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PROJECT DESCRIPTION

CANSO, NOVA SCOTIA PROSPECTIVE LAUNCH SITE

NOVEMBER 2016

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1.0 INTRODUCTION

Maritime Launch Services Ltd (MLS) was formed in Nova Scotia, Canada in October 2016 with the intention of bringing together the necessary skills, assets, launch vehicle technology and infrastructure to serve the burgeoning commercial space needs for satellites. We will leverage from the highly reliable and proven launch vehicles manufactured by Yuzhnoye SDO in Ukraine to bring their latest model Cyclone 4M to the North American market. The Cyclone 4M occupies an underserved market segment which offers the most efficient lift capacity to address developing launch industry requirements. Constellation launch requirements dictate an optimum number of spacecraft be launched together. Both larger and smaller vehicle classes do not offer the most efficient mass utilization. The Cyclone 4M provided under the MLS launch services and launched to a polar and/or sunsynchronous orbit from Canso, Nova Scotia will serve that market.

<u>Proponent - Maritime Launch Services Ltd, CRA business number 745704528</u>

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<u>Proposed Launch Site Location</u>

The launch site location being considered is within the Guysborough Municipality of Nova Scotia near the town of Canso and on a section of Crown land designated by PID 35096320 (Figures 1 and 2). The spaceport development area footprint is a narrow strip of land totaling approximately 40 acres out of the 2,400 acres within the Crown land PID. The spaceport development area consists of a launch vehicle processing/launch control area and a launch pad that are connected by a transportation route. Access to the land is expected to coincide, in part, with the access road to the Sable Wind Farm (Figure 3). Figure 4 depicts the proposed layout on the Department of Natural Resources wetland map for the area. Figures 5 and 6 are aerial photos of the proposed development area. Defining the footprint proposed consisted of:

- Locating a remote coastal area with clear access downrange to the desired orbit
- Keeping it as far away from any communities as possible and yet close enough to facilitate operational logistics and access to power, water, etc..
- Having nearby multimodal transportation including seaports for launch vehicle delivery
- Separating the launch pad and the launch vehicle processing facility/control center
- Avoiding environmentally sensitive areas such as wetlands or endangered flora and fauna

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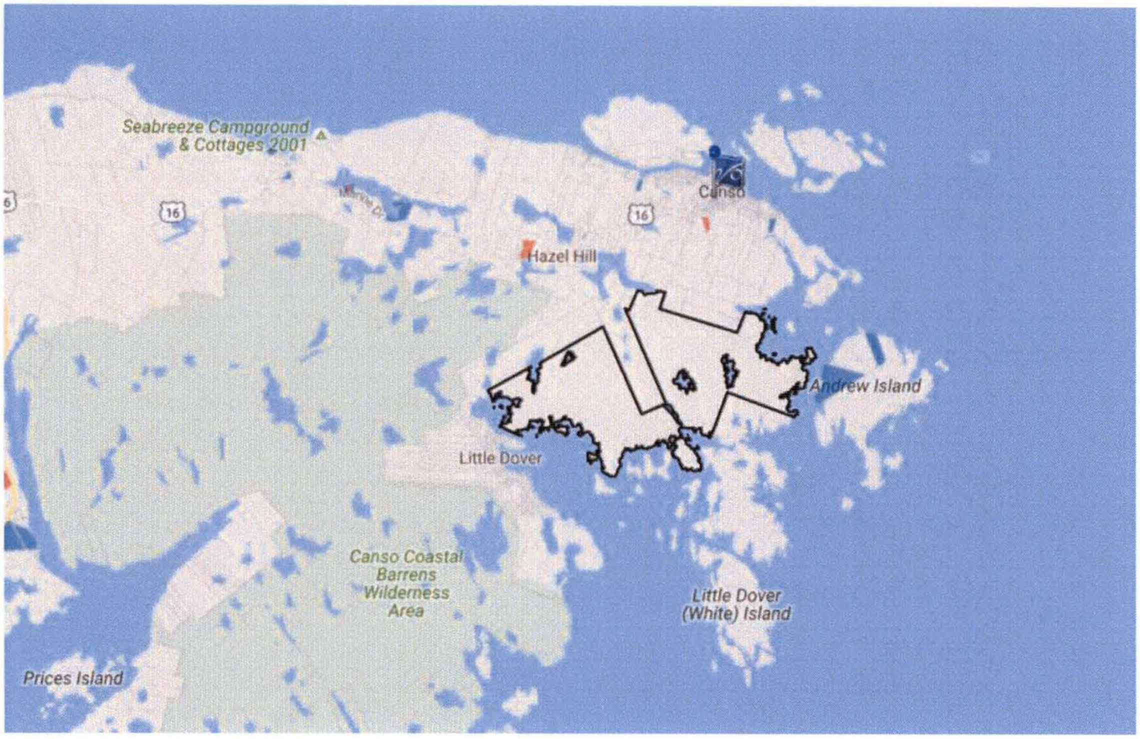

