.S. Economy: 2002 Results and Outlook for 2010"). They estimated the number of launches in the world and allocated an amount of those launches taking place in the U.S. under a constrained and robust scenario. The constrained estimate assumed that ten percent of all world launches would occur in the U.S. The robust scenario assumed 75 per cent of the launches would occur in the U.S. These estimates are provided in Table 2: Estimated Suborbital Flights Per Year.

Table 1 - Impact of Sub-orbital Research and Development

YEAR	INITIAL SPENDING (MIL. OF $)	TOTAL IMPACT (MIL. OF $)	EARNINGS (MIL. OF $)	NUMBER OF JOBS
1	12.5	21.35	5.25	144.75
2	12.5	21.35	5.25	144.75
3	12.5	21.35	5.25	144.75
4	12.5	21.35	5.25	144.75
5	12.5	21.35	5.25	144.75
6	12.5	21.35	5.25	144.75
7	12.5	21.35	5.25	144.75
8	12.5	21.35	5.25	144.75
9	12.5	21.35	5.25	144.75
10	12.5	21.35	5.25	144.75
TOTALS	125.0	213.50	52.50	

Source: Calculations by author

Table 2 - Estimated Suborbital Flights by Year

YEAR	2006	2007	2008	2009	2010	TOTAL
# OF WORLD FLIGHTS	253	321	411	522	666	2173
U.S. FLIGHTS (CONSTRAINED ESTIMATE)	26	32	42	52	68	220
U.S. FLIGHTS (ROBUST ESTIMATE)	190	241	309	392	500	1632
NM FLIGHTS (25% OF CONSTRAINED ESTIMATE)	7	8	11	13	17	56
NM FLIGHTS (25% OF ROBUST ESTIMATE)	47	60	77	98	125	407
NM FLIGHTS(50% OF CONSTRAINED ESTIMATE)	13	16	22	26	34	111
NM FLIGHTS (50% OF ROBUST ESTIMATE)	95	120	154	196	250	815
NM FLIGHTS (75% OF CONSTRAINED ESTIMATE)	21	24	33	39	51	168
NM FLIGHTS (75% OF ROBUST ESTIMATE)	141	180	231	294	375	1221

Source: FAA/AST, "The Economic Impact of Commercial Space on the U.S. Economy: 2002 Results and Outlook for 2010," March 2004, and authors calculations.

Just as the FAA/AST estimated low and high market penetration of U.S. spaceports in the global suborbital launch market, to gauge the potential impact in New Mexico, various levels of the Southwest Regional Spaceport's penetration of the domestic launch industry must be assumed. Alternative scenarios were examined, including 25, 50, and 75 percent penetration ratios of the New Mexico Spaceport in the U.S. commercial launch market.

Depending on the development scenario actually realized, New Mexico could be home to as few as 17 commercial flights per year (New Mexico captures 25 percent of the FAA/AST constrained estimate) and as many as 375 flights per year (New Mexico captures 75 percent of the FAA robust estimate). If the industry and New Mexico hold to the current tack of pursuing safety and delaying commercial launches until the technology is proven, the former scenario will be attained in the short run. This short run strategy, however, will allow the latter scenario to become more and more likely in the long run. In fact, some of the operating plans for companies interviewed in compiling this analysis suggest that it might be possible to realize even faster growth, particularly after 2010.

Flight operations do not by themselves have any economic impact. To estimate this, requires an estimate of the amount of spending that would occur for each flight.

It will be assumed that the amount of spending for each of these flights is $100,000. This is a low estimate considering that most estimates for the cost of a flight are in the neighborhood of $200,000. This amount includes the profits that would accrue to the companies and it will be assumed that these profits will not stay in New Mexico. These numbers do not include other spending that would occur by family and friends that come to New Mexico to witness the event.

The estimated economic impact of commercial operations in New Mexico is shown below in Table 3: Estimated Economic Impact of Estimated Suborbital Flights on the New Mexico Economy.

Conservatively, over the next five years the Southwest Regional Spaceport (SRS) could generate more than $5 million of initial spending, which would be multiplied into nearly $10 million or additional output, and nearly $3 million of earnings in the private sector. Even at this level of activity, nearly 30 new jobs would be created as a result of commercial operations at the Southwest Regional Spaceport.

Optimistically, and there is room for optimism given the business interests considering New Mexico as a base of operations, the impact could be far greater.

Table 3 - Economic Impact of Estimated Suborbital Flights on the New Mexico Economy

YEAR		2006	2007	2008	2009	2010	TOTAL
25% OF	INITIAL SPENDING (1000'S OF $)	700	800	1,100	1,300	1,700	5,600
CONSTRAINED	OUTPUT (1000'S OF $)	1,219	1,393	1,916	2,264	2,961	9,754
U.S. EST.	EARNINGS (1000'S OF $)	364	416	572	676	884	2,912
	EMPLOYMENT (# OF JOBS)	11.48	13.12	18.04	21.32	27.88	
25% OF	INITIAL SPENDING (1000'S OF $)	4,700	6,000	7,700	9,800	12,500	40,700
ROBUST	OUTPUT (1000'S OF $)	8,186	10,450	13,412	17,069	21,772	70,891
U.S. EST.	EARNINGS (1000'S OF $)	2,444	3,120	4,005	5,097	6,501	21,168
	EMPLOYMENT (# OF JOBS)	77.08	98.40	126.28	160.72	205.00	
50% OF	INITIAL SPENDING (1000'S OF $)	1,300	1,600	2,200	2,600	3,400	11,10
CONSTRAINED	OUTPUT (1000'S OF $)	2,264	2,787	3,8832	4,529	5,922	19,334
U.S. EST.	EARNINGS (1000'S OF $)	676	832	1,114	1,352	1,768	5,773
	EMPLOYMENT (# OF JOBS)	77.08	26.24	36.08	42.64	55.76	
50% OF	INITIAL SPENDING (1000'S OF $)	9,500	12,000	15,400	19,600	25,000	81,500
ROBUST	OUTPUT (1000'S OF $)	16,547	20,901	26,823	34,139	43,545	141,957
U.S. EST.	EARNINGS (1000'S OF $)	4,941	6,241	8,009	10,194	13,002	42,388
	EMPLOYMENT (# OF JOBS)	155.80	196.80	252.56	321.44	410.00	
75% OF	INITIAL SPENDING (1000'S OF $)	2,100	2,400	3,300	3,900	5,100	16,800
CONSTRAINED	OUTPUT (1000'S OF $)	3,658	4,180	5,748	6,793	8,883	29,262
U.S. EST.	EARNINGS (1000'S OF $)	1,092	1,248	1,716	2,028	2,652	8,738
	EMPLOYMENT (# OF JOBS)	34.44	39.36	54.12	63.96	83.64	
75% OF	INITIAL SPENDING (1000'S OF $)	14,100	18,000	23,100	29,400	37,500	122,100
ROBUST	OUTPUT (1000'S OF $)	24,559	31,352	40,235	51,209	65,317	212,674
U.S. EST.	EARNINGS (1000'S OF $)	7,333	9,362	12,014	15,291	19,504	63,504
	EMPLOYMENT (# OF JOBS)	231.24	295.20	378.84	482.16	615.00	

Source: Calculations by authors.

At its best, suborbital operations at the Southwest Regional Spaceport could generate initial spending of more that $120 million over the next five years, resulting in additional output of $212 million and earnings of $63 million. If realized, this level of activity would create and sustain more than 600 new jobs as a direct result of sub-orbital commercial operations at the New Mexico Spaceport.

2.2.1.5 *Orbital Operations Impact*

In addition, NASA will soon be asking for proposals to develop a crew transfer vehicle to take crews to the International Space Station. That contract will be for approximately $400 million over five years. Contenders for this grant could use the SRS for research and testing.

If awarded to a company located at the SRS and assuming that about half of the amount is for research and design and that about 25% of the remaining amount would be spent in New Mexico, the initial impact of this contract on the economy of New Mexico would be $50 million over the five year period. Assuming the same multipliers as before this would represent a total impact of around $85 million and total earnings of approximately $21 million over the five years and the generation of approximately 116 jobs per year.

The successful development of this vehicle will mean that it will be used to transfer crews and supplies to the International Space Station or low earth orbit. It has been estimated that four flights per year would be required to shuttle crews to the ISS and two flights per year to shuttle crews to low earth orbit. The estimated cost would be around $25 million per flight. This would all be accomplished by 2015. The six flights per year would total $150 million. This number could be viewed as a revenue figure to the company providing the flights. Assuming a profit margin of approximately thirty-three percent, the expenditure amount would be equal to $100 million. These flights may not even originate at the SRS, but because the company is located at the SRS, some of this expenditure would be impact New Mexico. A conservative spending estimate of $25 million would generate a total impact of over $42.5 million, an earnings impact of $10.5 million, and a generation of about 290 jobs per year in 2015.

The following tables summarize the impacts of the estimated spending on construction, suborbital research, development, and flights and orbital research, development, and flights discussed above. Table 4: Total Economic Impact provides high and low scenarios of economic impact in each area. Table 5: Earnings Impact provides the earnings impact based on the high and low scenarios. Table 6: Employment Impact indicates the high and low scenarios for job creation.

