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Paper Session I-A - Canada's International Spaceport

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Canada's International Spaceport

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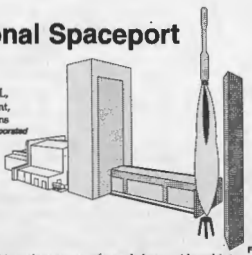


Figure 1

ABSTRACT

Since the early days of 1990, a small yet tenacious group of people have widened into an extensive and cohesive team, accomplishing many firsts in the world of space business - the development and operation of a privately financed, international, commercial space launch facility. ***SpacePort Canada*** - is located at the former Churchill Research Range on the Hudson Bay in northern Manitoba. The SpacePort will re-establish the facilities where over 3500 sounding rockets were launched between 1957 and 1989. The first phase of construction, involving the refurbishment of existing sounding rocket facilities, was started in July 1994 and concluded in November 1994. The remaining phases of the project involve further expansion of existing facilities and the construction of two new launch pads. The pads, capable of supporting rocket launches to place satellites weighing between 1000 - 4000 pounds into low earth orbit are designed to accommodate a variety of international vehicles. In addition to these facilities, buildings to support satellite processing, mission control and administrative support will be constructed. The SpacePort, created by Akjuit Aerospace Incorporated of Winnipeg, Manitoba, and managed by Raytheon Engineers and Constructors of Denver Colorado, will be capable of supporting launches carrying small satellite payloads in mid 1996. These satellites typically provide communications, remote sensing and environmental monitoring services. To date, twenty competing satellite consortia have announced plans to launch more than 1300 satellites to provide these services. ***SpacePort Canada*** is designed to fill a void in the current launch market - the world's first commercial spaceport, capable of launching several different international rockets from the same location, utilizing state-of-the-art equipment, buildings and launch facilities, combined with a highly competitive pricing structure.

Introduction

"Akjuit" is a single Inuit word which has profound meaning:

"A group of winter stars that rise in the east during the dawn of the day at the beginning of the coldest time of the Arctic Winter"

"The sighting of Akjuit gives the Inuit of the north alertness to prepare for the harsh, cold winter coming ahead and gives them greater courage to overcome any hardship. At the same time Akjuit fills the Inuit with excitement and promise for the coming of the light, when day meets night, and the new day of the north is born."

A New Company of Adventurers
Building International Access to Space
...our final commercial frontier

Akjuit Aerospace

Akjuit Aerospace

Akjuit Aerospace Incorporated was established in 1992 as the corporate entity responsible for developing a new polar commercial spaceport. The $1 million required to finance the conceptual design phase of the project was arranged by the formation of a limited partnership, SpacePort Canada Limited Partnership. Prior to the conceptual design phase, the technical team had invested almost 2 .5 million in services in kind for various feasibility studies.

Aware of the benefits from previous range activity, the community recognized they had an ideal location for supporting polar launches from a reactivated and expanded launch facility. The town of Churchill was driven by the realization that the establishment of a commercial polar spaceport and a sustainable economic development of this magnitude would offer their community, and Canada, enormous opportunities. A group of local residents led by the Mayor of Churchill, Douglas Webber, approached Siobhan Mullen, now President and CEO of Akjuit Aerospace, to lead the ***SpacePort Canada*** project. The residents of Churchill provided some of the initial financial support and continue to be involved in, and supportive of, ***SpacePort Canada*** in various ways, including representation on the Board of Directors, and providing local support for the project.

The composition of the Akjuit Board of Directors reflects the philosophy of the company: it brings together leaders from the business community, the aerospace and communications industries, the aboriginal community and the local community.

Raytheon
Engineers & Constructors

The Technical Team behind Akjuit is an extensive and experienced group of companies capable of designing, constructing, operating and marketing ***SpacePort Canada***. In addition to major legal and financial organizations, and numerous sub-contractors, the site technical team includes:

ACTA

Raytheon Engineers and Constructors, the premier space facility builder in the world, ACTA Incorporated, currently responsible for range safety analysis at Vandenberg Air Force Base and Cape Canaveral Air Force Station and TetrES Consultants Inc. a Canadian company performing environmental studies and and analysis for the SpacePort project.

TetrES
CONSULTANTS INC.