Figure 1 Crown Land Near Canso - PID 35096320

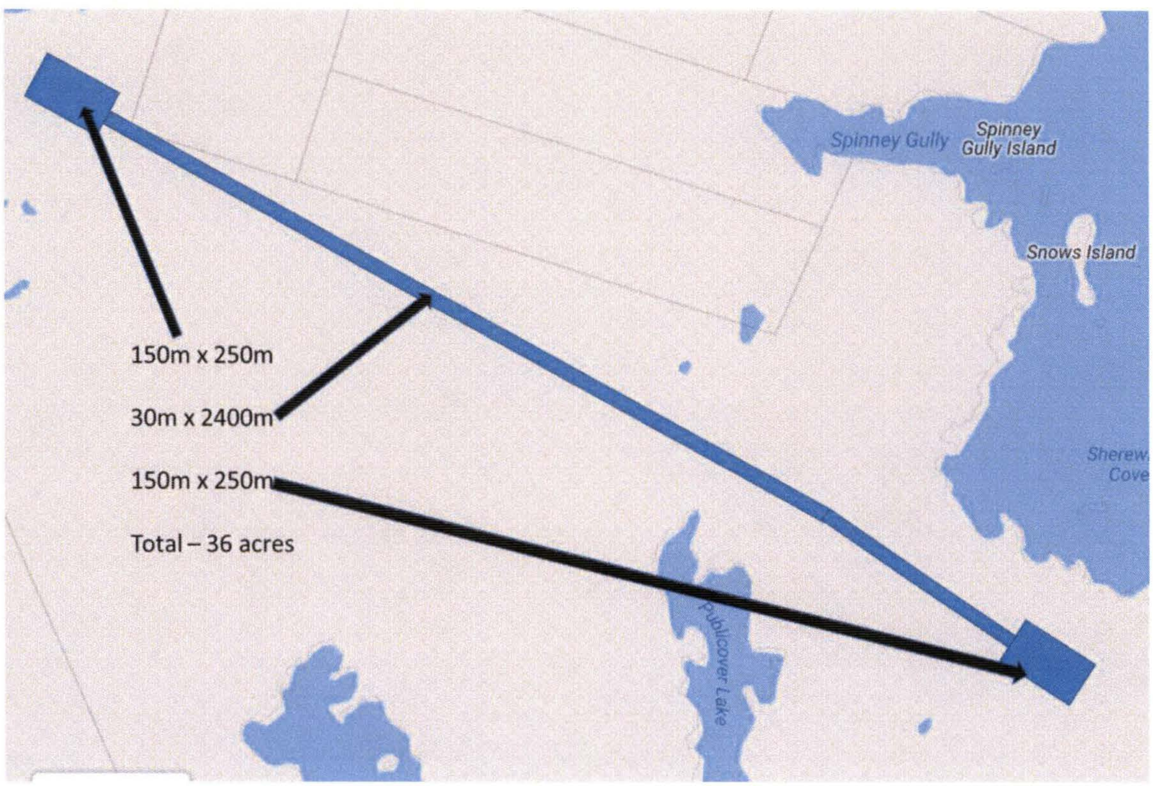

Figure 2 Spaceport Project Area Footprint

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Figure 3 Spaceport Development Area on Google Earth