Table 4 – Total Economic Impact

AREA	YEAR 1	2	3	4	5	TOTAL
SPACEPORT						
CONSTRUCTION	$120.00	$120.00	$120.00	$120.00	$120.00	$600.00
OPERATIONS	$.00	$3.40	$3.40	$3.40	$3.40	$13.60
SUBORBITAL (LOW SCENARIO)						
RESEARCH & DEVELOPMENT	$21.35	$21.35	$21.35	$21.35	$21.35	$106.75
LAUNCH OPERATIONS	$1.20	$1.40	$1.90	$2.30	$2.90	$9.70
SUBORBITAL (HIGH SCENARIO)						
RESEARCH & DEVELOPMENT	$21.35	$21.35	$21.35	$21.35	$21.35	$106.75
LAUNCH OPERATIONS	$24.60	$31.40	$40.20	$51.20	$65.30	$212.70
ORBITAL						
RESEARCH & DEVELOPMENT	$17.10	$17.10	$17.10	$17.10	$17.10	$85.50
LAUNCH OPERATIONS	$.00	$.00	$.00	$.00	$42.50	$42.50
TOURISM						
IMPACT PER 1000 VISITORS	0	0	0	0	0	
X-PRIZE CUP						
X-PRIZE EXPENDITURES	$18.00	$22.20	$26.50	$31.60	$35.10	$133.40
TOTAL ECONOMIC IMPACT (LOW SCENARIO)	177.65	185.45	190.25	195.75	242.35	991.45
TOTAL ECONOMIC IMPACT (HIGH SCENARIO)	$201.05	$215.45	$228.55	$244.65	$304.75	$1194.45

All numbers are in millions of dollars.

Table 5 – Earnings Impact

AREA	YEAR 1	2	3	4	5	TOTAL
SPACEPORT						
CONSTRUCTION	$40.00	$40.00	$40.00	$40.00	$40.00	$200.00
OPERATIONS	$.00	$.84	$.84	$.84	$.84	$3.36
SUBORBITAL (LOW SCENARIO)						
RESEARCH & DEVELOPMENT	$5.25	$5.25	$5.25	$5.25	$5.25	$26.25
LAUNCH OPERATIONS	$.36	$.42	$.57	$.68	$.88	$2.91
SUBORBITAL (HIGH SCENARIO)						
RESEARCH & DEVELOPMENT	$5.25	$5.25	$5.25	$5.25	$5.25	$26.25
LAUNCH OPERATIONS	$7.30	$9.40	$12.00	$15.30	$19.50	$63.50
ORBITAL						
RESEARCH & DEVELOPMENT	$4.20	$4.20	$4.20	$4.20	$4.20	$21.00
LAUNCH OPERATIONS	$.00	$.00	$.00	$.00	$10.50	$10.50
TOURISM						
IMPACT PER 1000 VISITORS	0	0	0	0	0	
X-PRIZE CUP						
X-PRIZE EXPENDITURES	$4.40	$5.50	$6.50	$7.80	$8.40	$32.60
TOTAL EARNINGS IMPACT (LOW SCENARIO)	$54.21	$56.21	$57.36	$58.77	$70.07	$296.62
TOTAL EARNINGS IMPACT (HIGH SCENARIO)	$61.15	$65.19	$68.79	$73.39	$88.69	$357.21

All numbers are in millions of dollars.

Table 6 – Employment Impact

AREA	YEAR 1	2	3	4	5
SPACEPORT					
CONSTRUCTION	1,450	1,450	1,450	1,450	1,450
OPERATIONS	0	23.2	23.2	23.2	23.2
SUBORBITAL					
RESEARCH & DEVELOPMENT	144.75	144.75	144.75	144.75	144.75
LAUNCH OPERATIONS		11.5	13.1	18	21.327.9
ORBITAL					
RESEARCH & DEVELOPMENT	115.8	115.8	115.8	115.8	115.8
LAUNCH OPERATIONS	0	0	0	0	290
TOURISM					
IMPACT PER 1000 VISITORS	0	0	0	0	0
X-PRIZE CUP					
X-PRIZE EXPENDITURES	121	150	179	214	232
TOTAL EMPLOYMENT IMPACT (LOW SCENARIO)	1,843	1,897	1,931	1,969	2,284
TOTAL EMPLOYMENT IMPACT (HIGH SCENARIO)	2,063	2,179	2,292	2,430	2,871

2.2.1.6 *Tourism Impact*

None of these impacts include the additional spending that would occur because of the ancillary businesses that will be needed as the spaceport is developed or as a result of non-flight tourism associated with the spaceport. Tourism multipliers suggest that per 1000 tourists there will be 7.16 jobs generated, an earnings impact of $120,280, and total impact of $365,718 annually.

2.2.2 CONCEPTUAL ECONOMIC IMPACT

The foregoing analysis is a realistic, albeit abbreviated, analysis of the spaceport as an enterprise at the micro level. The return, while positive absolutely, is still small relatively. To assess the true value of the Southwest Regional Spaceport, we must adopt a macro perspective, which while difficult and only possible conceptually, suggests the actual potential return on the State's investment. On this basis, the Southwest Regional Spaceport becomes more viable. It is what the spaceport can do for the whole state that needs to be considered, not just the returns directly attributed to the spaceport.

The spaceport is to be the base upon which a new industry is to be built. It will provide facilities to take advantage of sub-orbital flights, orbital flights and point to point transportation. All of these activities are in the development stage, some more advanced than others. While initially the economic impact will be felt in Sierra County and Doña Ana County, the potential is for job creation throughout the state. It is also the case that the types of jobs created will not just be for highly paid engineers.

It is difficult to estimate the impact from a spaceport because no spaceport of this type has ever have been developed. No economic model has been developed to incorporate the impact of a spaceport or commercialization of space industry because neither exists. The best that can be done is to think through the possible impacts.

3.0 NEW MEXICO'S SPACE ASSETS

3.1 SOUTHWEST REGIONAL SPACEPORT

3.1.1 BACKGROUND

The Southwest Regional Spaceport (SRS) is under development by the State of New Mexico. New Mexico's mission is for its spaceport to become the first and foremost full service commercial spaceport of the 21st Century. The world space launch industry is in the midst of a paradigm shift as it changes its focus from low volume, high cost operations (typified by launches of communications satellites to geosynchronous orbits) to high volume, low cost operations (typified by suborbital space tourism launches). This change in focus necessitates a shift in space launch systems and architectures with a corresponding shift in ground-based infrastructure. The infrastructure shift is from the Government-owned spaceports of today with their large inventories of mission-specific equipment, much of it dating from as long ago as the 1950s, to a modern commercial site with adaptable equipment and facilities that serve multiple programs and that are maintained to keep up with changing program requirements.

New Mexico's spaceport development program represents the first-ever effort to develop a full service spaceport from the ground up. Although its development plan is phased to provide the infrastructure and support services only as they are required by the industry, New Mexico expects its spaceport eventually to support both vertical and air launches in both suborbital and orbital operations. This document lays out a roadmap for developing the infrastructure necessary to support this vision. It includes all known potential New Mexico spaceport customers, including the X Prize Foundation as operator of the annual X Prize Cup and Personal Spaceflight Exposition. It is a forward-looking document in that it also considers, to the extent practical, vehicle types that have not been designed but that are beginning to emerge as practical possibilities.

3.1.2 PROJECT DESCRIPTION

The SRS will be the facility from which to launch and recover space launch vehicles of the 21st Century. It is expected that the facility in some ways will operate in the same manner as an airport. Multiple operators will use and pay for just the services they require from a range of offerings provided by the spaceport and by third party suppliers.

Although the spaceport is planned to accommodate certain expendable vehicles, the most important class of vehicles that will operate from the SRS is likely to be those that are fully reusable. These will be different from the current generation of expendable launch vehicles (ELVs) and from the partially reusable Space Shuttle in that any boosters or spent stages that separate from the vehicle during launch will land under full control either at the SRS or at a down range landing site. Expendable vehicles that fly from the New Mexico spaceport will be operated in a manner such that the vehicles or their spent components will land in predictable, safe locations either inside or outside the spaceport boundaries.

3.1.3 DESCRIPTION OF END-STATE SPACEPORT FACILITIES

The spaceport will be developed in phases to accommodate development of new requirements of the space launch industry. The end-state of the spaceport will be a full-service space launch and recovery installation that provides all required goods and services for the full range of space launch activities. It will include facilities to support suborbital and orbital launches of vertical launch and horizontal launch vehicles, as well as, to recover vehicles by horizontal landing, vertical powered landing, or parachute landing. The SRS will include a control facility with offices, maintenance facilities, vehicle assembly and payload integration facilities, a system of roads and utilities, and possibly a cryogenic fuel plant.

The SRS will be located in southern Sierra County in south central New Mexico. The facilities will be located near an abandoned railroad maintenance station called Upham.

The SRS will include 18,840 acres of land, of which 17,280 acres is New Mexico Trust Land administered by the New Mexico State Land Office (NMSLO), 1,280 acres of BLM administered land, and 280 acres of private deeded land owned by two different landowners. A safety buffer zone around the launch site and beneath vehicle flight paths will enclose up to an additional 13,000 acres of BLM-administered land.

Grazing and hunting are the primary uses of this land at the present. Of the 18,840-acre area of the SRS, only a small fraction will be affected by construction and operation. All facilities will be located within 7 sections (4,480 acres) of land, but only a fraction even of that area will actually be transformed by construction. An Environmental Impact Statement (EIS) is in preparation that addresses impacts from SRS construction, facilities, and operations.