History of the Churchill Research Range

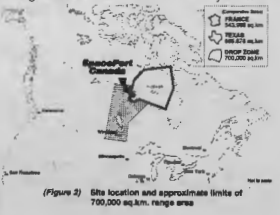
The Churchill Research Range was opened in 1957, the International Geophysical Year, as a launch site for sounding rockets to study the earth's near space environment, and is ideally situated for the study of the mid-auroral belt. During its years of operation, approximately 3500 sounding rockets were launched year round from the Range.

Due to government cutbacks in late 1984, the range was closed as a launch facility and a plan was implemented to dismantle it. As a result of this dismantling effort, most of the scientific, telemetry and tracking equipment have been removed from the range. The major buildings are still in place and have been refurbished.

In September 1993, Akjuit received an option to lease the Range. The leased land is bounded on the west by West Longitude 93 degrees 50 minutes 45 seconds, on the south by North Latitude 58 degrees 42 minutes, on the east by West Longitude 93 degrees 45 minutes and on the north by the shoreline for Hudson Bay.

The launch operations area is 8 degrees of latitude below the Arctic Circle, and together with the impact area encompass approximately 700,000 square km (270,000 square miles) comprising most of the Hudson Bay and a large tract of uninhabited land in the northeast section of Manitoba.

The lease option was solidified on the 18th of July, 1994, when Siobhan Mullen, Akjuit's President and CEO, and Albert Driedger, Minister of Natural Resources for the Province of Manitoba, signed a 30 year renewable lease for the Range.



(Figure 2) Site location and approximate limits of 700,000 sq.km. range area

SpacePort Canada

Over the last decade the small satellite market has emerged as one of the most significant sectors in the space industry, creating a new age in communications and earth observation. Recent decisions by international bodies and multi-national corporations have shifted the focus of development for certain applications from large expensive equatorial satellites to networks of numerous smaller and less costly satellite constellations in polar orbits. To support this growing industry, a new infrastructure (consisting of small satellites, small expendable launch vehicles, a polar spaceport, network control systems, and ground stations) is rapidly developing.

In response to the requirement for this new infrastructure, Akjuit Aerospace's new development, ***SpacePort Canada***, designed for suborbital and orbital launches, will integrate and market with Canadian industry an infrastructure package supporting the emerging small satellite industry.

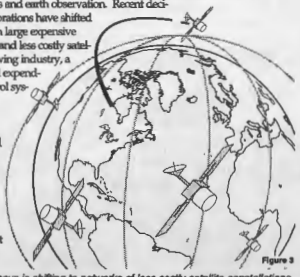


Figure 3

Focus is shifting to networks of less costly satellite constellations.

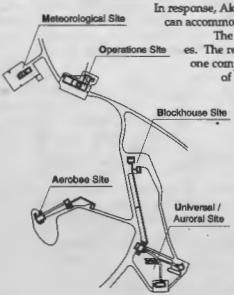
A Universal Launch Concept

SpacePort Canada, provides direct flight paths over the North Pole, and is based on the demands of the emerging small satellite industry for a commercial (non-military) launch site unencumbered by government demands and priorities.

In response, Akjuit Aerospace developed a universal launch concept which can accommodate several international launch vehicles.

The universal concept is comprised of three (3) launch complexes. The refurbished Churchill Research Range for sounding rockets is one complex, and two complexes will accommodate SELV classes of vehicles. The Air Launched Expendable Launch Vehicle (AELV) which uses an aircraft as its first stage, will utilize the Churchill airport but process its payload at and receive telemetry and tracking from ***SpacePort Canada***.

The universal launch concept allows the processing and launch of different vehicles of a single class from the same launch complex. Therefore, ***SpacePort Canada***, utilizing all three of its launch complexes, can accommodate a wide range of existing and next generation launch vehicles from around the world.



Former Churchill Research Range. Now Sounding Rocket Complex #1

Figure 4

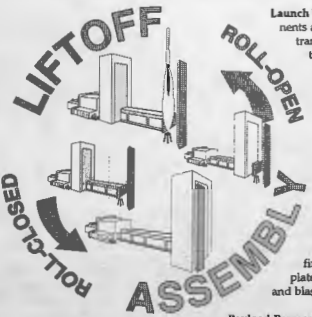
Location of the CRR

Ideally located for Polar and High Inclination Orbital Launches, ***SpacePort Canada*** is unique in the world for market proximity, infrastructure and commercial environment.