DNR Wetland Map

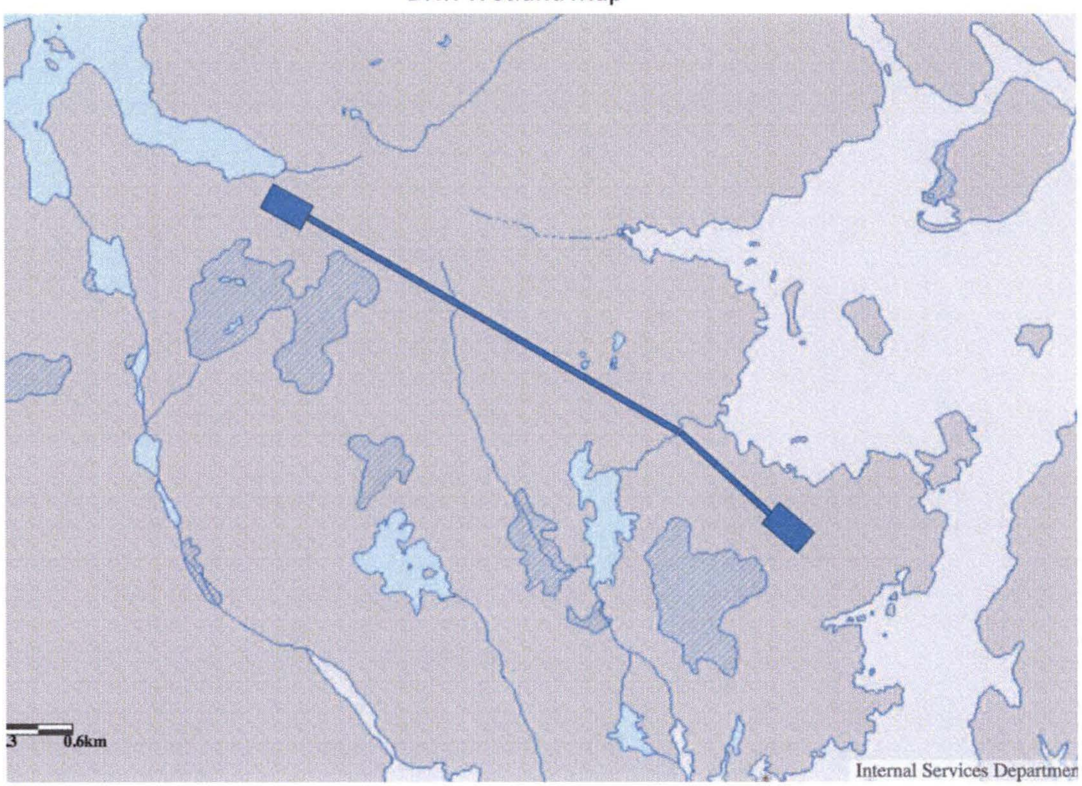

Figure 4 Project Area Layover on DNR Wetland Map

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Figure 5 Aerial View of Proposed Spaceport Location Looking Northwest

Figure 6 Aerial View of Proosed Spaceport Location Looking South

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2.0 PURPOSE AND NEED

Maritime Launch Service Ltd (MLS) proposes to construct and operate a private commercial space launch site for the purpose of establishing a commercially-controlled, commercially-managed, launch site that would provide launch site options in North America other than US Federal installations/ranges in the US, in support of the commercial space transportation industry.

The Proposed Action would allow MLS to offer the commercial space launch site for medium class orbital rockets designed and developed by Yuzhnoye SDO in Ukraine. The location proposed is from a point near Canso, Nova Scotia and is one that can achieve a polar and/or sun synchronous trajectory. The proposed commercial space launch site near Canso would:

- Serve the robust market for space transportation services to promote and enable private sector science and exploration missions;
- Enable a stronger, more competitive commercial space transportation industry;
- Sustain Yuzhnoye's 60 year leadership and innovation in space launch activities though partnering with the MLS and build on the strong relationship between Canada and Ukraine;
- Provide significant positive economic impact to the community and province hosting the launch site in terms of long term engineering and technician employment, infrastructure improvements, and tourism; and
- Improve Nova Scotia's attractiveness to the existing and evolving commercial space industry markets, resulting in new economic development opportunities and high-tech job creation.

