



Spaceport Sarita, a Development Scenario

SICSA

Sasakawa International
Center for Space Architecture
University of Houston
College of Architecture

This preliminary master planning and facility design project was undertaken as a public service in support of state, regional, and local initiatives to realize a commercial spaceport in Texas. The focus on the Sarita site in Kenedy County should not be interpreted as a preference for this location over either of two other candidate site options in Brazoria and Pecos counties. It is our intent to direct future study efforts to those alternate locations to enable special requirements, advantages, and constraints of each to be compared.

The proposals presented in this report were conceptualized and illustrated by fourth and fifth year undergraduate students in the SICSA program within the University of Houston's Gerald D. Hines College of Architecture. This work was supervised by SICSA's Director and Professor of Architecture Larry Bell.

We are proud to note that a distinguished outside review panel selected this work for "The Best College of Architecture Studio Award" at the University of Houston for the 2000-2001 academic year. The following students were recognized for this significant honor:

- Jim Glusing, Fourth Year
- Ricardo Martinez, Fifth Year
- Raul Medrano, Fourth Year
- Chris Munoz, Fifth Year
- Jorge Narvaez, Fifth Year
- Angel Rivera, Fourth Year
- Miguel Uribe, Fourth Year

We appreciate the support of many spaceport advocates who have contributed their expertise and ideas to this effort. Special thanks are extended to: Mr. Fred Johnson of the Texas Aerospace Commission for an abundance of spaceport reference information; Mayor of Kingsville Phil Esquivel, who visited us and provided valuable insights regarding regional and local spaceport development issues; Tom Moser, who worked closely with us to correlate our thinking with the priorities of the Texas Legislature; and Captain Tom Rodino of Shiner Moseley and Associates, who offered generous technical counsel regarding environmental protection and site planning considerations.

SICSA

The Commercial Space Revolution

Benefits from space commerce are rapidly changing the way we live, work, and do business.

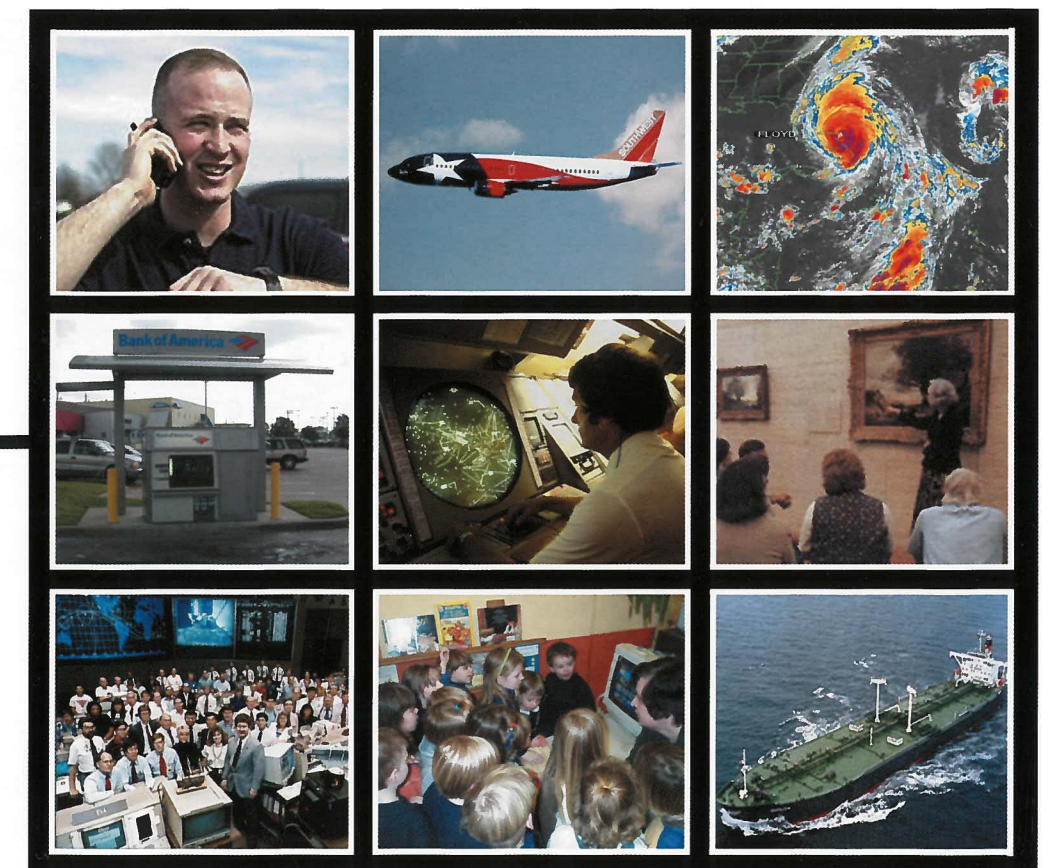
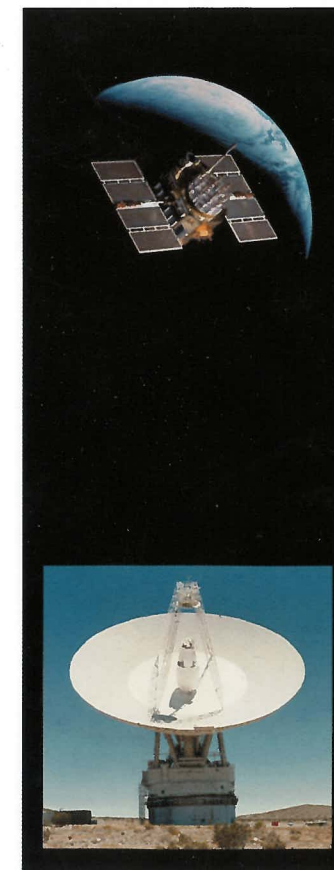
Commercial space initiatives are dramatically impacting many aspects of everyday life and business activity around the world. Space satellites enable governments, corporations, academic institutions, and individuals to instantly communicate with global counterparts over voice, video, and data networks. World-wide television audiences witness events as they take place even in remote locations. Small businesses have easy access to national and international markets for their goods and services. Children in small towns and disadvantaged neighborhoods have electronic access to great world libraries and museums. Diversified corporations coordinate management and technical functions involving widely decentralized offices and plants. Banking transactions, air traffic control operations, and a host of other corporate and public endeavors have been revolutionized. Weather imaging from space benefits travelers, hurricane trackers, and farmers. Crews on small boats as well as large ships at sea are able to pinpoint their exact locations during routine and emergency circumstances. The number of new developments and applications for space-based assets continues to grow daily.