3.2 AEROSPACE INFRASTRUCTURE

The Southwest Regional Spaceport will act as a catalyst for, but should not be mischaracterized as, the new commercial space industry in New Mexico. Even the first new space event, which was not even held at the SRS but instead at the Las Cruces International Airport, highlighted the state's history and aerospace assets.

New Mexico's aerospace and aviation industry is ranked 36th in the U.S. by employment with 8000 jobs. In New Mexico air transportation has been negatively affected by the relocation of many Mesa Airlines jobs from Farmington to Phoenix. The job market for aerospace and nuclear engineers is expected to slow because of cuts in Defense Department and Federal government expenditures.

The growth of the new commercial space industry can build upon the state's strengths and revitalize the aerospace industry in NM, which even two years ago was considered to be at risk. In doing so, jobs will be created across a broad spectrum of the state's workforce.

The design and manufacture of the technologically sophisticated products of the aerospace industry require the input and skills of various workers. Skilled production, professional specialty, and technician jobs make up the bulk of employment. A significant number of managerial and administrative support occupations also are employed, stemming from the need to manage the design process and factory operations, coordinate the hundreds of thousands of parts that are assembled into an aircraft, and ensure compliance with Federal record keeping regulations. The aerospace industry has a larger proportion of workers with education beyond high school than the average for all industries.

As the commercial space industry expands, individuals will be employed by private business, research laboratories, and universities throughout the state. Even a cursory examination of some of our current aerospace endeavors (Table 7: Aerospace Manufacturing: New Mexico Vendors) makes clear that this is a state opportunity, not a southern New Mexico phenomenon.

Table 7 - Aerospace Manufacturing: New Mexico Vendors

VENDOR	ADDRESS	CITY	PHONE	WEBSITE / E-MAIL
AEROPARTS MANUFACTURING & REPAIR INC.	431 RIO RANCHO BLVD. NE	RIO RANCHO	891-6600	
ARES CORPORATION	555 OPPENHEIMER DR	LOS ALAMOS	661-6390	
BOEING COMPANY	6200 UPTOWN BLVD. NE	ALBUQUERQUE	872-0282	
DEVORE AVIATION CORP. OF AMERICA	6104 JEFFERSON NE	ALBUQUERQUE	345-8713	WWW.DEVOREAVIATION.COM
ECLIPSE AVIATION	2503 CLARK CARR LOOP SE	ALBUQUERQUE	245-7555	WWW.ECLIPSEAVIATION.COM
GE AIRCRAFT ENGINE	336 WOODWARD RD. SE	ALBUQUERQUE	765-9200	
GENERAL ATOMICS	2237 S TRINITY AVE B	LOS ALAMOS	445-3730	
GENERAL TECHNOLOGY CORP.	1450 MISSION AVE NE	ALBUQUERQUE	345-5591	WWW.GT-CORP.COM
HONEYWELL	WSMR	WSMR	455-4690	
HONEYWELL INC.	9201 SAN MATEO NE	ALBUQUERQUE	828-5000	WWW.HONEYWELL.COM
LIGHTPATH TECHNOLOGIES INC.	3819 OSUNA NE	ALBUQUERQUE	342-1100	WWW.LIGHTPATH.COM
LOCKHEED ENGINEERING & SCIENCES CO	NASA ROAD - AFCSF	LAS CRUCES	524-5011	
LOCKHEED ENGINEERING & SCIENCES CO WSTF	NASA RD., NE OF LAS CRUCES	LAS CRUCES	524-5011	
LOCKHEED MARTIN CORPORATION	P O DRAWER H, WSMR	WSMR	679-5128	
LOCKHEED MARTIN NV TECH	182 EAST GATE DR.	LOS ALAMOS	667-4867	
OPTOMEC INC.	3911 SINGER BLVD. NE	ALBUQUERQUE	761-8250	WWW.OPTOMEC.COM
RAYTHEON TECHNICAL SERVICES CO	301 S CHURCH	LAS CRUCES	523-3965	
ROCKETDYNE	2511 BROADBENT PKWY NE #C	ALBUQUERQUE	345-2660	WWW.BOEING.COM
SANDIA AEROSPACE CORP.	5445 EDITH BLVD. NE	ALBUQUERQUE	341-2930	
WHITE SANDS RESEARCH CENTER	1300 LA VELLE RD	ALAMOGORDO	434-1725	

Source: Bradley & Saunders, 2001

Starchaser Industries, the first of the new commercial space ventures to have operations in NM, can be added to the list. And they are just the first of potentially many.

4.0 SITUATIONAL ANALYSIS

4.1 POLITICAL, ECONOMIC, SOCIAL, AND TECHNOLOGICAL ENVIRONMENT

4.1.1 POLITICAL FORCES

From a political point of view, the establishment and investment in a spaceport cannot come at a better time. The Reagan Administration began to encourage the commercialization and privatization of space transportation. In 1982, the National Space Policy was adopted which anticipated private sector involvement in the development of launch vehicles. In 1983 the National Security Council issued a comprehensive policy for Evolving Launch Vehicle (ELV) commercialization. The Commercial Space Launch Act was passed in 1984 to encourage entrepreneurial activity in space. The act was later amended to cover limited liability to launchers to encourage research and development.

The present Bush administration has announced that the United States is embracing a new vision for space exploration. This new vision includes private industry in the development of the next generation of space vehicles. The space shuttle program has been shut down due to high costs and continuing technical problems. A more cost effective system must be developed to shuttle astronauts into space. The military must also cut cost and become more efficient. The Pentagon is looking for ways to better use current technology to cut the cost of surveillance and communications.

From a state perspective, the utilization and expansion of the aerospace industry is paramount to the economic development of the state's economy. Of particular importance is that the aerospace industry in New Mexico is geographically spread throughout the state. Any increase in activity benefits all parts of the state. Besides the federal initiatives, a private commercialization of space industry is developing. The X-Prize Competition will take place annually in New Mexico for at least the next five years. The companies involved are the builders of the new private space industry. The private commercialization of space and federal initiatives provide a golden opportunity for economic development in the state.

4.1.2 ECONOMIC FORCES

The annual aerospace related payroll in southern New Mexico exceeds $300 million with work being done by White Sands Missile Range, NASA White Sands Test Facility, General Dynamics Corporation, and New Mexico State University's Physical Science Laboratory. Additional aerospace activity takes place at Holloman AFB, Kirtland AFB and the New Mexico Institute of Mining and Technology.

While the immediate economic impact of the operation of the spaceport will be particularly felt within Sierra County and Doña Ana County, the Southwest Regional Spaceport will catalyze the commercial aerospace and ancillary industries throughout all of New Mexico. Forward and backward linkages already exist within the state economy. The federal government will be spending millions of dollars to revamp its space exploration and military programs. Private companies are also spending millions of dollars to develop a space tourism industry and to partner with the government sector.

The windfall of tax revenues received because of the high prices of natural gas and oil provides a means for the investment in the initial infrastructure needed to take advantage of the opportunities presented.

4.1.3 SOCIAL FORCES

Space exploration and utilization has captivated the imagination of the population since the Apollo missions. Many are disappointed and frustrated with the continuing problems experienced by the space shuttle program. The interest in space is evidenced by the fact that private citizens have finally had the opportunity to experience space. While only those who are really rich have been able to do this, the general populace still has the idea that they too may be able to reach space. The development of private, commercial space related companies provides the only avenue for these dreams to be realized. It is in the realm of possibility that the costs could be lowered to allow almost anyone the chance for space travel.

Perhaps the most significant social factor associated with the commercial space industry is its educational value. For many, the educational benefits of the spaceport are second, and only by a little, to its potential economic return. Interest among students in science, technology, engineering, and mathematics (STEM) was at its highest during the Apollo-era and has languished since. This endangers the nation's ability to go back to space, both militarily and commercially, and national defense. It has become a national crisis.

The situation is worse in New Mexico. According the National Report Card on High Education in 2004, NM are ill prepared for college education and, therefore, challenged to participate in let alone be a foundation for the commercial space industry.

While the spaceport by itself cannot correct all of these problems, it can be a key to turning it around. Current programs, such as NM MESA, can be enhanced and new programs launched surround the burgeoning commercial space industry in New Mexico. It will be a wonderful gift to the state's children, who ultimately will be needed as part trained and educated workforce necessary to sustain the industry.

4.1.4 TECHNOLOGICAL FORCES

Technological forces represent the greatest opportunities and challenges to the commercial space industry and, therefore, the Southwest Regional Spaceport. If through improved science and engineering, the entrepreneurs of commercial space are able to reduce to cost per pound of payload and/or the cost per passenger, commercial space will become more a reality and less the dreams of a few. While early evidence suggests the entrepreneurs will prevail, as they usually do, there remain many questions that must be considered. As they relate to the spaceport, New Mexico must weigh just how soon the technology will mature and, therefore, how long in advance it must make an investment in advance of economic development.

The pace of technological evolution is further complicated by competing technologies. Recalling history, communities, states, and even the federal government had to bet on the competing technologies of trolleys, canals, and railroads. Trolleys and canals are now interesting museum pieces but are hardly the engines of economic development. Or, more recently, the world witnessed the debate between Beta and VHS, and, more recently still, the question of tape versus DVD. VHS won, of course, and DVD is the fastest evolving technology in history. New Mexico will have to bet on not just the speed of technological change but also upon one or more of several competing technologies. Investing narrowly to accommodate a single technology minimizes infrastructure investment but increases the risk of technical obsolescence. Investing to accommodate many currently competing technologies will cost more in the short term but perhaps less in the long term as it reduces the risk of technological obsolescence.