The teamed effort between MLS, Yuzhnoye and Nova Scotia augers for a space launch program conceived and timed to capitalize on the new opportunities in space. The global space industry is on the cusp of major change, one characterized by more frequent launches of smaller, short-lived, satellites, many of which will go into sun-synchronous polar orbits (Figure 7). The appetite for space-based services and information is growing asymptotically. This is especially true for internet-related developments and more precise information (agronomic, economic, meteorological, hydrological, etc.) about specific localities. Perhaps most important, space-based remote sensing is now much more dynamic, with information becoming more perishable and the demand for frequent resampling growing geometrically. Being able to support the new demands of the market will require low-cost solutions that can be rapidly tailored to individual customer preferences. Moving quickly will allow the MLS to capitalize on this market in the area of space craft design and construction, launch services, and engineering and expand those programs as they currently exist in Nova Scotia. Rapid establishment of a brand/reputation, within the context of the first Canadian spaceport initially and world-wide eventually, will cement the positioning of the Nova Scotia as a pathfinder model in the emerging scientific, economic, commercial, and strategic global relationships.

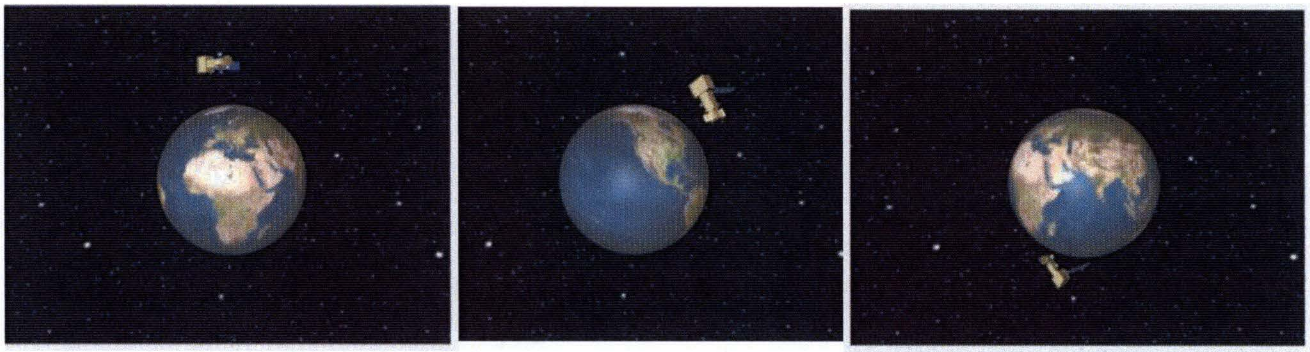

Figure 7 Polar Orbit Satellite Trajectory

Many countries, including Canada, have a need to develop satellites intended for low earth orbit for a range of applications as described above. As it stands today, there are very few launch locations globally that can serve this growing market and even fewer that serve the launch trajectory to a polar and sun-synchronous orbit. In most cases, they are restricted-use federal ranges, are expensive to launch from and are antiquated. The busniness plan developed for the prospective launch site near Canso shows a strong case for an extremely efficient, safe and cost-effective launch facility using the Yuzhnoye launch vehicles that will provide clients the orbital access needed.

2.1 PROPOSED ACTION

The Proposed Action is for Transport Canada to approve launches by MLS that would allow MLS to conduct launches of the C4M medium class orbital vertical launch vehicles from a private launch site on what is currently Nova Scotia Crown land within the Guysborough Municipality near Canso. From a purely Civil Aviation safety point of view, Canadian Aviation Regulation (CAR) 602.43 covers rocket launches. CAR 602.44 allows the Minister of Transort to issue an authorization for a rocket launch if it is in the public interest and is not likely to affect aviation safety. This authorization would likely take the form of a Special Flight Operating Certificate (SFOC). The Transport Canada Atlantic Region office would provide additional details and guidance related to an SFOC application, and would in turn consult with the Ministry headquarters to review the launch specific safety analysis. SFOCs are normally for a single event, like an air show. Depending on the frequency of launches, Transport Canada would assess the possibility of a standing SFOC that could cover recurring activities.

As part of the Proposed Action, MLS would construct a vehicle processing facility and vertical launch area (Figure 8) to support its launch activities. All on site facilities would be constructed through private funding, and on ~40 acres of currently undeveloped Crown land that would be purchased or leased by MLS. In addition, underground power and data lines and utilities would be installed in a new transportation route between the launch vehicle (LV) Processing Facility area to the vertical launch area.