Vast opportunities await those who succeed in reducing the cost of space access.

While the economic and social benefits associated with space commerce appear limitless, the pace of future progress will be influenced by costs of delivering satellites to orbits. Visionary companies that develop innovative ways to reduce these space transportation expenses, along with the far-sighted investors, communities and broader regional and state-wide entities that support these initiatives, will reap enormous rewards.

Let's make certain that they are Texans.

Texas is globally renowned for its legacy of space achievements and the pervasive entrepreneurial spirit that characterizes our business environment. It is appropriate the rich benefits of commercial space transportation be shaped and realized here.



Project Background

Kenedy County is one of three candidate Spaceport locations in Texas.

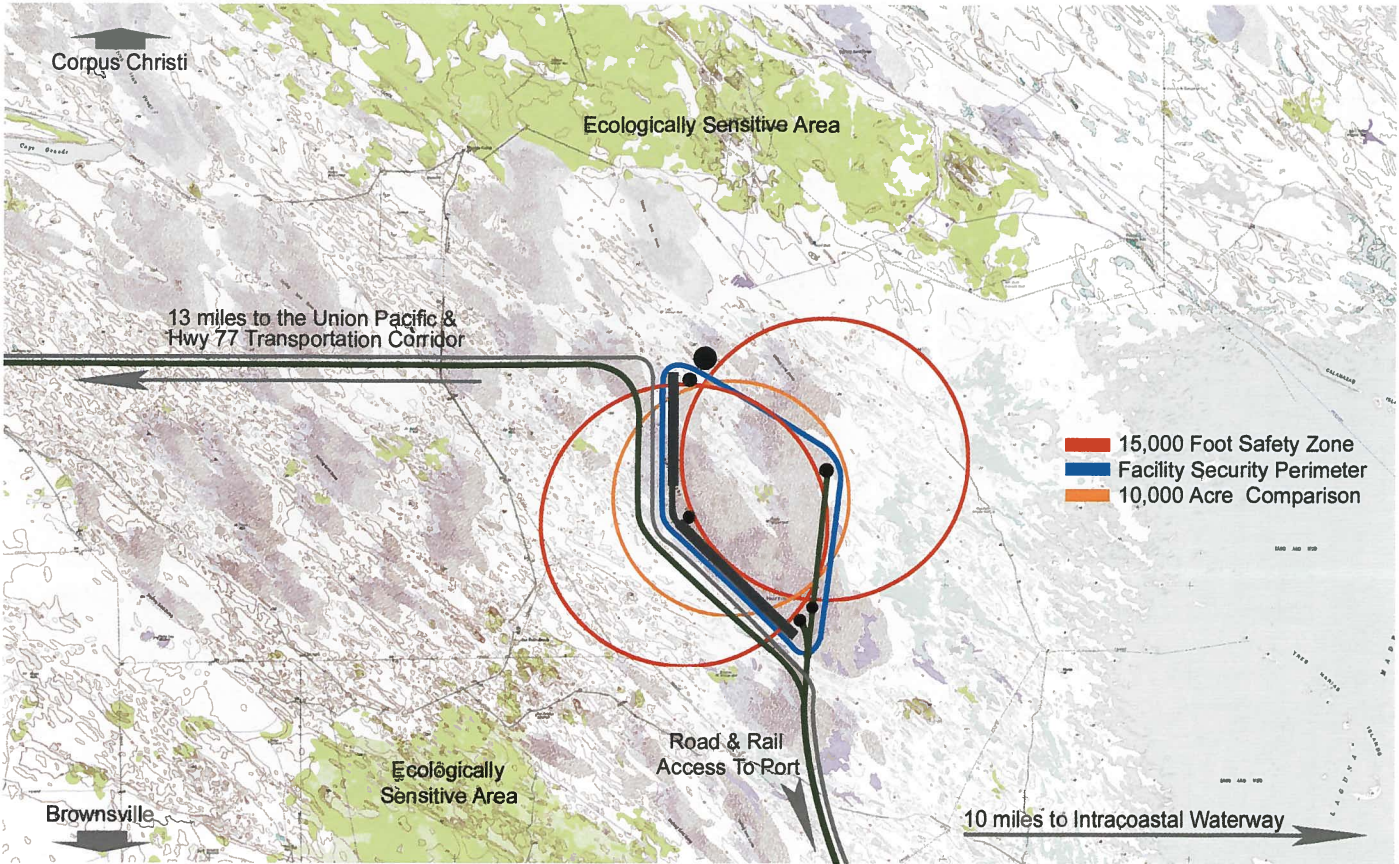
The 10,000 acre Sarita site offers excellent transportation access by land and by water.

This site also affords important launch and safety advantages.

The Texas Aerospace Commission is actively working with a variety of public and private organizations to promote the creation of a commercial spaceport in Texas. The spaceport would serve the development and the operations of advanced Reusable Launch Vehicles (RLVs) to reduce space transportation costs. Three counties have been selected as candidate locations: Kenedy County (in South Texas); Brazoria County (in East Texas); and Pecos County (in West Texas). The Sasakawa International Center for Space Architecture (SICSA) is providing planning and design support for regional government and corporate organizations that are advocating the Kenedy County option. These organizations include: the City of Kingsville; the South Texas Spaceport Consortium, Inc.; and the Kenedy County Spaceport Authority.