Timing and competitive technologies are exacerbated by infrastructure considerations. Once again, New Mexico need not guess; at least to some degree, history provides some lessons. In the rush to provide high speed, long-haul transport of people by rail, some states bet on maglev trains requiring dedicated and expensive rights of way. Others bet on and invested in high speed trains that could use existing and shared rights of way. At least for the time being, the latter option seems to be prevailing; at least in some markets. If that were be the case for commercial space, the Southwest Regional Spaceport would be competing not just against other spaceports but, potentially, major airports as well.

Perhaps the most troublesome and, therefore, most important technological force New Mexico faces in developing and managing the Southwest Regional Spaceport is safety. A fatal accident in commercial aviation barely attracts attention beyond the evening news and causes only a minor hiccup in air travel, if having any effect at all. A fatal accident in a NASA mission, for example the Shuttle, grounded the fleet for nearly two years and caused a national debate about the merits of manned spaceflight. An accident, which is certainly possible in the emerging commercial space market, could be fatal to the industry if not to particular individuals.

Taken as a whole, external environmental factors indicate a viable commercial space market and a unique opportunity for New Mexico to shape and, therefore, benefit from its development. Political, economic, social, and technological forces are coagulating into a critical mass for success in commercial space. But amongst these factors, the vagaries of technology are the greatest; not so great as to be dissuasive about investing in the Southwest Regional Spaceport as a whole, but instead suggesting the need for more intensive analysis of the investment as a business prospect. Like all business prospects, this requires a thorough understanding of the market.

4.2 COMPETITIVE ENVIRONMENT

For many, entrepreneurial commercial space, regardless of segment, is no longer a question of if, but when. New Mexico is not alone in aspiring to be at the forefront of and, thereafter, establishing itself as a foundation of this emerging industry. The Southwest Regional Spaceport will compete with existing and proposed spaceports for the business of the above listed companies. The facilities and services offered will partially and probably overwhelmingly determine the success of that competition, at least in the short run. In the long run, though, New Mexico's ability to attract and retain users of, and tenants in, the Southwest Regional Spaceport will not rest in technical capabilities alone, but instead in the State's ability to support their business models. Otherwise, as has too often been the case over the years and in others industries, technology will be born in New Mexico, deployed in California, and profited from in Virginia.

The Federal Aviation Administration (FAA) has licensed five commercial launch facilities: California Spaceport at Vandenberg Air Force Base; Spaceport Florida at Cape Canaveral Air Force Station, the Virginia Space Flight Center at Wallops Island; Kodiak Launch Complex on Kodiak Island Alaska; and the Civilian Aerospace Test Center in Mojave, CA. Other states have considered developing commercial spaceports, including Idaho, Louisiana, Mississippi, Montana, Nevada, North Carolina, and Utah. There are numerous other spaceports in development in the United States and internationally, including Oklahoma, Texas, Russia, and Australia. While the Southwest Regional Spaceport will not compete directly with the federal spaceports, their existence must be acknowledged

The number of operating and proposed spaceports indicates that the launch market is highly competitive. As space development in the United States shifts towards the involvement of the private sector and new technologies are developed, the market may get even more competitive.

International competition is, perhaps even more significant than already licensed, let along proposed, domestic spaceports. New Mexico's domestic competitors survive by political largesse, a legacy that might be more hindrance than helpful and have operational limitations. Foreign competitors, though, may not be so burdened. Those in search of efficiency and effectiveness launch from, and use, Russian technology. Those looking to launch over water but seeking to avoid excessive regulatory burdens launch from various archipelagos. Others, looking to benefit from launching over water while simultaneously enjoying the best, but avoiding the worst of U.S. regulatory burdens, are launching from various island groups in the Trust Territories of the Pacific, such as the Northern Marianas Island and the Federated States of Micronesia.

4.3 STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS

Given the number of spaceports in existence and in the planning stages, what advantages would the Southwest Regional Spaceport have over its competitors? A Strengths-Weakness-Opportunities-Threats (SWOT) analysis provides insights into the prospects faced by the Southwest Regional Spaceport. The goal of the organization is to build on strengths, eliminate or minimize the effect of weaknesses, take advantage of opportunities and to guard against threats.

4.3.1 STRENGTHS

The Southwest Regional Spaceport has numerous strengths. The site has favorable elevation, climactic, and latitude characteristics. It is located in a desert region with sparse population which is particularly useful for missile testing, space tourism, and sounding rocket work where payload recovery is required. While there is very little infrastructure, facilities can be built to satisfies the needs of the companies that will use the port.

The spaceport can be served by a number of high technology governmental and associated commercial entities with ties to the aerospace and related industries. New Mexico has a long history of helping develop space exploration and testing. The spaceport will be located near the White Sands Missile Range which also has a history of rocket development and testing. Because of proximity to the White Sands Missile Range, the air space is restricted. No commercial flights are allowed over the area.

Technology clusters have formed in the state to foster the health of the space sector, and contribute to general economic development. Presently there is a good political climate where public and private individuals and institutions are working together to take advantage of high technology opportunities.

The state of New Mexico possesses numerous economic, political, and commercial advantages that pertain to the spaceport. These include incentives for expanding local business and attracting new firms—such as the Job Training Incentive Program, Aerospace Research and Development Deduction, Local Economic Development Act, and Investment Tax Credit. Included in the traditional industries of the state are research and development and electronics manufacturing. Expanding industries include aerospace manufacturing, advanced business services, electronics-component manufacturing, and telecommunications. Networking alliances exist and government initiatives are in place to promote trade within and outside the region to foster an entrepreneurial culture (New Mexico First, 2004). The workforce has a reputation for hard work.

Further, the universities and community colleges in the state are heavily involved in workforce development and in providing incubator services (New Mexico First, 2000). In addition, the universities have strong programs in the sciences, engineering, business administration, and economics. New Mexico State University recently added a space engineering degree to its offerings. The effort has even spread to the middle and high school levels. Students at White Sands Middle School are able to enroll into a magnet program dedicated to aerospace studies. The state attracts a large tourist complement, which is favorable to space tourism facilities. The quality of life in the state–featuring such items as scenic sites, recreation possibilities, cultural opportunities, parks and forests, historic sites, fairs, and other diversions, and lack of congestion–is very useful in attracting employees into New Mexico. Governmental and business personnel in the state have manifested a significant commitment to the growth of the industry.

4.3.2 WEAKNESSES

The Southwest Regional Spaceport has some disadvantages. The main disadvantage is that the spaceport exists only on paper. Not even minimal infrastructure is in place. The FAA license application has not been submitted. In addition, New Mexico has a history of "almost" starting large projects.

Being in the formative stage, the Southwest Regional Spaceport is not at the level of maturity and development as are some competitors. It may be some time before it is in a position to take advantage of learning curves and develop sufficient size to enjoy the economies of scale possessed by some older competitors. In addition, some rivals have already established working relationships with their customers which may render it difficult to convince these customers to switch spaceports. The logistical infrastructure—the network of transportation ways and carriers—has yet to be further developed, in order to be commensurate with some other spaceports. Further, the facility is not located nearby large population centers and is in need of further logistics infrastructure, both of which could be deterrents to space tourism patronage. Some sectors in the state have yet to develop an expanded entrepreneurial culture that would be useful in promoting the degree of distribution and supplier support which the industry prefers and even requires.

4.3.3 OPPORTUNITIES

Numerous indicators suggest that space will be a growth industry, at least in the long run, if all of the sub sectors, including space tourism and space services, are taken into account and develop as anticipated. Demand for the services is worldwide and can be expected to expand in the future. Space tourism, in particular, has a potentially bright future. There is political, economic, and popular support for this area of activity. Low earth orbit provides opportunities for space life science research, to study the geology, climate, and biosphere of earth, and to assemble large vehicles for interplanetary exploration. Further, environmental support is evident, as space offers significant potential advantage, in fields such as the generation and transmission of solar energy (Collins and Taniguchi, 1997).

New Mexico will be the home of the X-Prize Cup and will sponsor space related events each year for the foreseeable future. In addition the federal government has embarked on a program to include private industry in the development of the next generation of space vehicles.

Of particular importance is the federal initiative to include the private market in the development of the next stage of space exploration and the military establishment interest in cutting the cost of surveillance and communications.

4.3.4 THREATS

Paramount among the threats is the substantial competition from rivals (some with significant financial backing and managerial excellence) within the United States and abroad, posing an obstacle to effective penetration of the market and the attraction of needed capital. Economic, regulatory, and physical risk raise the possibility of both financial cost and physical failure associated with space efforts. There is some degree of saturation in the telecommunications sector, and this is predicted to continue into the future. This picture is coupled with a decline in market share for United States firms. Further, if the sub-orbital tourism markets do not develop as predicted, the industry may not experience the desired degree of growth.

Another threat is the possibility of restrictive legislation which could be imposed by federal and state governmental bodies in an attempt to more fully regulate this sector. This is particularly true when trying to compete with launch facilities in foreign countries. Finally, limitations in public and private sector financing can impose an obstacle to future growth. Spatial projects must compete with earth-bound organizations for funds.