Figure 8 Artists rendition of the Vehicle Processing Facility and Launch Pad

Proposed operations would consist of up to 8 launch operations per year as well as associated pre-flight activities such as mission rehearsals. All launches would be expected to have commercial payloads, including satellites or experimental payloads. All launch trajectories would be to the south over the Atlantic Ocean.

The Proposed Action must also meet safety, risk, and indemnification requirements as identified by Canadian regulatory authority. As part of the process, MLS also would need to coordinate with NavCanada to put in place Notice to Airmen for air traffic, the Coast Guard to put in place Notice to Mariners for sea traffic as well as with other international organizations along the launch trajectory.

2.1.1 Operational Activities

The Yuzhnoye C4M launch vehicle program is designed for minimal vehicle assembly and processing on the launch pad. The goal is to launch within a few days to several weeks of payload arrival at a launch site. The C4M is described below, as are the operational parameters for these vehicles.

2.1.1.1 Yuzhnoye C4M

The C4M is a two stage medium-lift class launch vehicle with a gross lift-off weight of approximately 272,000 kilograms (kg) with an approximate length of 40 meters. The C4M uses liquid oxygen (LOX) and highly refined kerosene, also known as rocket propellant-1 or refined petroleum-1 (RP-1), as propellants for its first stage and nitrogen tetroxide (N2O4) and unsymetrical dimethyl hydrazine (UDMH) as propellants for its upper stage to carry payloads into orbit. Figure 9 provides a depiction of the launch vehicle and specifications table.

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	1st stage	2nd stage
ILV launch mass (without PL), kg	259460	12583
Engines	4×RD870	RD861K
Propellants	LOX+Kerosene	NT+UDMH
Stage thrust: Earth/Vacuum, tf	317.6 / 353.8	- / 7.9
Thrust propellants reserves, kg	224800	10700
Stage diameter, m	3.9	3.98
Payload fairing diameter, m	4.0	
ILV length, m	38.9	
Performance: LEO, Hcr=200 km, i=45,3°, kg SSO, Hcr=700 km, kg	 5000 3350	

Figure 9 C4M Integrated launch Vehicle (ILV) and Specifications

2.1.1.2 Launch Vehicle Delivery

The C4M stages will be prepared for shipment in Ukraine, loaded aborar a RoRo (Roll On, Roll Off) vessel (Figure 10) and carried across the North Atlantic for delivery to the Port of Mulgrave (Figure 11) and then barged to the Port of Canso as regulated by Transport Canada Marine Security requirements.