The proposed spaceport would be located on a 10,000 acre site which is part of the 235,000 acre Kenedy Ranch in Sarita, Texas. This site is approximately 70 miles south of Corpus Christi, 75 miles north of Brownsville, and 10 miles west of the Padre Island National Seashore. The area's transportation infrastructure affords excellent site access which is essential for delivery of large RLV elements and payloads. It is located 13 miles east of the Highway 77 (Interstate 69) and the Union Pacific rail corridor, which extends from Canada to Mexico; and 10 miles west of the Gulf Intracoastal Waterway which connects with major Texas ports in Houston, Corpus Christi and Brownsville. The 125 ft. wide, 12 ft. deep Intracoastal Waterway runs north/south through the Laguna Madre.

A Sarita site would be closer to the equator than any other existing or proposed spaceport in the continental US. Sarita offers an ideal easterly launch trajectory to take advantage of the Earth's rotation for added boost and is also distant from population centers which could be endangered by possible catastrophes.



Planning Approach and Phasing

Protection of the natural environment and the safety of people and wildlife are important priorities which have guided SICSA's spaceport planning approach. The Sarita site is located in a pristine and vulnerable region which must be preserved. The South Texas coast and Laguna Madre area are nesting grounds for a variety of bird species. Several of these species are listed as endangered, and the Padre Island National Sea Shore, is in their flight path. A rare Ferruginous Pygmy Owl nests in the branches of local oak trees, and Ocelots are also reported to live in the area. While preliminary environmental impact studies have been conducted for a prospective spaceport, much more detailed investigations will be required. Launch facilities must be located and planned to minimize risks to all wildlife.

Safeguards to preserve the region's rural character are also essential. The area's local economy draws heavily upon ranching and hunting leases as primary revenue sources. Many residents are concerned that spaceport development and launch operations will have a detrimental impact upon country lifestyles that they presently enjoy and wish to maintain. Some will regard potential pollution of grazing lands for cattle and urbanization of the countryside to be unacceptable costs for the projected employment and economic benefits. Accordingly, SICSA's plan confines all spaceport operations and ancillary support areas within controlled development boundaries. Ground and air transportation would link the site to established urban centers which will offer comprehensive community services to spaceport employees.

Spaceport construction and operations are planned to be staged according to evolutionary needs and budgets. SICSA's approach envisions three general phases of development: an initial experimental vehicle assembly and test phase; a commercial satellite launch phase; and ultimately, a human launch phase for space tourism.

Spaceport planning must protect the natural environment and wildlife.

Rural lifestyles must also be preserved throughout all phases of development.

Three phases of development are proposed.

Ground Transportation Infrastructure

Runway construction for SPACE ACCESS launch vehicles is essential.

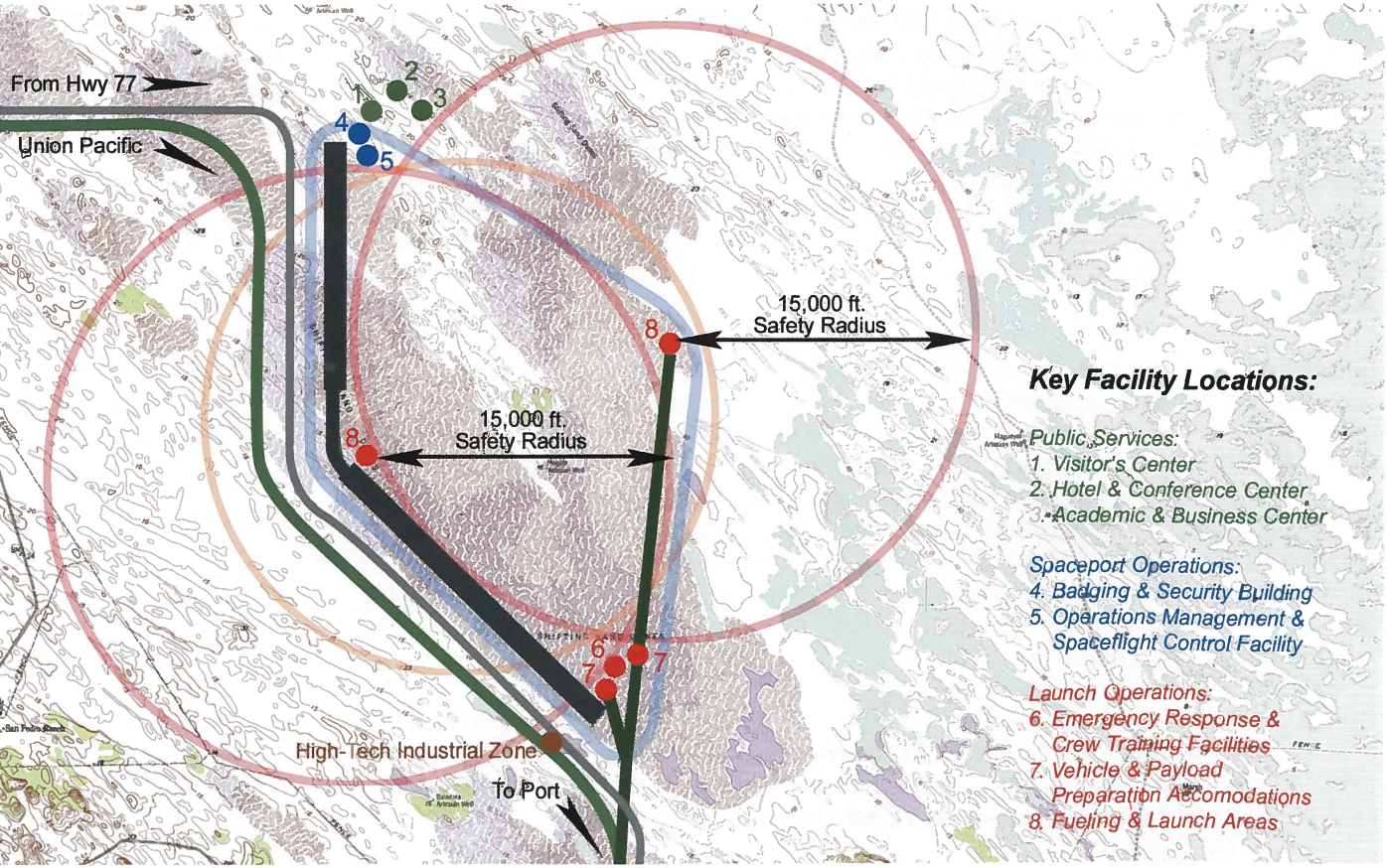
Air cargo use can help to amortize runway costs and support new high-tech industries.