Always a threat is the perception held by some members of the public that space business is not a solid reality, that it is based upon the dreams of visionaries but has limited practical value. The industry is in need of a communications program that informs and educates the public about the potential benefits which this field offers.

In sum, the overall picture for the spaceport is promising, but not without risk. While there are weaknesses and threats in existence, the strengths and opportunities are abundant and indicate the potential for success.

5.0 PLANNING FRAMEWORK

5.1 MISSION

The Southwest Regional Spaceport will be the premiere American spaceport of the second space age.

5.2 VISION

The Southwest Regional Spaceport will be the vehicle to open the space frontier to all citizens, will bring new companies and jobs to New Mexico, increase tourism statewide and help brand New Mexico as the place to experience the future.

5.3 GOALS AND OBJECTIVES

OBJECTIVE 1.
To have a fully operational spaceport facility by 2010.

Goal 1.1
Obtain FAA licensing by October 2006
Goal 1.2
Complete infrastructure construction phases as outlined in infrastructure plan
Goal 1.3
Obtain funding in phases as outlined in the financial plan
Goal 1.4
Complete operational implementation phases as outlined in the operations plan.
Goal 1.5
Complete marketing implementation phases as outlined in the marketing plan.

OBJECTIVE 2.
To enhance the economic development, tourism and educational opportunities in the state.

Goal 2.1
To develop backward linkages for companies to serve the needs of the launch companies operating at the spaceport
Goal 2.2
Have numerous, regularly planned, weekly launches by 2010 to serve as a basis for tourism
Goal 2.3
To develop hotel(s), restaurants, and other amenities on site to be used by tourists
Goal 2.4
To have educational connections between the spaceport and grade schools, high schools and colleges
Goal 2.5
To develop a museum and educational tours of the companies and facilities on site

OBJECTIVE 3.
To provide an environment for the care, development and success of the businesses operating at the spaceport

Goal 3.1
To provide a set of amenities on site that cater to the businesses using the spaceport
Goal 3.2
To develop connections between the companies on site and the research, development, testing and evaluation capabilities already existing in the state

6.0 TACTICAL CONSIDERATIONS

6.1 MARKETING

Strategies are needed in a number of areas. These include segmentation, services, and promotion. This section deals with each of these, in turn.

6.1.1 SEGMENTATION

By segmenting the market, the spaceport will be able to create a specific marketing mix for each subgroup of potential customers that the organization intends to satisfy. This can engender considerable customer loyalty and make it difficult for rivals to win away patronage. The spaceport, if it can carve out particular portions of the market, will be in a relatively secure position.

It is apparent that some segments are attractive for the near future and might be approached initially. An example is space tourism. Others lie far in the horizon and may not be good targets for some time to come. An example is the space elevator market.

Other near term markets include reusable launch vehicles, space transportation systems, fast package express, space tourism, space business and theme parks, space manufacturing, microgravity research and development, remote sensing, communication, space solar power, entertainment, space rescue services, space mining, waste disposal space servicing and transfer, space utilities, and orbital debris removal

Orbital markets, while further out on the planning horizon, are also viable. Large numbers of launches are expected for ISS missions, military remote sensing, television and radio, civilian remote sensing, and data communications.

6.1.2 SERVICES

A variety of ground facilities and activities may be required to support profitable formation of general public space travel and tourism enterprises (O'Neil, 1998). These include firms that are formed to exploit demand even before actual in-space trips are available to the public. The facilities could span a wide range and include theme parks, trip training facilities, medical facilities, space camps, amateur rocketry facilities, space-related merchandise, hotels with spas and golf courses, restaurants and other public quasi-entertainment and supportive facilities that could develop around the sites. The operations could offer attractions such as virtual reality experiences, where on the surface a person could experience in some degree the characteristics of human spaceflight—whetting the appetite for the "real thing." The success of such businesses could be crucial in raising public awareness and capital for actual in space travel and tourism to follow.

The ground facilities and activities could be set up prior to the time when actual in-space excursions are offered to the public. These opportunities could be useful in preparing the public for space travel and in providing revenues to the spaceport. In turn, these commercial enterprises could assist in increasing public awareness and capital investment for in-space travel to follow. And they could continue to attract patronage once in-space travel is in effect.

Passenger preparation is a necessary service for space tourism. This would include developing a familiarity with the systems on board, to assure health and safety. Rather than being a burden, it may well prove that preparation activities are a valued part of the overall space travel experience. Broad experience in the preparation process itself could become a revenue generating element of the business.

To be successful, space tourism and commercial space generally requires a variety of ancillary goods and services. These include construction, interior design, hotel management, catering, fashion, entertainment and sports, which currently are cut off from this source of economic growth. Increases in employment in these and other more technology-oriented industries will allow the state to enhance its economic position relative to import activity from less developed economies that rely upon labor intensive industry and low wages.

6.1.3 PROMOTION

Promotion will be a vital tool for communicating with outside parties, particularly customers. The communica tions are employed, in this case, to convince customers that they should make use of spaceport facilities and services. These customers include launch operators and developers, subcontractors, aerospace satellite and vehicle manufacturers and suppliers, material and fuel suppliers governmental units, space tourism operators, space tourists, payload support and operations ancillary service enterprises, research units, technology centers, institutions of higher education, providers of capital, and others. Promotion is necessary, in most cases, to attract these parties to the spaceport, either as providers of goods and services or as buyer/consumers.

Further, promotion is needed to develop favorable attitudes in the ranks of New Mexico citizens, influence wielders, and governmental officials, in order to ensure the provision of adequate resources for spaceport development and operation. Communications must convince these parties that the spaceport will bring significant economic advantages to the state. Relevant and up to date space related information should be provided to policy makers, the media, and the general public. This should emphasize the impact of space enterprise on the economy of New Mexico. A contact plan for outreach to state policymakers and their staffers, including their visitation to the spaceport for orientations, may be needed. Texas has embarked upon a promotion program which embodies most of these influences. In the same vein, the state of Florida is actively engaged in developing a program to achieve the same purposes.

A variety of media and activities can be used to promote the spaceport. They include advertisements, participation in trade shows, development of a website and newsletter, attendance at space related conferences and meetings, publicity with the regular print media and television, and educational programs.

6.1.4 ACTION ITEMS:

1. *Segmentation*
   a. Develop a list of targeted near-term and long-term markets.
   b. Identify the companies most likely to be involved in the targeted markets.
   c. Identify those companies that would become the backward linkages for direct customers of the spaceport.
   d. Develop a plan to contact and foster relationships with companies listed above.

2. *Services*

a. Develop a list of targeted service providers for the spaceport.
b. Identify those companies most likely to be involved in the ancillary activities of the spaceport.
c. In conjunction with the operations plan, foster connections between the spaceport and the educational institutions in the state.
d. In conjunction with the operations plan, develop museum and educational tours of on site companies and facilities.

3. *Promotion*

a. Develop a promotion strategy to develop support of spaceport from state citizens and legislature.
b. Develop a promotion strategy for outreach activities.
c. Develop a web site and internal and external newsletters.
d. Develop a strategy to promote the spaceport through the use of all types of media.

6.2 LEGAL

The legal environment creates a variety of obstacles to development of the private commercial space industry. These obstacles fall primarily into two categories: regulatory issues and liability concerns. With respect to liability concerns, given the infrequency of space launches, there is a very limited statistical base for calculating expected risk, and as a result, insurance availability is limited and premium expenses for private space launch activities are high.

6.2.1 REGULATORY AND LICENSING ISSUES

1. *FAA Licensing of Launch Vehicles and Spaceports*

Although a variety of governmental agencies have been involved in the regulation and licensing of commercial space launches in the past, today this function is largely within the purview of the Office of the Associate Administrator for Commercial Space Transportation which is a part of the Federal Aviation Administration (FAA-AST). Primary authority for licensing and regulating commercial space operations rests with the FAA/AST. The FAA/AST issues licenses for both spaceports and individual launches. In 2000, the FAA established operational and licensing requirements for launches and reentry of RLVs. One of the most significant tasks undertaken by the FAA-AST during the licensing process is assessment of the third party risk. Given the mandate from Congress to ensure that public health and safety are not jeopardized by space launch activities, it is not surprising that the licensing process is complex and time consuming. While the FAA/AST has taken measures to assist developers with understanding the licensing requirements, some industry experts assert that the complex regulatory and licensing requirements place the U.S. launch vehicle developers at a competitive disadvantage to those in other countries. The Commercial Space Launch Amendments Act of 2004 (CSLAA) attempts to address some of these concerns, particularly with respect to licensing vehicles carrying human beings for compensation or hire. Until the FAA/AST adopts implementing regulations, it is difficult to assess the ultimate impact of the CSLAA. Some of the CSLAA provisions (such as those authorizing imposition of medical and training requirements for space travel customers) may actually increase the regulatory burden imposed on the developing space travel industry. However, Draft Guidelines issued by the FAA in February 2005, suggest that the additional regulatory requirements will not be onerous and may, in fact, benefit the industry by clarifying its responsibilities to passengers and crews of SLV's. Any further efforts to streamline licensing and regulatory requirements must be managed at the federal level.

2. *Federal Technology Transfer Restrictions and Export Controls*

For the purpose of protecting space-oriented national security interests, the federal government imposes complex technology transfer restrictions and export controls (Waldop). The U.S. has some of the strictest unilateral export controls in the world. The Export Administration Act (EAA)(50 U.S.C. 2410) and the Arms Export Control Act (AECA)(22 U.S.C. 2778) are the main statutes establishing the U.S. export control regime.