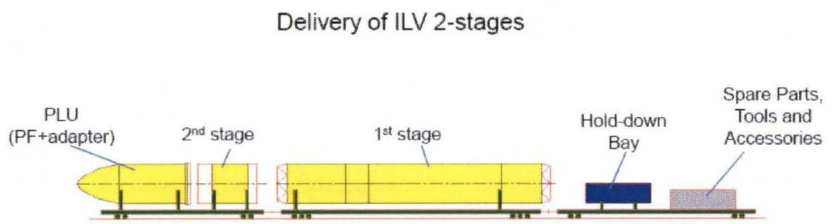

Figure 10 LV Transport Configuration

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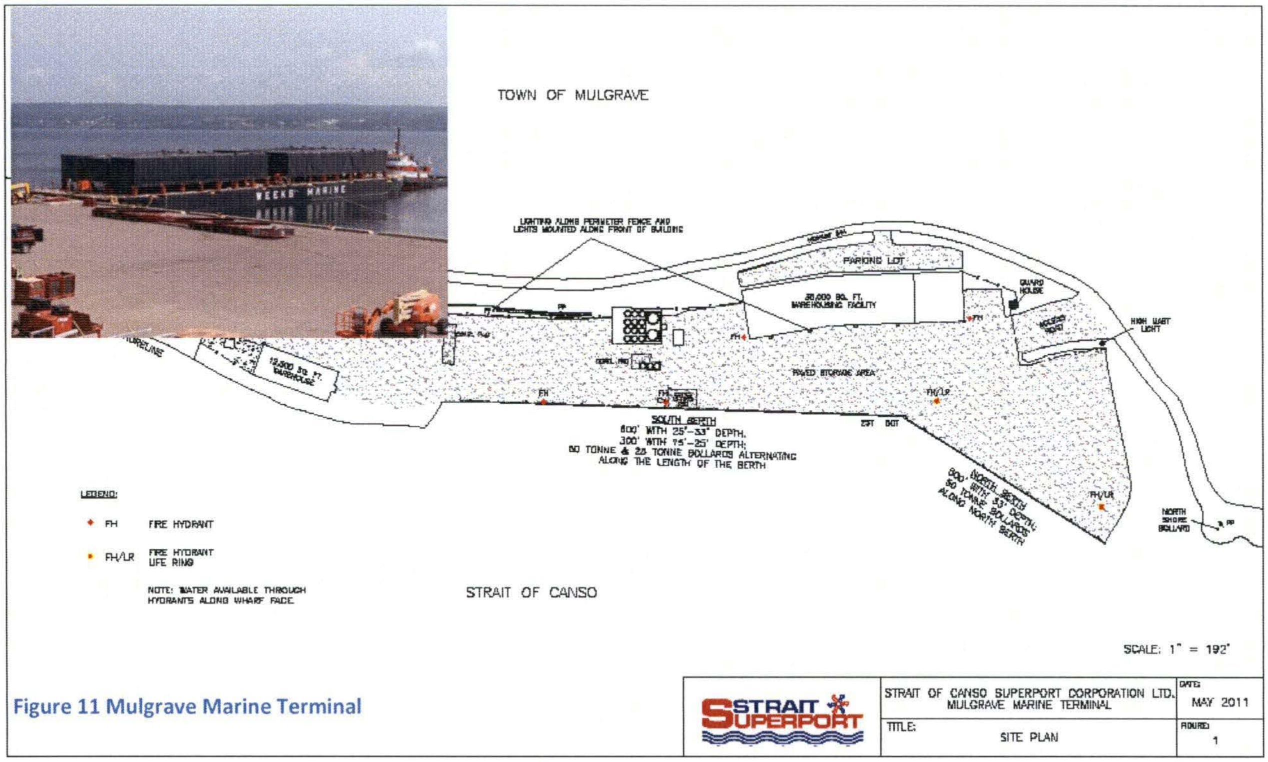

Figure 11 Mulgrave Marine Terminal

Payloads

The C4M would be expected to have payloads, including satellites or experimental payloads. Most payloads would be commercial; however, some could be Canadian Space Agency or Canadian Department of Defense payloads, or a Federal contribution to a commercial payload. This contribution can be monetary (e.g., funding a technology demonstration) or physical, such as providing a secondary payload/instrument.

Primary Payload Processing

MLS plans that primary commercial payload processing would occur at the control center/vehicle processing area. Primary payload processing activities include payload checkout, spacecraft propellant loading, and payload encapsulation in the fairing. Radiating, a common standard communication check before launch, of the payload would occur during processing. Once primary payload processing is completed, the payload would be transported to the vertical launch area prior to launch.

Most payloads would almost always include some additional propellants on board, either for orbit maintenance or orbital insertion burns. Payload propellants may include hypergolic fuels such as unsymmetrical dimethyl hydrazine (UDMH), monomethylhydrazine (MMH), and nitrogen tetroxide (NTO), as well as pressurized inert gases including helium and nitrogen, and some solid propellants. Hypergolic describes a propellant that ignites on contact with an oxidizer. UDMH, MMH, and NTO would be stored in the satellite fuels storage area for the satellite and at the launch pad for the launch vehicle upper stage. Inert gases helium and nitrogen would be required at both the vertical launch and LV processing/control center areas.

A small amount of ordnance, such as small explosive bolts and on-board batteries, would also typically be used and stored in the payload processing facility in the control center area. Any hazardous materials would be handled in accordance with Federal, Provincial, and local laws and regulations.

2.1.1.3 Integrated Launch Vehicle Transport to the Launch Pad

Ground transportation support during a launch campaign (preparation for and the actual launch event) would be minimal. This support would consist of a specialized transporter/erector that delivers the launch vehicle to the launch pad via a rail system as shown in Figures 12 and 13.