Rail line and roadway connections to the site and to a nearby port are also needed.

SICSA's proposed initial phase of spaceport development would focus on creating a cargo transportation infrastructure, an airstrip for spacecraft and air cargo, and facilities for launch vehicle preparation and payload integration. Key on site elements include a 15,000 ft. long runway and hangars to accommodate a horizontal takeoff launch vehicle that is being developed by SPACE ACCESS. The estimated \$60 million runway cost might be amortized in part through commercial air freight use.

The Kenedy County region is designated as an economically depressed area which is eligible for business tax abatement incentives, and is also part of the NAFTA Free Trade Zone. These advantages are reinforced by the Sarita sites's close proximity to Mexico, which can enable it to benefit from a Border Industrialization Program established by the Mexican Government in 1965. This program enables US assembly plants in Mexico that employ Mexican labor to export their products back to the US under favorable terms. Many of the largest US corporations currently operate such plants, including a large number of high-tech industries that could support Spaceport Sarita's launch and payload equipment development. Accordingly, a high-tech industrial area is contemplated within the spaceport boundaries.

SICSA's Phase I development plan proposes that the local surface transportation infrastructure be expanded and upgraded to accommodate movement of large cargo elements. First, a rail line would be extended from the Union Pacific corridor to connect with an upgraded port near the site serving barge traffic from the Intracoastal Waterway. This rail connection may require that a highway overpass leading to the site be constructed to enable unimpeded vehicular traffic flow on Highway 77. The rail line would serve the proposed industrial zone. An airstrip for commercial, institutional, and government visitors will be constructed during Phase II.



Vehicle and Payload Preparation Accommodations

Key elements of Spaceport Sarita's development will include servicing facilities to prepare spacecraft for operational status, integrate commercial payloads into the vehicles, transport or otherwise connect the vehicles to launch areas, and accomplish fueling. The emphasis of Phase I is upon accommodating SPACE ACCESS launch vehicles that take-off and land horizontally like conventional aircraft.

Three large interconnected hangars would be constructed to house SPACE ACCESS vehicle maintenance and payload integration functions. The second and third of these hangars can be built sequentially over time as needs and budgets dictate. Large spacecraft elements, such as rocket engines and satellites, can be delivered to these facilities by roadways and by rail. Satellites and components would be lifted to checkout clean rooms at the upper level by cranes attached to outside walls, then lowered into spacecraft cargo bays by a similar interior crane system. The cranes would be mobile, enabling versatile distribution and positioning of cargo elements between and within the hangars.

To optimize Spaceport Sarita's future beyond Phase I, SICSA's site and facility plans anticipate a need to accommodate other future types of RLVs that can expand economic opportunities. These vehicles can be expected to include vertically launched rocket systems that land horizontally as well as vertical launchers that land vertically. Such vehicles typically require special facility provisions, such as hangars that enable spacecraft to be serviced both horizontally and vertically, a launch pad with a vertical support gantry, and a prime mover to transport launch vehicles from the hangars to the pad. For safety, launch pad and refueling areas must be located at least 15,000 feet away from any occupied structures, including the maintenance and payload integration hangars.

Launch vehicle preparation in Phase I will use aircraft-type hangars.

Satellites will be checked out in upper level clean rooms.

Later development may add servicing and launch facilities for rocket vehicles that launch vertically.

Emergency Response and Crew Training Facilities

The site’s remote location affords safety advantages, but requires independent emergency services.

The Spaceport Sarita site is located in a very sparsely populated area, greatly reducing the magnitude of regional concerns regarding human safety. This remote setting, however, requires that independent response services be provided to protect on-site residents and users. Effective measures to optimize safety and ensure rapid responses to any emergency situations will be essential throughout all phases of spaceport development and operations.

Beginning in Phase I, fire fighting crews and medical professionals who are trained and equipped to address all foreseeable types of contingencies would be stationed on standby in a proposed Emergency Response Facility. This structure would be strategically located for rapid access to spacecraft assembly, testing, and launch areas.

Firefighters and paramedics would remain on constant standby.

The initial stage, to be constructed during Spaceport Sarita’s earliest development phase, would provide garages and maintenance areas for fire trucks and ambulances, as well as eating, sleeping, and recreational amenities for fire fighters and paramedics. A nearby heliport would enable rapid transport of severely injured people to regional hospitals for comprehensive treatment services.

Medical, health fitness, and training facilities would be added as needs warrant.

A later expansion stage occurring during Phase II would add a separate Medical and Crew Training Facility. This would take place when a substantial level of commercial satellite launch activity and a significant population of on-site personnel warranted the necessary investment. The facility would provide a larger, fully staffed medical clinic and health fitness center, as well as accommodations to enable on-site maintenance and operations personnel to prepare for a variety of technical roles. These training functions will support regional employment objectives by enabling area residents to qualify for newly created skilled and well-compensated job opportunities.



