

Canadian Aerospace Flight Test Area and Runway Needs -- for Higher Risk Commercial Experimental Aircraft and Spacecraft Development

DreamSpace™ Group
Aerospace Review Submission

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Company Background – The DreamSpace™ Group foundations go back to 1996 with the founding of the da Vinci Project, an all volunteer effort to build and fly a 3 person suborbital spacecraft in the XPRIZE Competition. The Groups founder, Brian Feeney has over 30 years of direct aerospace business and design experience. He is a founding member of the Canadian Space Commerce Association and a past two term director.

Introduction - The Century of UAV's, SST's and Spacecraft – The recommendations in this proposal cover the flight test side of the Canadian Aerospace Industry from from Unmanned Aerial Systems also known as UAS, UAV's, UCAV's (combat military), commercial supersonic aircraft including UAS variations, suborbital spacecraft and in the longer term, evolved orbital spacecraft. The common link to all of these aircraft, spacecraft types is their initial through development phases of higher to very high risk flight testing. This results in a general need for:

- large range safety areas.
- Long main runways with even longer pre and post runway runoff areas.
- Unlimited altitude to space flight corridors for suborbital spaceflight testing.
- Horizontal supersonic flight corridors.
- Unfettered runway / airport access for testing, logistics support, moving personnel in / out by air. Given the competitive commercial nature of the industry, 24 / 7 access is essential to a test range and its supporting runway / airport.
- Depending on the location and nature of the test area, annual prior approved accessed may be put in place for the benefit and safety of all participants.
- The ability to "make noise" 24 / 7 typical of military fighter aircraft and rocket engine based flights that would exceed normal airport standards.
- Government flight approval for long block periods of time.

The main focus is on runway capable designs though the "Flight Test Area" should not

preclude the testing of ballistic flight profile rocket designs.

Current Flight Test Areas in Canada – Canada has a few flight test locations. For UAS there are two locations in Alberta and one each in Quebec and in Manitoba. In Alberta there is the Foremost location with a 3,000 Ft runway. CFB Suffield Airport in Alberta has a very short runway of less than 1,000 feet though it was once longer and has expansion potential. It is on the south west corner of CFB Suffield which is the largest Canadian Forces Base and training range. It offers potential for expanded testing and is discussed further below. The UAS Centre of Excellence is located at Alma airport in Quebec and has a 5,000 Ft runway. The Manitoba location is a small private grass strip for UAS testing.

For manned aircraft, flight testing does take place at various airport locations across Canada. First flight tests have occurred at numerous airports including North Bay and London Airports in Ontario both noted for their 10,000 and 8,800 Ft runways respectively. Depending on the nature of the new design and risk assessment, many airports may be suitable. One example is Brampton Airport in Ontario with a 3,500 Ft runway, which has had many first flights of home build experimental aircraft. The Canadian Military has a very well known and established flight test Center at CFB Cold Lake.

The Needs are Necessitated by the Rapidly Evolving Market – Why does Canada need another flight test area? The current locations while suitable up until now, do not address the rapidly evolving new markets for much larger and faster UAS vehicles, corporate Super Sonic business aircraft and manned suborbital spacecraft for scientific payload research, secondary payloads air launched to orbit and space tourism vehicle flight testing.

These new era of flight vehicles require much larger range safety envelopes than is available at current airport locations. They also require much longer runways. While an SST or winged suborbital spacecraft may be built for a balanced field length of 6000 Ft, flight test safety necessitates runways lengths of at least 12,000 Ft at sea level equivalent, a preference for wider than normal widths in excess of 200 feet and total pre-runway and runoff area lengths of double to triple the base runway i.e. 24,000 to 36,000 feet gross runway length. The base runway may be conventional paved construction while the pre and post runoff areas may be compacted ground and or gravel as per military engineering specifications.

Many new designs, especially UAS and suborbital spacecraft incorporate full craft emergency parachute recovery systems. This necessitates that the general flight test area geography be as flat as is available and the absolute minimum of structures and trees i.e. no forests. The flight vehicle category described is High Risk. Off airport landings while not frequent, will happen. The contemporary approach to aircraft development is to save not only the test pilot(s), if on board, but also the flight hardware itself with minimum damage. This makes for a far more cost effective development program, assessment of why the flight vehicle and or crew failure occurred without loss of hardware and overall greater safety.