These laws all have an impact on the commercial space industry, much of it negative. Commercial space companies may seek to export technology in order to acquire necessary components or to sell their own components or systems to SLV developers abroad. SLV operators need to transfer technical details about their vehicles to insurance companies, many of which are outside the U.S., to obtain launch insurance quotes. Commercial space ventures have noted difficulties and delays in obtaining necessary licenses to even allied countries.

Undoubtedly, the complex regulatory scheme for the export of technology has a deleterious effect on the commercial space industry. The federal government, through its regulatory agencies, continues to seek an appropriate balance between protecting national security and promoting commercial space activities. Whether any significant amelioration of the regulatory burden can be achieved remains to be seen.

3. *Relevant New Mexico Statutes*

While most of the regulatory concerns of note arise at the federal level, there are several state laws that may be of importance to the spaceport and its customers. The State of New Mexico has already taken a variety of steps to encourage and attract space related industry to the State, including making some regulatory concessions. For example, commercial space launch activities and spaceport operations have been exempted from the state gross receipts tax (NMSA § 7-9-54.2). In 2005, a statue creating a Spaceport Authority was enacted. The new authority has been given authority to issue revenue bonds to finance the development of the spaceport.

New Mexico statutes relating to aviation should be reviewed. As currently written, it is likely that an SLV will be treated as an aircraft under the New Mexico Statutes, and will be subject to the regulations and restrictions imposed on aircrafts (NMSA § 64-1-1 and NMSA § 64-1-21. Under New Mexico statute, the SLV's are likely to be considered common carriers (NMSA § 64-1-6). The law imposes a higher duty of care on common carriers, and hence, such entities have potentially higher liability exposure than other business activities. This heightened standard of care will only exacerbate liability concerns in the SLV industry and is probably inappropriate given that SLV's will, particularly in the early developmental years, be subject to risks far beyond those typically created by other carriers and the passengers and owners of cargo on SLV's will be apprised of those risks. Similarly, it may be advisable to amend other statutes to exclude SLV's from treatment as aircraft and the SRS from treatment as an airport. For example, New Mexico statutes currently preclude an airport facility that receives funding under the Aviation Act (64-1-11 to 64-1-17 NMSA 1978) from charging landing fees (with some exceptions). If the SRS intends to charge launch fees, and if it will receive funds from the state aviation fund, then the statute should be amended to allow such fees. Further clarification may also be needed regarding the applicability of the statute requiring a joint airport zoning board (64-2-1 NMSA 1978), the Aircraft Registration Act (64-4-1 through 64-4-15 NMSA 1978).

6.2.2 LIABILITY ISSUES

Liability concerns play a prominent role in development of the spaceport. Spaceport and launch vehicle operations will give rise to a wide variety of liability exposures ranging from mundane workers' compensation claims to environmental contamination. The greatest and least predictable potential exposure arises from the possibility of a catastrophic launch vehicle accident.
The potential for liability exposures related to spaceport ownership and operations has ramifications in two related but distinct contexts. One ramification is the potential hazard to the people of New Mexico and the potential cost to the state. With respect to this issue, it is important to remember that many of the spaceport activities that will create liability exposure will be similar in nature to those encountered at any other state operated facility (such as a state park or a school). Among the typical liability risks would be such things as the risk of injuries to employees (worker's compensation), typical premises liability concerns (so called slip and fall cases), etc.

The second ramification is the impact that liability exposure has upon the commercial space ventures that may become spaceport customers. Like many other business enterprises, the commercial space ventures and their insurance companies are concerned about the potential for enormous liability verdicts. A state that can give some assurance that liability exposures will be reasonable and predictable will have a substantial competitive advantage in attracting customers to its spaceport. Conversely, to the extent that the space launch vehicle developers and operators (SLVO's) who are the primary customer base for the spaceport and their insurance companies perceive New Mexico to be a haven for out-of-control liability awards, they are less likely to find our spaceport to be an attractive location.

The nature and types risks associated with the space operations depend, in significant part, on the types of launches and the related activities that are undertaken at the facility. The bottom line is that not all space launches are alike and, consistent with typical a risk management analysis, the State will need to determine the parameters of acceptable launch types, vehicle types and fuels types that will be permitted for use at the NM Spaceport. By restricting the types of space launches to those that have been determined to meet acceptable risk levels, the liability risks associated with the Spaceport can be controlled and insurance costs for SLV operators can be reduced.

A spaceport that is owned and operated by the State of New Mexico will carry certain liability risks for the State, as does any other State operated facility. The extent of that liability, however, is subject to some existing limitations and can also be controlled in some respects. Under the CSLA's liability risk-sharing regime, non-federal launch sites and reentry site operators (such as New Mexico would be as operator of the SRS) are covered as additional insureds under the launch licensee's third party liability insurance if their site is used to support the licensed launch or reentry that results in the third party claim. As a result, the SRS not only would have the benefit of the insurance obtained by the licensee but would also be eligible for U.S. Government indemnification under the CSLA if third party claims arising from the launch activity exceeded the FAA required insurance amount. The flip side is that the SRS would also be required to participate in the reciprocal waiver of claims agreements under which it will assume its own risk of property damage or loss and agree to be responsible for its employee claims.

The FAA has determined that the CSLA insurance and indemnification provisions extend only to site operations that are related to licensed launch activities. Hence, the State would not enjoy the same protections when providing associated launch site services which are not part of a licensed launch or reentry (such as ground tests, static demonstrations etc.) The SRS will most likely want to offer launch services that are not subject to the CSLA protections.

If it chooses to do so, the State must choose one of the following options for dealing with third party claims:
(1) accept the risk under the state's existing risk management program and bet the state's assets to cover liability exposure
(2) buy insurance (but without the benefit of federal guidance on limits) and bet state assets in the event the amount is inadequate
(3) require cross-waivers and liability coverage from customers (creating a disincentive for customers to locate at the SRS)
(4) forego the non-licensed activity (again, potentially creating a disincentive for customers and potentially decreasing revenue opportunities)(FAA, DOT 2002).

The Spaceport Florida Authority (SFA), a state government organization licensed by the FAA as a launch site operator has taken issue with the FAA's decision not to establish insurance requirements for such operators. The SFA contends that the indemnification available under the CSLA liability risk sharing regime should be available to licensed launch site operators as well as licensed launch operators because both types of licensees conduct hazardous activities for which insurance may not be reasonably available.

Aside from the issue of FAA licensed vs. non-licensed activities, a good deal of the liability exposure for the State will depend upon the role that the State chooses to play in the operation of the Spaceport and the scope of activities that the State allows to be conducted there. Ownership of the land and allowing spaceport operations, standing alone, is unlikely to result in liability since most liability claims will require proof of fault (negligence). If the state's role is primarily that of a landlord, providing only the use of the physical space and its infrastructure, with no on-site state employees, the liability exposures should be fairly narrow in scope. Even this minimal level of involvement does have some risks - primarily related to inadequate design or maintenance of the infrastructure.

Basically, it is safe to say that the State's liability exposure will increase in direct proportion to amount of control and involvement it maintains in SRS operations and the number of ancillary activities that it chooses to allow at the SRS site. Should the State choose to take a more active role in the Spaceport operations, for example, by directly providing ancillary services, the State's liability exposure will be greater than a model where the State takes a relatively passive role.

Similarly, liability exposure will be increased by activities that bring third parties in close proximity to the launch site. To the extent that the State utilizes the SRS site as a tourist and education destination, thereby attracting large numbers of third parties to the site, those activities will increase the risk of third party damages (and therefore increase the FAA calculated MPL and, hence, the insurance requirements for the launch vehicle operators).

The State's liability arising from the spaceport will also be determined by the State's Tort Claims Act (TCA), as it is with claims arising from any other state activity (NMSA § 41-4-4). At present, the State has waived immunity for liability for damages caused by the negligence of public employees in operating and maintaining any building, public park, machinery, equipment or furnishings. (NMSA 41-4-6 1978) This waiver would almost certainly apply with respect to operation and maintenance of the spaceport. The State has also waived liability for damages caused by the negligence of public employees in the operation of airports (NMSA 41-4-7 1978). The State's liability, however, is subject to multi-tired damage caps which limit the State's liability for any one occurrence (NMSA 41-4-19).

6.2.3 STATE OPPORTUNITIES TO CREATE AN ATTRACTIVE LEGAL ENVIRONMENT

The federal government has taken an active role in attempting to control and clarify the liability risks that commercial SLV operators are most likely to encounter. Traditionally, however, the parameters of tort liability have been established by state law. To the extent that space launch activities may give rise to damages within the state, which continues to be true. As a result, the state is in a position to enact new laws, consistent with federal law, that further delineate the standards for liability and the scope of liability that will be imposed in the event of claims resulting from space launch activities.

Damages resulting from space ventures could occur anywhere around the globe or even outside the traditional reaches of earth's jurisdiction and might involve individuals from a variety of nations and states within the U.S. As a result, numerous state, federal, foreign or international laws may govern limitation of liability issues in claims against either spaceport operators or SVL operators. Eventually, claims resulting from space launches could give rise to any number of jurisdictional and conflict of laws issues that have never before been seen in the courts of this country or abroad.