Emergency Response & Crew Training Facility



Vehicle Parking and Maintenance



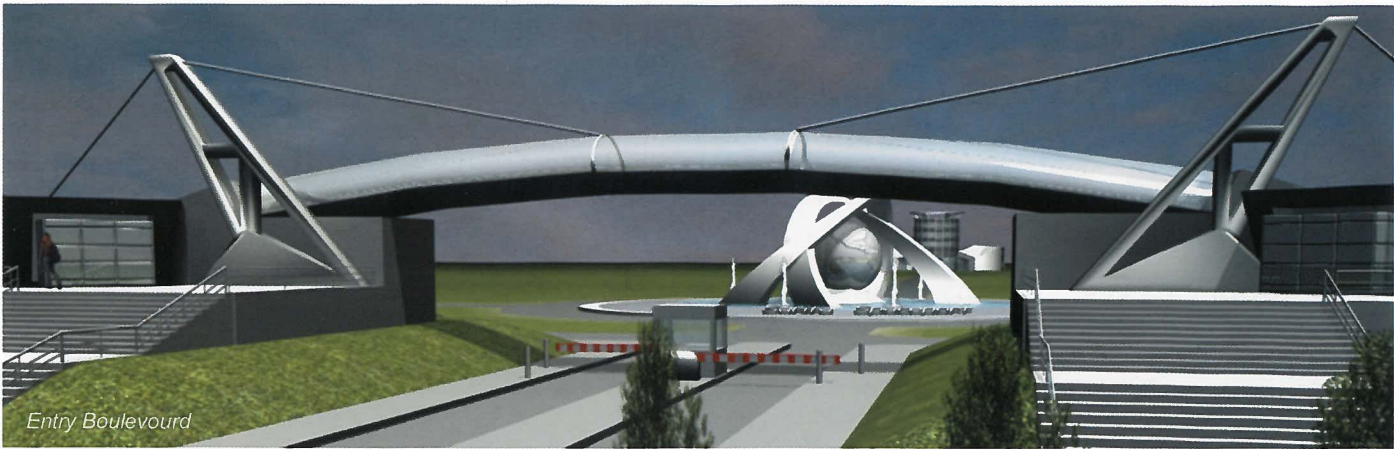
Emergency Vehicle Parking



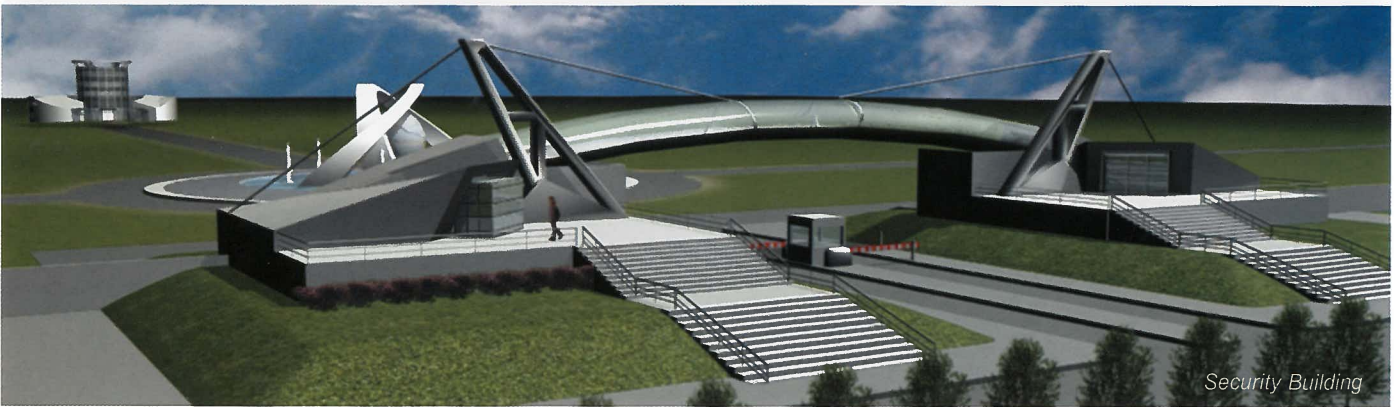
Southern Approach to Emergency Facility



Completed Complex



Entry Boulevard



Security Building

Badging and Security Building

The security of Spaceport Sarita’s technology development and operational facilities from unauthorized access is an important priority. Advanced launch vehicles and satellite payload systems represent possible targets for international and industrial espionage aimed at obtaining proprietary design information. Spacecraft and fuel depots must be protected from vandals and terrorists who might wish to cause destruction which could potentially put lives at risk. The spaceport’s location near the Texas border with Mexico also presents special problems. Illegal immigrants sometimes pass through this area and damage or steal private property.

During the early experimental test and launch phase of spaceport operations, it may be adequate to limit tight security control to only highest risk areas. These places would include design and engineering offices, vehicle assembly and test facilities, and volatile fuel storage areas. Later, when operations and needs warrant, it will probably become necessary to secure the entire operational site. This might involve building a tall, electronically monitored perimeter fence with security personnel at all entry and exit points.

A proposed Badging and Security Building will provide the main entrance gateway for site-level control. Authorized visitors requiring temporary access badges would obtain them here following clearance checks. Personal automobiles would be left in this area, and shuttle vans and buses would be available for general on-site transportation and tourist services.

Administrative offices and leisure accommodations for security personnel are provided at the ground level of the building. The second level serves as an elevated observation area for entrance and site surveillance.

Illegal immigrants and vulnerability to terrorism and espionage represent security concerns.

Initially, security countermeasures will emphasize the highest risk areas, followed by site-level precautions.

Surveillance and controlled access must be provided.

Operations Management and Spaceflight Control Facility

Accommodations for spaceport management and operations control are part of Phase II.

A control tower and orbital system tracking center would be incorporated.