The market for UAS vehicles is expanding at a very rapid rate for all classes of commercial and military aircraft worldwide. The current annual market is approximately \$6 billion dollars in size for 2011 and is expected to rise to approximately \$10 billion

dollars per year by 2018 - Ref. Market Study by The Teal Group.

Corporate Super Sonic Business Jets have been under development by all major airframe manufacturers for the past decade. The initial maturing of this market is expected to take place prior to 2020. Gulfstream Aerospace, Dassault Aircraft have announced development programs and Boeing and Lockheed are expected to announce programs at this years Farnborough Airshow. At \$100 million plus each it will be a very large value added market.

The suborbital spacecraft industry is in the mid term of its development. Serious work on commercial vehicles began immediately following the winning of the XPRIZE Competition in 2004. Leading US companies are Virgin Galactic working with Scaled Composites and XCOR all basing their development out of Mojave Airport in California. Blue Origin is another US company with a flight test area based in Texas. They satisfied their needs by purchasing some 284,000 acres of scrub ranch land!

A brief word on the suborbital space tourism market which is slated to begin sometime in 2014 with the first paying passenger flights. The purposes of this document is not to prove this market but only to give an indication of its sizable potential based on actual seat sales to date. Virgin Galactic has pre-sold just under 500 seats at US \$200,000 each - source Virgin Galactic press releases and interviews. XCOR has pre-sold 175 seats at \$95,000 each - source June 11, 2012 spacenews.com. Armadillo Aerospace and their partner Space Adventures have pre-sold a similar number of seats - 175 at \$110,000 per seat - source Space Adventures and various online news sites.

The aggregate dollar sales volume to date totals over US \$135 million. While absolute flight seat volume seems low, one has to consider the infancy of this emerging industry, first commercial flights are still about two or less years away. The price point with competition will drop in the coming years which will cause the volumes to grow substantially. Within a decade it is expected to be about equivalent to a first class seat on an A380 from London or New York to Sydney (\$20,000 to 25,000), increasing the once in a life time flight experience to several tens millions of people.

Foreign Flight Test Areas – There are really not too many locations available worldwide for high risk flight testing. Many are controlled by various militaries with a very limited to no access policy.

In the US the most notable location is the Mojave Air and Spaceport (formerly just Mojave Airport) in California. It is notable as it is an FAA approved spaceport for suborbital flights. They have invested in the airport with a main runway extension to 12,500 feet. With the exception of the very small town of Mojave adjacent to the airport, it is ideally located in a flat desert area in close proximity to the Edwards Airforce Base, Rogers dry lake with several supersonic flight corridors, unlimited ceiling and closed areas for super sonic flight and or high risk flight testing.

Roswell New Mexico Airport and its 12,500 Ft runway has been used by many companies including Gulfstream Aerospace for conventional aircraft flight testing.

Australia has one of the most attractive locations near Adelaide known as the Woomera Range with a closed airport (available to test flight operations) with an 7,782 Ft runway with long runoff areas, generally flat / scrub off airport geography. It attracts test flights

and rocket launches from all over the world. They are currently averaging 9 rocket test flights per day! The Australian government is investing over \$100 million dollars in improving the test range facilities, tracking radar, communications systems etc.

Why Not Test fly in the United States - in a word - ITAR. The types of vehicles under discussion are heavily ITAR controlled. This means that US citizens cannot participate in their development which would include flight testing as that would result in the transfer of flight test data at a minimum which is ITAR controlled. A flight test center / location for a company is not a part time effort. There needs to be the allowance for a long term commitment to maximize the benefits of the product development cycle. This would necessitate the highering of US citizens.

One can do this, however the craft under development would then fall under ITAR export controls. Notwithstanding the very high cost of running an ITAR based program which is out of reach for small companies, the ITAR control will slow and would limit exports of the flight hardware. All of the New Space Companies in the US including Virgin Galactic (Scaled Composites), XCOR, SpaceX etc do not allow non US citizens as employees for the opposite reasons of excess cost due to ITAR should they have a Non US citizen on staff. Further export controls are so tight that XCOR is only able to do wet leases on its sub orbital flight hardware to foreign companies with only XCOR employees allowed to service and fly the spacecraft. A further example of ITAR restrictions can be seen with Virgin Galactic not being allowed to sell flight seats on its sub orbital spacecraft to Chinese citizens as they may be able to see ITAR controlled hardware, subsystems?? Virgin Galactic is not a US company per se but their US subsidiary that builds the flight hardware is.