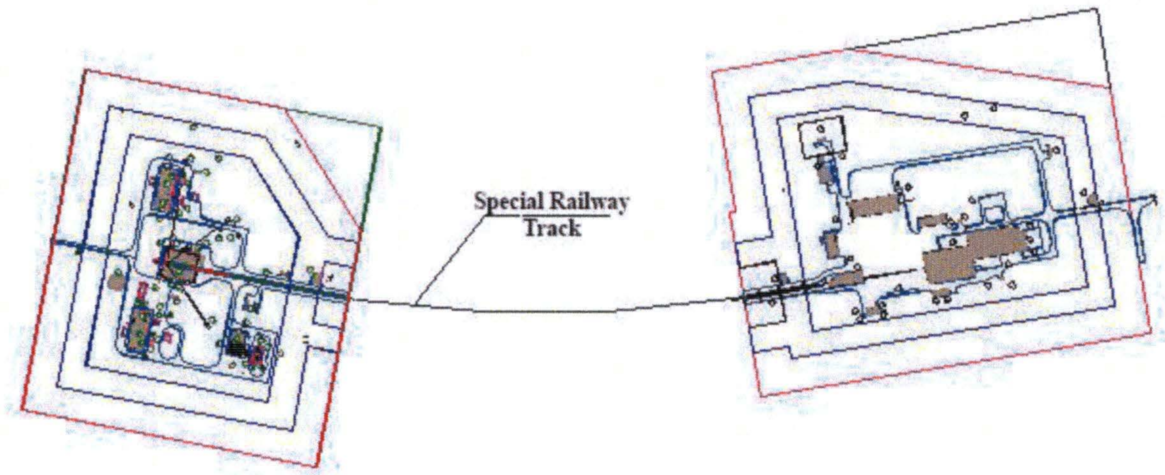

Figure 12 Special Railway Track between Processing Facility and Launch Pad

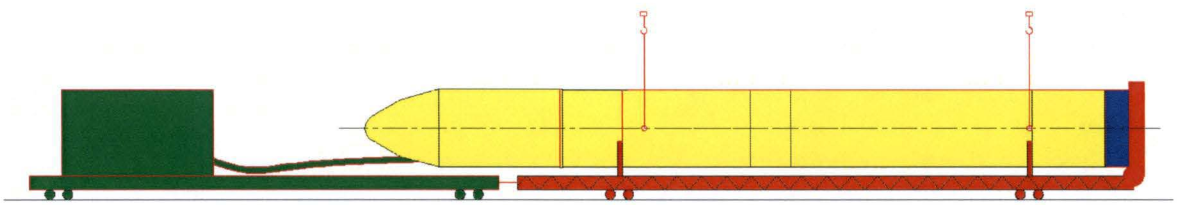

Figure 13 Launch Vehicle mounted on Transporter/Erector

2.1.1.4 Propellant, Gas, Fuel, Oil, and Solvent Storage

LOX and RP-1 used for the C4M first stage would be stored in dedicated propellant storage areas within the vertical launch area. The exact tank(s) dimensions are not known at this time; however, LOX storage would be 80,000 gal (~303,000 liters) total. Liquid Oxygen sources in Nova Scoita include Air Liquide in Dartmouth for bulk tanker truck delivery. Kerosene tank(s) would be 30,000 gal (~115,000 liters) total. Bulk kerosene sources include thr NARL Refining LP in Come By Chance, NL for sea vessel bulk delivery to Canso. NTO and UDMH used for the second stage of the C4M would be stored in decicated propellant storage area within the vertical launch area. Tankage specification are not known at this time; however,

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NTO storage would be 5,000 gal (~20,000 liters) total for up to three launches. Bulk NTO sources include the US, Europe and China. Tankage specification are not known at this time; however, UDMH storage would be 5,000 gal (~20,000 liters) total for up to three launches. Bulk UDMH sources include the US, Europe and China.

Helium would be used as a pressurant for the main tanks during flight. It would also be used as a purge during fueling operations and at engine start. Helium would be obtained from commercial sources via a tanker and would be stored in above ground storage tanks (high pressure tube banks). Approximately 200,000 liters of inert gaseous helium and nitrogen, respectively, would be stored at the vertical launch area. In addition, approximately 30,000 liters of helium storage and 90,000 liters of nitrogen storage would be required at the LV processing control center area. Typical storage of these gases would be six to eight tanks, approximately 1 m x 12 m each.