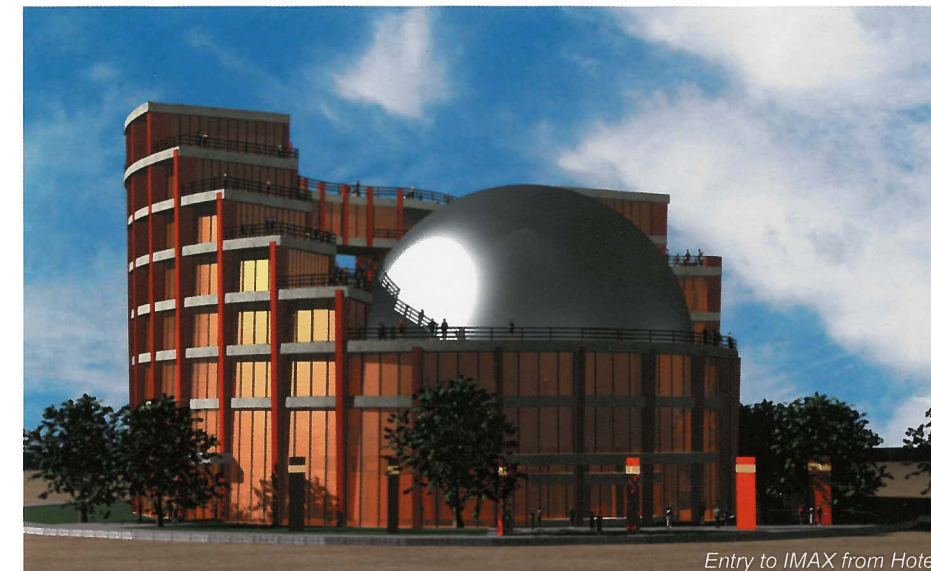
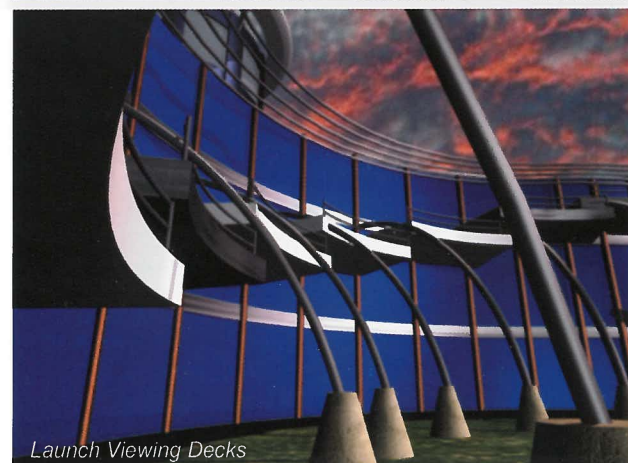
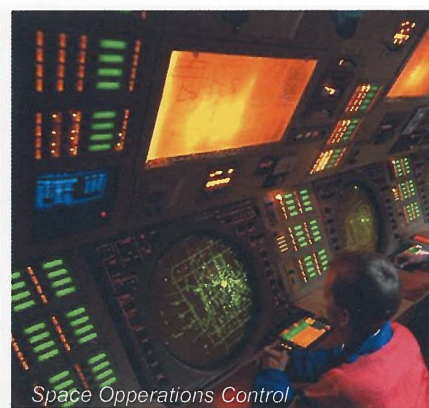
This facility can also function as a general aviation passenger terminal.

Expanded and intensified spaceport operations that occur during Phase II will create the need for an Operations Management and Spaceflight Control Facility to house executive administration and launch oversight functions. This building will provide an office suite for overseeing on-site surface, aviation, and launch activities; as well as a launch mission control tower and tracking center for monitoring the functional status and positions of deployed spacecraft and orbital satellites.

The control tower will offer a viewing station to observe ground and air traffic, and also function as a command center for dispatching and coordinating emergency services. Such contingencies would include responses to potential fires, explosions, and vehicle launch or landing failures. Located immediately above the control tower, the tracking center will maintain communications with spacecraft and satellite monitoring stations all over the world, enabling continuous radio contact and performance reports.

The Operations Management and Spaceflight Control building can also serve as an airport terminal for corporate, institutional and government spaceport users. This function would become most appropriate after a proposed general aviation runway is constructed during Phase II. This north-south runway will supplement the primary spacecraft and cargo airstrip which is planned to be implemented at the beginning of Phase I.

To facilitate convenient access, the Operations Management and Spaceflight Control Facility is proposed to be located between the general aviation runway and the Badging and Security Building. An entry monument introduces visitors to this arrival area within the secured site boundaries.



Visitor's Center

The exciting and historic nature of spaceport activities can be expected to attract thousands of visitors to the Sarita site, especially during launch and landing events. Commercial services that cater to the interests and needs of these populations can offer valuable sources of revenue. This potential income base will expand as the scale of on-site operations and the frequency of missions increases over time.

In order to act upon these tourism market opportunities, SICSA proposes that a Visitor's Center be created in a public area immediately outside the site's secured working zone that requires special access permits. The Center will share a plaza with an Academic and Business Center, as well as with a Hotel and Conference Center. Collectively, this complex will provide an attractive arrival destination and public services area with diverse accommodations both for temporary guests and for resident corporate and institutional users.

The Visitor's Center construction will be staged to meet expanding evolutionary needs. Commencing during Phase II of spaceport development, the initial stage will feature a planetarium, a modern IMAX theater, souvenir shops, fast food establishments, and an outdoor exhibit area. Later expansion will enclose the central exhibit space and add supplemental areas for retail sales, museum displays, public viewing of launch and landing operations, full-service dining, and child and adult-oriented education programs.

The Visitor's Center can play an important role in promoting public interest in space as a vital and beneficial frontier for technical, social and economic progress. It can also advance greater awareness of Texas as a continuing world leader in areas of technology development, education and business enterprise.

Tourism offers a promising source of spaceport revenues.

The first stage of a Visitor's Center would be built in Phase II, and expanded to provide additional services as needed.

A key priority is to advance public awareness of space activities, benefits, and opportunities in Texas.

Academic and Business Center

Spaceport Sarita will stimulate and create valuable education and research opportunities in Texas.

The spaceport will also attract a variety of business organizations that can draw upon the academic resources.

Some facility accommodations can be shared.

As a hub for commercial space activities, Spaceport Sarita will attract university and corporate research and engineering programs associated with many aspects of spacecraft development, testing and mission operations. These programs will advance higher education, promote new business service opportunities, develop and demonstrate new technologies, and prepare management and operations personnel for critical leadership roles. Such contributions are vital to the success of commercial space endeavors, and are important to prepare the region's underutilized labor pool for skilled and financially rewarding employment. SICSA's proposed Academic and Business Center responds to these needs.