For a Canadian enterprise that wants to operate globally, an ITAR controlled program is simply not a feasible option with its severe limits, the need for flexibility and speed to enter foreign markets. One can operate foreign made flight hardware in the US and or sell to American interests. The In-door is always open. Another way to look at it is the sizable competitive advantage of a non NON - ITAR based program having the benefits of all worlds.

Canadian Companies in these emerging markets - Several Canadian companies have entered the UAS market the most notable of which are Diamond Aircraft of London Ontario, CAE amongst many others. It is also known that at least one Canadian company is engaged in the development of a larger UAV and UCAV both subsonic and supersonic with a Supersonic Business Jet variant. Specific Bombardier Supersonic Business Jet plans are unknown at this time though their competition may lead one to a conclusion of, "its somewhere in the pipeline". There is also a manned suborbital spacecraft under design development that utilizes a runway for departure and landing.

Specific Canadian Test Flight Range Opportunities - The author has assessed several potential sites across the country. The most notable is the Suffield Base / Range in South Eastern Alberta. It is proposed that as a first step the Suffield airport have a substantially lengthened runway to support near term test flight operations. Three cautions to note though are the facilities right beside the runway that pose a safety hazard to ground personnel for a high risk flight. The second one is geographic in terms of runway length. There appears on Google Earth views to be an obstruction, possibly an oil pumping rig that would limit runway length and or the runoff area. The third has to do with security especially as it pertains to any military vehicle flight testing. The airport

is very close to a major highway. This is also a commercial concern.

A second option is to situate a new runway at the south end of the Suffield Range. The land appears to be relatively flat. There are long stretches of track roads tens of kms in length one of which may be taken over as a runway. This may bring down the cost at least in terms of pre and post runoff areas that may only need modest grooming and compacting. The south end of the Suffield Range has an existing flight corridor closed all the way to space in addition to various other air space closed at other times of the year. Given the existing nature of the range, noise would not be an issue.

Initially minimum facilities could be built, a general hangar with basic communications and tracking equipment. Investment in the facility could grow according to user needs and economic assessment.

There may be other potential location across Canada, though the author has not been able to identify one that meets as much of the criteria as Suffield. Southern Ontario has much to offer with its generally open farm lands and personnel, aerospace manufacturing support base etc. However the population density is too high. As noted earlier the London Airport already supports first flight testing. Diamond Aircraft is based at London Airport and flew their new jet there for the first time. It also has Canada's only commercial flight test center school to provide flight test services and support. The airport is open 24/7 and it is a base for the Jet Aircraft Museum which fly's older Canadian Forces fighter aircraft - noise allowance.

There may also be an opportunity at the large Meaford Test grounds adjacent to the southern end of Georgian Bay.

The existing test flight range at CFB Cold Lake is potentially viable, however while the airport is generally surrounded by open farm land, almost the entire range is over forested areas. Nevertheless it may be suitable for supersonic UAS and SST flight testing in the latter stages of a flight test program. The one element that may be a stumbling block is the general hesitation on the part of the military to allow routine 24 / 7 access to a base including flying in personnel etc. This may be surmountable as has been accomplished both in Woomera Australia which is under the RAAF and RAF Boscombe Down airfield which is the United Kingdoms main flight test center.

It should be noted that initial test flying over water is an absolute non starter for a host of safety and cost reasons.

What this means to Canada - Choosing to build a commercial multi purpose high risk test flight facility would be in part catching up to the present two commercial leaders, namely Mojave Airport in the United States and Woomera Airport in Australia as well as stepping ahead of the competition by building a world class facility to not only support Canadian companies but also to attract foreign enterprises to both test and possibly establish manufacturing operations.

The 21st Century is seeing the opening of space from commercial manned suborbital and soon to be orbital flights too the already world wide rapid expansion of the use of Unmanned Aircraft. Quiet SST's initially at the corporate jet level followed by their return to commercial service will form a new and strong additional market sector. These and other flight opportunities will see a sizable increase in the Aerospace Manufacturing

Industry as we find more ways to take flight both in the atmosphere and off planet. Canada has the opportunity to take a lead position, supporting its own Aerospace Industry and emerging small companies while attracting foreign companies to settle here.