Spaceport Facilities

Several new facilities will be constructed at ***SpacePort Canada*** to accommodate the launch of various classes of international rockets. Each individual facility has been designed to be consistent with the universal nature of the spaceport, and have the ability to support several different rockets using common facilities. In addition, the facilities have been sized to allow for a high launch rate (the Mission Control Centre, for example will allow the simultaneous launch/check-out of two (2) rockets). A brief description of each of the critical facilities follows:

Rocket Assembly Building: From the separate Rocket Storage Buildings the Launch Vehicle components are transported to the Rocket Assembly Building for assembly and/or electrical integration checks, etc.. The Assembly Building consists of a large off-loading/transition bay for maneuvering these Launch Vehicle components and three rocket assembly bays.



Launch Tower: The Launch Vehicle components and rocket payload are moved from the transition bay of the assembly building to the Launch Tower via an enclosed transfer corridor. This transfer corridor is separated at both ends from the adjoined facilities by firewalls.

The Launch Tower consists of a fixed tower which contains multiple floors of service spaces, elevator, exit stairwell and entry levels which provide services for the actual launch pad enclosure. This enclosure consists of a movable tower which provides shelter and several adjustable work platforms for the final assembly and preparation of the rocket. The walls of the fixed tower facing the launch pad will be plated with steel to protect against the heat and blast forces during a rocket launch.

Payload Processing Facility: The "payloads" (satellites) which utilize the launch vehicles, will vary in their specific missions, e.g. research instrumentation, communication remote sensing, etc.. These payloads are shipped from the manufacturers facilities to Churchill and are transported directly to the payload processing building where a small receiving bay and storage room are provided. A transfer corridor is provided to serve as a connection and air lock between the four separate operational areas of this facility. Two user processing areas are provided for assembly and checkout of the payload. One will be maintained as a class 10,000 clean room, and the other a class 100,000 clean room.

Mission Control Centre (MCC): The MCC is a two story building housing two identical Launch Control Centres (LCC) from which all of the launch pads are controlled. The building will also provide space to support telemetry, tracking, and weather monitoring equipment. The weather balloon inflation bay is attached.

In additon to these critical facilities, several support (adminstration, storage, maintenance etc.) facilities will be constructed.

Construction and Development

Ground breaking at ***SpacePort Canada*** began in July 1994 with the refurbishment of existing facilities. Over the course of the winter 1994/95, engineering will be completed for the critical facilities scheduled for construction during the second orbital facility construction season scheduled for June 1995. ***SpacePort Canada's*** permanent facilities were launch ready for suborbital vehicles in the winter of 1994 and the inital operational capability for orbital launch vehicles will be mid 1996.

SpacePort Operations

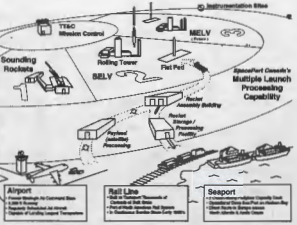
The SpacePort's philosophy of operation is:

"to provide an operational launch site that permits the customer to operate an efficient, safe and successful launch program".

The division of operational activity between the SpacePort and the customer is clear and straightforward. The customer will plan, operate, maintain and supply logistic support for their own equipment. They will have contact with the SpacePort to schedule support services and will provide the launch enable command.

The SpacePort will plan for, operate, maintain and provide the logistic support for the launch facilities as necessary for the conduct of an efficient and successful space program. Flight and Ground Safety as well as launch licensing and environmental compliance will be SpacePort responsibilities.

Figure 6 depicts an operations flow for processing a rocket and its spacecraft. In this configuration, the SpacePort is fully developed. With separate processing facilities for sounding rocket programs and with individual storage, assembly, and launch sites for each class of vehicle, multiple programs can be accommodated. The Mission Control Centre and miscellaneous support buildings will be operated as multiple program facilities. They will be expanded incrementally as demand grows.



Operations Flow - SpacePort Canada **(Figure 6)**

SpacePort Canada will utilize the existing port, rail, and airport in both the construction and operation phases of the spaceport. Construction equipment, and materials required during construction will arrive by ship or rail, rocket components will arrive primarily by air and rail. Electronic equipment and satellites will arrive by air. All facilities have been designed to provide comfort to workers throughout the year and launch vehicles will be kept enclosed until minutes before launch. Programs consistent with industry standards, will be established to maximize range safety and minimize environmental impacts.