Like many other planned spaceport facilities, construction of this Center will be staged for evolutionary expansion as needs dictate. The initial stage will establish a multi-purpose building that serves institutional and corporate users in the same facility. Key accommodations will include offices for research and administrative personnel, laboratory-classroom spaces, conference-lecture areas, and libraries. Subsequent development will create a second building that is dedicated exclusively for corporate business and technology users. This structure will contain lease space which can be configured for special requirements of each resident. The first building will then be reassigned more specifically for institutional research and instructional programs.

The dedicated corporate building will facilitate stringent security safeguards. These precautions will be important to enable companies that are competing in highly technical and sensitive service markets to protect valuable intellectual property. The separate buildings will share a common outdoor courtyard, and the institutional library and assembly spaces will also be made available for corporate occupants.



Academic & Business Center



Business Center Courtyard



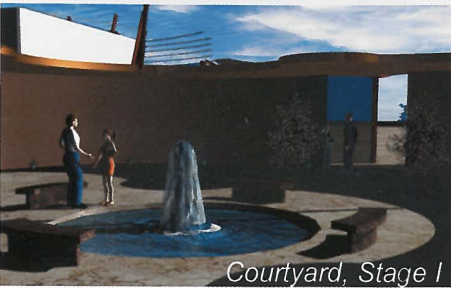
Academic Center in Plaza



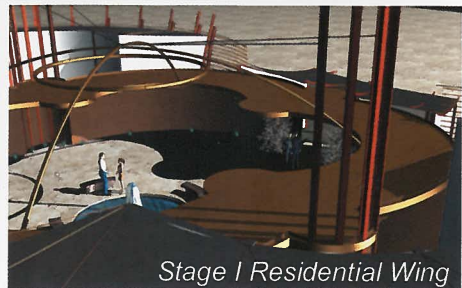
Courtyard Structures



Hotel & Conference Center from Plaza



Courtyard, Stage I



Stage I Residential Wing



Staff Lodging, Stage I



Development Stages



Fully Developed Hotel, Stage II

Hotel and Conference Center

A proposed Hotel and Conference Center will accommodate overnight sleeping needs of visitors, will provide longer-term lodging for residents, and will offer meeting spaces and amenities for large and small groups. These functions will be expanded through staged construction growth as commercial satellite launch operations become more and more frequent, and as additional academic programs and business users are attracted to the site. When completed, Spaceport Sarita can function as a somewhat autonomous living and working community that is confined within the site boundaries to avoid problems of urban sprawl.

The first stage of construction will provide basic living accommodations for site residents, offering efficiency suites with limited kitchen appliances in one building, and a separate building that will contain conference rooms and exhibition spaces for various public and business functions. These two low rise structures will flank a central courtyard.

A second and ultimate growth stage will construct a commercial hotel that will rise over the central courtyard to accommodate public visitors, conference attendees and other guests. Piers to support this structure will be set in place when the courtyard is originally created to minimize disturbances to the flanking wings during construction. Modular building components and assembly methods will also facilitate the erection process.

The completed hotel will incorporate a restaurant and spaceport viewing area at the penthouse level for individuals and groups. Together with the Visitor's and the Academic and Business Center, this facility will enhance Spaceport Sarita's tourist appeal, business vitality, and revenue base.

On-site lodging can prevent urbanization of pristine ranches and hunting areas.

Accommodations in Phase I will serve the living needs of employees and users, providing conference and exhibit spaces for businesses and visitors.

The facility can be expanded in answer to the opportunities of tourism.