While the State lacks the authority to control liability claims for damages that occur outside its geographic boundaries, damages within the state are significantly more likely to occur than damages outside the state, particularly if SRS limits itself to suborbital launches.

With respect to those damages that could occur within the state boundaries, New Mexico has the authority and opportunity to enact statutes that define and seek to limit the liability exposure resulting from launch activities at the SRS. The enactment of such laws would, at a minimum, send a signal to potential customers that the State is attempting to provide a friendly legal environment for such commercial space activities. These laws could also have a positive impact by influencing insurance providers to reduce premiums in response the decrease in liability exposure.

New Mexico could adopt a statute specifically stating that passengers on space launch vehicles, who have been given appropriate informed consent that conforms to federal regulations, and their survivors are precluded from obtaining any monetary damages for injuries or death resulting from the space launch and related activities, except in cases where the space launch operated acted with gross negligence or reckless disregard. This high standard of proof would be consistent with the federal proposal and should further discourage lawsuits and make recovery unlikely in most instances.

One of the most interesting, and practical opportunities for New Mexico to differentiate itself from other states developing spaceports is through the creation of a state funded bond to cover the CSLA Tier One financial responsibility requirement of SLV operators. A state fund of approximately $10 million would be necessary to pursue this option. The fund would be pledged as a bond to pay Tier One damages should they occur, in satisfaction of the FAA/AST financial responsibility requirements. Spaceport customers might be allowed to use the bond at no cost or low cost. The money in the fund would be invested and would continue earning a return for the State unless and until claims were asserted.

In determining whether the idea of a State funded bond is viable, it is important to remember that the risk of third party and government damages resulting from launches at the SRS is expected to be extremely low. In addition, the MPL calculations performed by the FAA/AST provide a good indicator of the level of risk associated with individual launches. To limit the risk of claims against the funds (while at the same time limiting the risk imposed on New Mexico's citizens), the State could adopt requirements of MPL's of less than a specified dollar amount as the criteria for permitting launches at the SRS site. But no matter what restrictions are imposed, the use of such a fund will place the risk of loss squarely on the shoulders of the State and its taxpayers, rather than upon private insurance companies.

6.2.4 ACTION ITEMS:

1. Obtain FAA licensing by October, 2006.
2. Work with Federal authorities with respect to licensing and regulatory procedures.
3. Work with Federal authorities with respect to intellectual property concerns.
4. Work with state authorities and legislature to enact new laws, consistent with federal law, that further delineate the standards for liability and the scope of liability.
5. Work with state authorities and legislature to amend current statutes concerning the definitions of aircraft, common carrier, and airport.
6. Work with state authorities and legislature to create a 'bond' to cover the SCLA Tier One financial responsibility of SLV operators.

6.3 FINANCIAL AND INVESTMENT

Provided below is a description of the overall finance plan and a detailed financial analysis that computes the yearly breakeven revenues for various scenarios for the proposed Southwest Regional Spaceport.

The SRS finance plan is built on an initial public ownership structure which will evolve into a public/private ownership structure over time and incorporates a staged approach to raising the estimated $170 million to $230 million needed to construct the spaceport. This finance plan reviews the sources of potential capital available to the SRS, details the SRS infrastructure and operational capital requirements and computes the breakeven revenues necessary for meeting the infrastructure and operational capital requirements.

6.3.1 POTENTIAL SOURCES OF CAPITAL

As with any large transportation project, there are three main sources of capital available to fund infrastructure development and early stage operational costs: outright government grants, debt and equity capital.

Grants - Probably the most promising and economically most viable source of infrastructure and early stage operational funds for the SRS are State of New Mexico legislative appropriations. This project is essentially a major economic development project for the state and, hence, it would be appropriate for substantial state support. To date, the legislature has appropriated nearly $20 million for the SRS project addressing initial setup funding, New Mexico Office of Space Commercialization (NMOSC) operations and capital outlays. It is anticipated that the State of New Mexico will provide substantial early stage infrastructure development funding along with early stage and possible later stage annual operating subsidies. An important point to note is that this analysis does not consider the opportunity cost of alternative uses of these state appropriated monies or any associated economic benefits and multiplier effects from the state appropriated capital expenditures for the SRS.

SRS may receive federal grants from one or more of the following sources: National Aeronautics and Space Administration (NASA), Department of Defense (DOD), Federal Aviation Administration (FAA), and Department of Transportation (DOT). The FAA also grants funds to passenger and cargo airports under the Airport Improvement Program (AIP). The likelihood of successful funding from these sources, however, is questionable.

Finally, as with some current airfields, the New Mexico Spaceport could be designed as a dual use facility, meeting the needs of both commerce and government. If possible, without jeopardizing the launch integrity of private operators, a major concern, a substantial portion of infrastructure and operating costs could be borne by the federal government.

Debt - The 2005 legislature passed and the governor signed HB419, the "Spaceport Development Act" which gave the Spaceport Authority the power to issue revenue bonds. These revenue bonds are payable only from properly pledged spaceport revenues (e.g. Launch fees and/or facility leases) and the bondholders may not look to any other state fund for the payment of interest and principal of the bonds. The authority cannot incur debt as a general obligation of the state or pledge the full faith and credit of the state and its taxing powers to repay the debt.

In theory, two other types of bonds would be available to fund SRS infrastructure development: General Obligation bonds and Private Activity Bonds (Conduit Debt). Given the risky and uncertain nature of the pace of SRS development and expected future revenues, it would not appear prudent for the State of New Mexico to issue General Obligation bonds that pledges the full faith and credit of the state. It may be possible, in later development stages of the spaceport, for the issuance of Private Activity Bonds which act as a "conduit" between the public and private sector. These bonds would not be direct obligations of the state or the SRS but would be paid off solely from the revenues generated from the private activity project.

New Mexico Local Economic Development Act - Additional funding may be possible at the local level, especially for infrastructure leading into the Southwest Regional Spaceport. The stated purpose of the NMLEDA is:

> "… to implement the provisions of the 1994 constitutional amendment to Article 9, Section 14 of the constitution of New Mexico to allow public support of economic development to foster, promote and enhance local economic development efforts while continuing to protect against the unauthorized use of public money and other public resources. Furthermore, the purpose of that act is to allow municipalities and counties to enter into joint powers agreement to plan and support regional economic development projects." [5-10-2 NMSA 1978]

The NMLEDA allows municipalities and counties to expend funds on economic development projects. The law also stipulates how much can be spent, what constitutes an economic development project and what is a qualifying entity. The local government unit must also have adopted by ordinance an economic development plan or a master plan with an economic development component. The unit must follow certain procedures when pursuing economic development projects. Municipalities and counties are also allowed to enter into joint power agreements.

In general, the amount of expenditure allowed for economic development projects is limited to five percent of the annual general fund expenditures of the local government. However this limitation does not apply to a) the value of contributed land or buildings pursuant to a project participation agreement, b) revenues generated by the imposition of an infrastructure gross receipts tax, c) the proceeds of a revenue bond to which the infrastructure gross receipts tax is pledged, or d) donated funds.
An economic development project is the direct or indirect assistance by a local government unit to a qualifying business. Economic development projects can take almost any form. The local government unit can purchase, lease, grant, construct or reconstruct buildings or other infrastructure and acquire or convey land. The government unit can also provide direct loans or loan guarantees for land, buildings or infrastructure. The unit could also provide public works improvements essential to the location or expansion of a qualifying business.

In general, a qualifying entity is any business or individual who is engaged in business except for retail and farming. The business or individual must be engaged in the manufacturing, processing or assembling of agricultural or manufactured products or engaged in the storing, warehousing, distributing or selling products at the wholesale level. A commercial enterprise engaged in the distribution of products or services commonly known as public utilities cannot be a qualifying entity unless it is a telecommunications enterprise that makes most of its sales outside of New Mexico or is an Indian nation, tribe or pueblo or a federally chartered tribal corporation. The only other instance that a retail enterprise can be a qualifying entity is when it provides a facility known as a farmer's market.

In order to provide funding for an economic development project the local government unit must adopt through ordinance an economic development plan or master plan that has an economic development component. The law is not very restrictive of what must be in this plan but it suggests a list of items that may be in the plan. Items that are suggested include goals and strategies, qualifying activities and entities, application and verification procedures, the identification of revenue sources and what other resources the governmental unit may use, and safeguards against default, termination of aid and if the qualifying entity leaves the area.

Once an application for an economic development project is accepted, the governmental unit and the qualifying entity, under the NMLEDA, must enter into a project participation agreement. This agreement must specify the contributions of both parties, the security provided by the qualifying entity to the governmental unit, a schedule for project completion and provisions for performance review. All projects must be approved by ordinance.
The final part of the law that is of interest is that it allows multiple governmental units to combine under a joint powers agreement to develop a regional economic development plan. Any project must be approved by all of the governmental units participating in the joint powers agreement.

6.3.2 INFRASTRUCTURE AND OPERATIONAL CAPITAL REQUIREMENTS

Initial infrastructure estimates indicate costs of between $170 million and $230 million. It is anticipated that the SRS will be developed in a multi-phased "staged" approach with only the very necessary and essential facilities and services initially provided with a gradual expansion as the revenue and cash flow generation capability expand over time. It is currently estimated that the initial necessary infrastructure costs will be approximately $20 million per year over a five year period starting in 2006. This would include construction of possibly two 12,000 foot runways, hangers, fuel storage, support structures (Simulation and Mission Control Facilities), necessary launch pads and launch area structures, roads to the facilities, basic utilities and communication capabilities. Initial operational costs are estimated to be about $1,250,000 per year. It is expected that the eventual overall cost of the infrastructure will approach $200 million plus or minus $30 million and yearly operational costs will be approximately $2 million.