Range Safety

The extremely large uninhabited area around the SpacePort and the very low population density in the general direction of a polar launch eliminate the possibility of over flight risk or noise pollution affecting any populated or developed areas. This permits a direct flight path over the pole with minimum risk. However, ***SpacePort Canada***'s siting, layout, design and operation will still use range safety standards and practices which are at least as conservative as the standards used at other worldwide launch sites.

Environmental Awareness and Public Consultation

Another key competitive advantage enjoyed by ***SpacePort Canada,*** is the emphasis placed on environmental assessment and protection from the very start of the project. Akjuit has placed a priority on making absolutely certain that environmental issues were addressed early in the design phase so that potential impacts would not impede the project's commercial viability later. As a result, Akjuit was awarded an Environment Act Stage I License for the construction of ***SpacePort Canada*** on March 17, 1994, by the Province of Manitoba.

The Akjuit approach has been a prudent one. Akjuit moved early to enlist the services of the best environmental consultants available, who advised very strongly that the best way to proceed was

with a pro-active approach to any potential environmental impacts. Two to three years of environmental assessment work were completed before filing for a license.

The project's initial environmental assessment report found that there is unlikely to be any major impact due to the development of ***SpacePort Canada***. The conclusion stated "all potentially significant adverse impacts of the project appear to be capable of being mitigated with known technology including proposed design features." Local support and public consultation have also been a key issue in the development of ***SpacePort Canada***.

Description of SpacePort Canada Market

The market for ***SpacePort Canada*** will consist of satellites requiring polar or near-polar orbits and sounding rocket payloads. The satellite market requiring these orbits can be divided into two categories: small satellites in networks or constellations, and individual small satellites requiring polar orbits.

Until recently, most applications of satellite technology required geostationary spacecraft in equatorial orbits, especially in the area of telecommunications. Geostationary satellites are generally large spacecraft (weighing thousands of kilograms and costing in the hundreds of millions of dollars) that orbit around the equator 35,900 km (22,300 miles) from the earth. These satellites in equatorial orbits provide continuous coverage over a fixed region on the earth's surface. Small satellites, on the other hand, weighing less than 900 kg (2000 lbs) and usually costing less than $25 million apiece, comprise constellations in polar low earth orbits only hundreds of kilometers from the surface of the earth. In comparison, constellation systems can provide continuous global coverage. Since these small satellites in low and medium earth orbits demand less power from their ground stations, this system is more attractive for certain applications such as global positioning, messaging, and mobile communications.

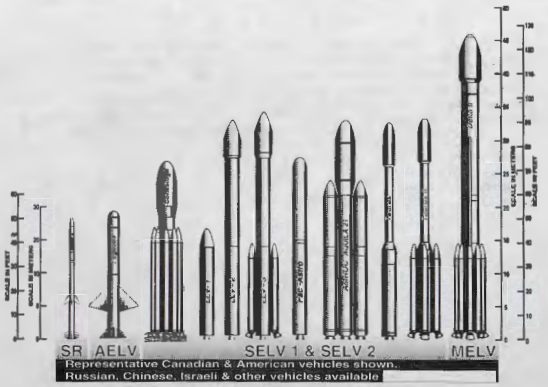
A listing of proposed satellite constellations that are currently in the design and development cycle appears below.