Bringing Substance to Vision

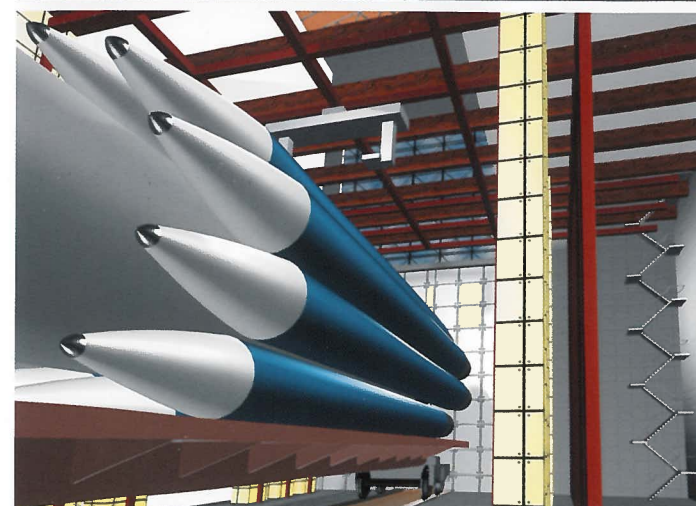
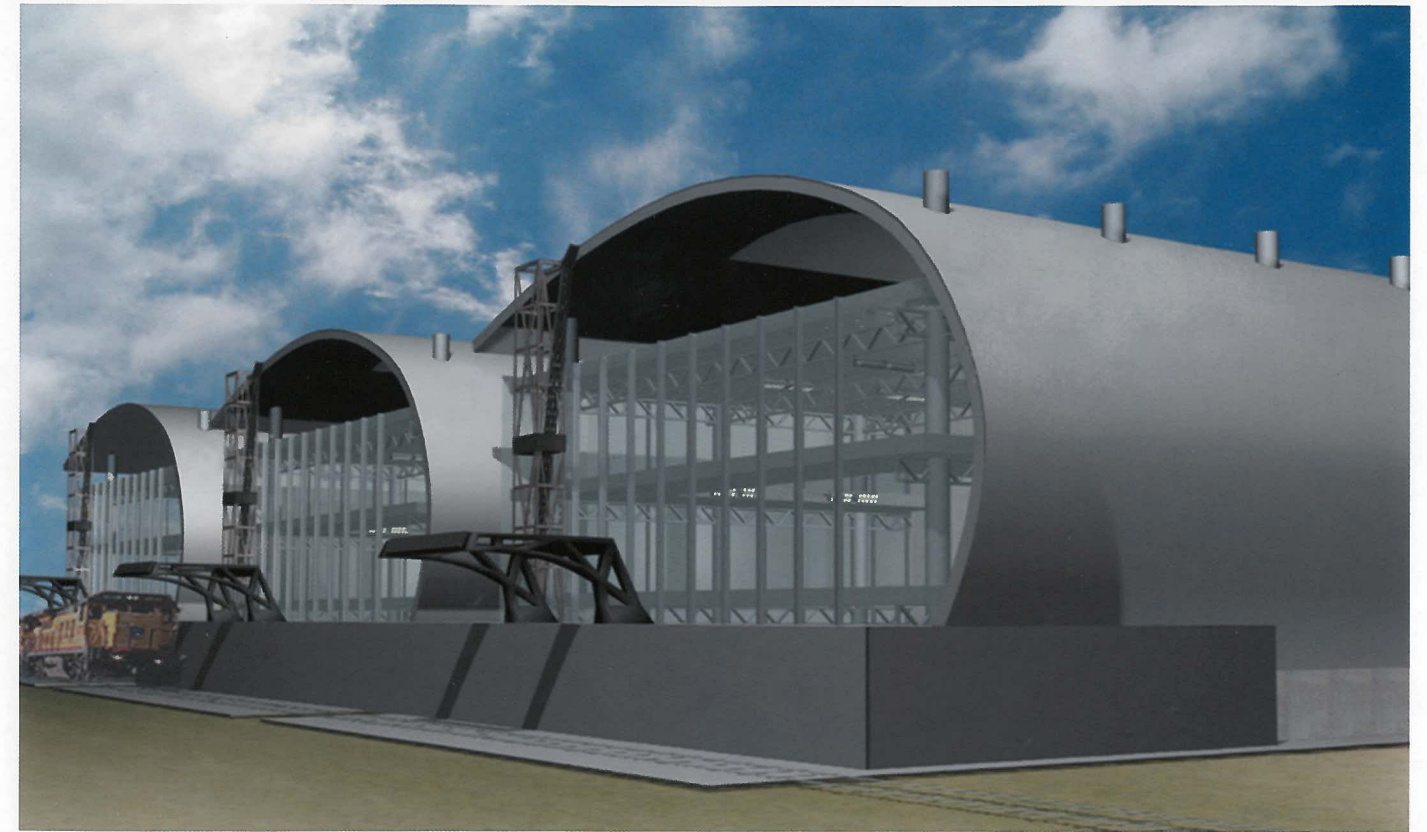
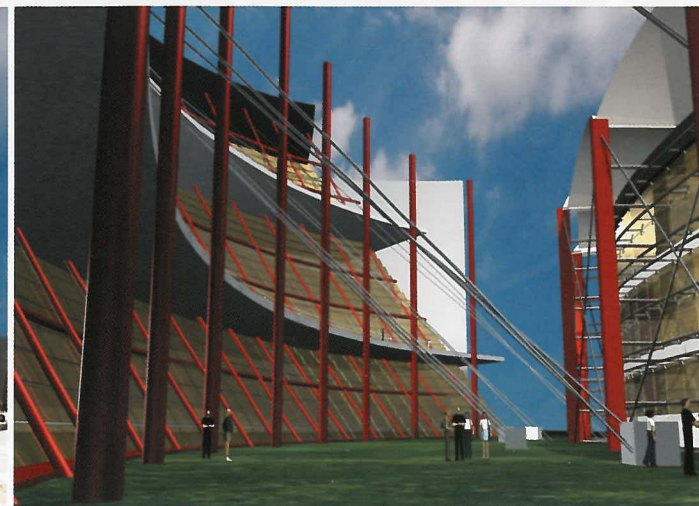
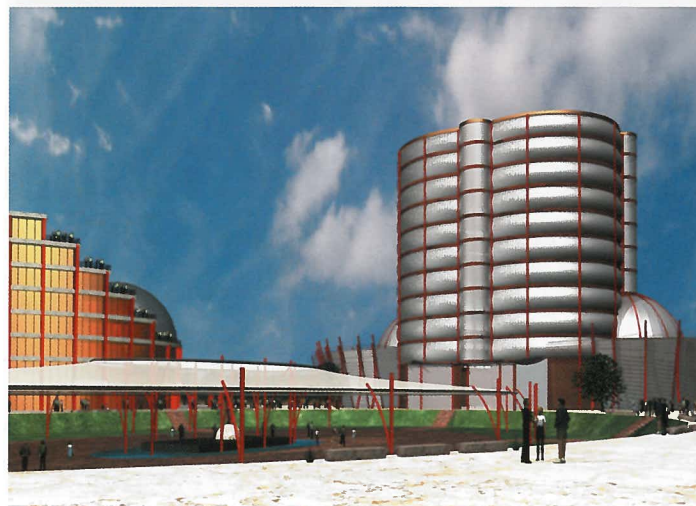
Our leadership will shape the future.

That's just the way we are!

As Texans, we can do no less.

At present, Spaceport Sarita exists only as an unrealized vision of vast possibilities. This vision embodies images of advanced spacecraft launched from a Texas site that will bring new economic opportunities and advance progress in our state and nation; images of a place that will generate new jobs and offer necessary technical training for the underemployed regional population; images of a center for learning which will stimulate children and adults to recognize the importance of commercial space programs in everyday life, and help prepare young professionals for exciting and rewarding careers; images reflecting the strength of the indomitable Texas spirit.

Yet bold actions, not images, form the true substance of vision. The concepts that have been presented only illustrate examples of unrealized potentials. It is now time to move forward and transform achievable dreams into exciting realities.





Public Facilities Surrounding Visitor's Plaza



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