Given the staged infrastructure and operational requirements of the spaceport, pro forma financial statements for the SRS via a breakeven revenue approach can be estimated. This approach utilizes the estimated staged infrastructure and operational costs to compute the overall necessary SRS yearly revenues that would be required for the state to earn a zero Net Present Value on its investment (i.e. breakeven) under various total infrastructure and real cost of capital assumptions. This breakeven revenue is essentially what would be needed in yearly revenues to cover operating costs, service any debt issued and provide the state with a return on its staged infrastructure investment equal to its assumed real cost of capital. The spreadsheet model breakeven revenue results (for eighteen scenarios) and assumptions are presented in Table 8: SRS Financial Plan Spreadsheet Model Breakeven Revenue Results and Assumptions.

In the Table 8 model it is assumed that the State of New Mexico contributes $100 million to SRS infrastructure development over a staged 5 year period starting at the beginning of 2007. It is also assumed that Spaceport Authority Revenue Bonds are issued in 2012 based on a then established, consistent revenue and cash flow stream. The breakeven cash flow results in Table 8 are substantial and can best be understood by examining one of the scenarios. The scenario described here is the one associated with $200 million in infrastructure cost and 7% real cost of capital. In this scenario, it is assumed that the total SRS infrastructure cost will be $200 million which will be financed by a yearly $20 million appropriation from the State of New Mexico legislature over a 5 year period starting in 2007 and ending in 2011 along with $100 million of Spaceport Authority 30 year 6.5% coupon Revenue bonds issued in 2012. Sinking fund payments on these revenue bonds are assumed deferred for 10 years. Operational expenses are estimated to be $1.25 million in 2006 and 2007 and $2 million per year thereafter. It is assumed that infrastructure costs are depreciated over a 30 year period with no salvage value and that accounts payable (receivable) are 30 days of operating expenses (revenues) respectively.

Table 8 - SRS Financial Plan Spreadsheet Model Breakeven Revenue Results and Assumptions

INFRASTRUCTURE COST	REAL COST OF CAPITAL	YEARLY BREAKEVEN REVENUES NEEDED STARTING IN 2006	YEARLY BREAKEVEN REVENUES NEEDED STARTING IN 2010
$170,000,000	4%	$8,360,258	$10,923,279
	7%	$9,054,420	$12,666,041
	10%	$9,785,801	$14,856,164
$200,000,000	4%	$9,986,807	$13,048,481
	7%	$10,491,320	$14,676,090
	10%	$11,027,677	$16,741,498
$230,000,000	4%	$11,613,355	$15,173,684
	7%	$11,928,219	$16,686,139
	10%	$12,269,552	$18,626,833

OTHER ASSUMPTIONS:

OPERATION COST ESTIMATES:	2007-2008	2008-2041	
	$1,250,000/YEAR	$2,000,000/YEAR	
STATE APPROPRIATIONS	2007-2011	$20,000,000/YEAR	$100 MILLION TOTAL

SPACEPORT AUTHORITY REVENUE BONDS: PRINCIPAL	YEAR ISSUED	INTEREST RATE	MATURITY
$70,000,000 (FOR $170,000,000 INFRASTRUCTURE COST	1-1-2012	6.5%	30 YEAR
$100,000,000 (FOR $200,000,000 INFRASTRUCTURE COST)	1-1-2012	6.5%	30 YEAR
$130,000,000 (FOR $230,000,000 INFRASTRUCTURE COST)	1-1-2012	6.5%	30 YEAR

MISCELLANEOUS ASSUMPTIONS:

ZERO INITIAL STATE OPERATING SUBSIDY FUNDING ON 1-1-2006, NO FEDERAL FUNDING
BOND SINKING FUND DEFERRAL: 10 YEARS
INTEREST INCOME RATE (SINKING FUND): 4.1%
INTEREST INCOME RATE (CASH): 3.6%
DEPRECIATION: STRAIGHT LINE OVER 30 YEARS WITH NO SALVAGE VALUE
ACCOUNTS PAYABLE/ACCOUNTS RECEIVABLE: 30 DAYS OF OPERATING EXPENSES/REVENUE

No other state or federal funding is assumed. Given a real cost of capital of 7%, yearly revenues of $10,491,320 would be required for the state to breakeven on its staged five year $100 million dollar investment. Breakeven as used here is defined as a zero Net Present Value (NPV), which essentially means that the state is earning the associated assumed real cost of capital on its five year staged investment. Note that a real cost of capital is used since all the estimates are in 2006 constant dollars. Table 8 also shows the breakeven revenues required assuming a deferred start in 2010 rather than 2006.

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Overall, the breakeven revenue requirements in Table 8 monotonically increase as the size of the infrastructure cost increases, as the real cost of capital increases and as the yearly revenue receipt start date is moved back. It should be noted that even under an ideal situation of minimum infrastructure costs of $170 million, a 4% real cost of capital, a 2006 revenue start date and zero operational costs over the SRS life, the breakeven cash flows are still greater than $6 million per year. The critical question to be addressed is where the breakeven revenues will come from and whether they will be sufficient to meet these breakeven requirements. An important issue not addressed here is the potential for broad local and regional economic development benefits from the SRS staged infrastructure expenditures and the associated development of the site. The multiplier effects of these expenditures along with the both temporary and permanent increases in employment and associated tax revenues generated for the state should not be ignored.

6.3.3 ACTION ITEMS :

1. Develop a plan to obtain startup funds for infrastructure from the state legislature.
2. Develop a plan to produce revenues from the spaceport. Potential sources are facility lease/usage Fees, launch fees, X Prize Cup Revenue Sharing, land leases, and naming rights.

6.4 OPERATIONS

6.4.1 MANAGEMENT

Ownership of the spaceport is clear, in the sense that it will belong to the State of New Mexico. What is unclear, however, is who is going to operate it. The New Mexico spaceport authority together with the Office of Space Commercialization must decide this important question. The question is whether the state manages only the economic development aspects of the project, or, will they also manage the day to day operations of the spaceport.

The most straight forward of the options is that the state manages the spaceport itself. The benefit of this option is that the state retains complete control over operations; however they do open up the possibility of liability in the case of accidents due to negligence.

The second option is for the state to outsource the operation to a university with research and development as well as operational capabilities. The benefit here is that the facility remains under state control and is run by a group which has years of experience launching various missiles, balloons and experimental aircraft.

A third option is that the state outsourcers the operations to a main customer. The state reduces their liability concerns in case of accidents, but loses control.

A fourth option is that the operation is outsourced to a large aerospace company such as Lockheed or Boeing. The benefit here is that a large company has all the experience and resources one would need to operate a large and busy facility. The downside is that the state loses control.

Of these the two most viable options are for the state to operate the spaceport itself or assigning control through a management contract to a spaceport tenant. The former holds the advantage of assuring all users and tenants of the facility fair use and access. However, this would increase risk borne by the state and require hiring expertise it currently does not have. Contracting management of the spaceport would minimize risk to the state, assure expert management, and enhance safety.

6.4.2 FACILITY MANAGEMENT

A spaceport authority normally provides the following facilities, programs, and services to its launch customers:

- Safety (including range safety and public safety)
- Communications
- Propellants and gas handling
- Laboratory and shop support
- Meteorological Support
- Environmental Management
- Physical Plant Maintenance
- Security
- Institutional Support
- Scheduling of Launches
- Conflict Resolution

While the infrastructure plan is not part of this document, all design elements must include consideration of these items.

The management of the spaceport entails the management of the various services and products provided to customers and the coordination of customer activities.

6.4.3 ANCILLARY MANAGEMENT

Besides the management of the facilities that directly affect the primary users of the spaceport, the management team will need to coordinate all other types of development at the spaceport.

The vision of the spaceport includes facilities that span a wide range of possibilities. These possibilities may include theme parks, trip training facilities, space camps, amateur rocketry facilities, space related merchandise, hotels with spas and golf courses, restaurants and other public quasi-entertainment and supportive businesses that would develop around the site.

In addition, educational opportunities can be developed on site or through outreach programs. A spaceport museum should be developed and tours of existing businesses should be developed.

6.4.4 ACTION ITEMS:

1. Complete FAA/AST Licensing Process.
2. Complete necessary agreements with the Bureau of Land Management.
3. Complete agreements with the State Land Office.
4. Complete agreements with White Sands Missile Range.
5. Identify those ancillary enterprises that will be included at the site.
6. Develop a time line for the development of ancillary businesses at the site.

7.0 SUMMARY AND CONCLUSIONS

The new commercial space industry is very real as a business development prospect for entrepreneurs and economic development opportunity for New Mexico. Starting from suborbital freight operations, then evolving to suborbital passenger operations, thereafter suborbital point-to-point flights for freight and passengers, and finally orbital operations, the new commercial space industry is about takeoff;

Southwest Regional Spaceport can be a catalyst for the industry and its foundation in New Mexico. While all research, gleaned from references and input from industry experts, suggests that New Mexico take a phased approach to investment and development, it also suggest that the economic development return on the investment likely will be positive, although subject to risk; under some scenarios, spectacularly so.