Proposed System	No. of Sats	First Launch	Operator	Manufacturer	Purpose	Project Status	Payload Mass(lbs)	Proposed Vehicle	Orbit Incln.
ARTES	na	1995	ESA	na	Data & Location	Proposed	550	na	na
Arlas	48	1995	Constellation Comm. Corp.	Defense Systems Inc	Voice & Data	Design/ Dev	400	Orbex	polar
Calling (Iridium)	840+	1998	Calling Comm. Corp.	na	Voice & Data	Proposed	1650	na	na
Courier	60	1994	Moscow Inst. of Thermotech	NPO Elkon Asaos,ECAS	Voice & Data	Design/ Dev	na	START	na
Ellipso	14-18	1997	Ellipsat Corp.	Fairchild	Voice & Data	Design/ Dev	500-700	na	63 deg
Globalstar	48	1996	Loral Qualcomm	Space Systems/Loral	Voice & Data	Design/ Dev	770	na	52 deg
Iridium	66	1996	Iridium Inc.	Lockheed	Voice & Data	Design/ Dev	1575	Delta LM,Proton	polar
KITcom	9	1996	KITcom Pty.	na	Data	Proposed	na	PA-2	na
Leo One	36	1995	Leo One Panamericana	Defense Systems Inc	Data	Design/ Dev	350	Russian TBA	80 deg
Odyssey	12	1997	TRW	TRW	Voice & Data	Design/ Dev	2500	na	na
Orbcomm	36	1994	OSC	OSC	Data & Location	Design/ Dev	87	Pegasus	40 deg & polar
Signal	48	na	Russia/CIS	NPO Energia	na	proposed	na	Russian	na
Smolsat	36	1994	Smolsat	NPO Prikachol	Data	Design/ Dev	550	Cyclone	na
Starnet	24	1995	Starsys	Defense Systems Inc	Data & Location	Design/ Dev	na	na	60 deg
TAOS	12	1995	CNES	Aerospatiale	Data & Location	Proposed	330	na	57 deg

Source: KMPG Peat Marwick and DOT 1993
na: not available at the time of writing

Truly Global Demand

Based on a general consensus of industry forecasters, Akjuit believes that the present level of world demand for small satellites will increase dramatically worldwide. The vast majority of these satellites will require a site that can achieve polar orbits. As to sounding rockets, world demand is expected to rise significantly with a continuing growth into the next decade. Although the bulk of demand for small satellites initially is expected to come from US satellite constellations launched primarily by US vehicles, Akjuit management believes that the SpacePort will function in much the same way as any major international commercial airport operates today - open to customers worldwide. Potential launch customers include several of the major US aerospace companies, as well as governments and private interests in France, Spain, Italy, Japan, Russia, Ukraine, Canada, Brazil, India, Israel, China and Australia. There are also several countries with strong sounding rocket programs including the US, Norway, Sweden, Britain, Germany, France, Japan, and Canada, as well as developing countries entering the scientific research arena.



Competitive Costs Are the Key

While respect for the environment and for the local communities boost public acceptability of ***SpacePort Canada***, the most important message that Akjuit must transmit to potential users is the cost benefit of the project. The bottom line, of course, is that satellite and launch vehicle manufacturers will go where there is assurance of a successful mission and where the price is most competitive. The costs at ***SpacePort Canada*** will easily compete with those at other sites.

The cost of using ***SpacePort Canada*** can be divided into three categories. The most obvious of these are the direct launch costs. The other two are the hidden costs and the intangible costs. The for-

mer encompasses environmental assessments, range safety analysis, insurance, launch permits and other incidentals. The latter reflects the advantages of using ***SpacePort Canada*** relative to other potential launch sites. Factors such as the use of well understood business practices in managing SpacePort operations and streamlined government approvals of licences and permits are enormous intangible benefits.

Ahead of the Competition

Akjuit Aerospace is not alone in having identified a market requirement for a polar launch site to support the small satellite industry. There is competition. This is especially relevant, as there is unlikely to be room for more than one successful commercial spaceport in the near future, and almost certainly no room for more than two within North America even over the medium to longer term.

For a commercial spaceport to be successful, it must be able to satisfy a unique and demanding range of criteria: safe operational area, favourable weather, easy access, a transportation infrastructure, environmentally licensed, a streamlined launch permit process, as well as being cost effective.

Based on these criteria, Akjuit believes that ***SpacePort Canada*** is well ahead of the competition. This belief has already been endorsed by several potential customers who have analyzed the potential launch sites and acknowledged that Akjuit is years ahead of its competitors.

Conclusion

Competitively priced, the ***SpacePort Canada*** site in northern Manitoba, with its excellent geographical location and weather conditions, is ideally suited for polar and high inclination orbital launches. Moreover, Canada's strategic and economic neutrality, exceptional existing infrastructure, Churchill's local support and Akjuit Aerospace's sensitive concern for the environment, will mean a stable and cooperative atmosphere for a launch site with easy accessibility and year round launching.

Akjuit Aerospace is at the cutting edge of the revolution in space transportation technology, and responsive to the rapidly emerging small satellite industry. Akjuit encourages the international space and telecommunications industries to join them as the world enters the commercial space market through ***SpacePort Canada*** -

Canada's international space development
with an abundance of
"Space for Business"