Payload fuel, UDMH, MMH, and NTO, would be stored for each mission only at the LV processing area. MLS does not intend to store bulk quantities of these propellants in large tanks at the LV processing area where the payloads are integrated. A typical storage tank for these types of propellants is 50 gal. These propellants would be stored in above ground storage tanks in the approximate 20 x 20 ft satellite propellant storage areas of the LV processing/control center area.

All tanks and containment systems would be cleaned, tested, and certified before first use; all tanks would be tested to the Transport Canada regulations, American Society of Mechanical Engineers (ASME) Section VIII Pressure Vessel Code requirements, or American Petroleum Institute storage tank requirements, as applicable. Permanent over-ground lines would be installed to connect both the LOX and the RP-1 storage areas to the launch pad. These piping systems would be designed, installed, and tested in accordance with ASME B31.3 Piping Code requirements.

First fueling of LOX and RP-1 would be done with quick disconnect fittings typically used in the aerospace industry. Gaseous nitrogen would be used on the system for cleanliness purges, and liquid nitrogen would be used for cooling purges on an as-needed basis. Gaseous nitrogen would be created from liquid nitrogen delivered to the site by commercial truck.

In addition, approximately 100 gal of isopropyl alcohol would be on site per launch operation for additional cleaning operations, though only 20 gal would be required for various cleaning operations during launch preparation. Solvent flushes would be performed during operation of the launch vehicle programs. Small volumes (less than 300 gal) of heavy gear oil, hydraulic oil, and cutting oil (less than 5 gal), and a limited supply of various solvents and adhesives would be stored in the shop areas or at the pad for general use in the maintenance of ground equipment. An oxygen/acetylene torch with its associated gases (carbon dioxide [CO_2] and argon) may also be used on a limited basis. Welding gases and supplies would be stored in 10 K-bottles each. Welding equipment would be maintained on site for occasional use. Approximately 10,000 gal of generator fuel (diesel/gasoline) would be stored at the vertical launch area.

2.1.1.5 Pre-Launch Activities

This section describes the activities that may be conducted leading up to an actual launch. Pre-launch activities would include mission rehearsals and coordination with governmental agencies and media outlets to provide notification of launch operations and establish secure areas in the vicinity of the vertical launch area. MLS will develop a Security Plan that will outline a process to prevent the public from accessing the area during hazardous operations.

Mission Rehearsals

The goal of mission rehearsals is to verify that all vehicle and ground systems are functioning properly, as well as to verify that all procedures are properly written. After final systems checkout, there would typically be a mission rehearsal without propellants on board (referred to as a dry dress rehearsal), followed by a mission rehearsal with propellants on the vehicle (referred to as a wet dress rehearsal) to verify full launch readiness. During a wet dress rehearsal, ground operators step through the flight procedures. The entire launch countdown is executed, with a pre-programmed abort just before the engine startup sequence, and before ignition. Two dress rehearsals (one dry and one wet within 32 days of launch) are typical in a launch preparation schedule to allow for team training and for coordination of activities between the mission-specific MLS crew and operations personnel.

Public Notification of Launch Operations

Launches and wet dress rehearsals would require restricting public access in the vicinity of the vertical launch area and securing land and water areas. These activities would require public notification.

At least two weeks in advance of a launch operation (i.e., actual launch or wet dress rehearsal), the Atlantic Region Office for Transport Canada and the Municipality of Guysborough would be notified of the proposed date, the expected closure times, and backup closure dates and times. MLS would post written notices of the date, time, and the proposed closure area in several businesses and local offices in the area and within the Municipality, as well as an advertisement in local newspapers. MLS would also coordinate with the FAA in the US with regard to launch activities. In addition, MLS would coordinate with the Coast Guard, NavCanada, and the provincial government of Nova Scotia and other potential stakeholders in order to ensure public safety and allow for the issuance of Notice to Mariners (NOTMAR) and Notice to Airmen (NOTAM).

Approximately 3-6 days prior to a launch operation that would require a closure, the public would be notified through local media and through the use of NOTMARs and NOTAMs.

Security Plan Implementation

15(1)(k)
18(1)(b)

[redacted]

15(1)(k)
18(1)(b)

[redacted]

[redacted]

15(1)(k)
18(1)(b)

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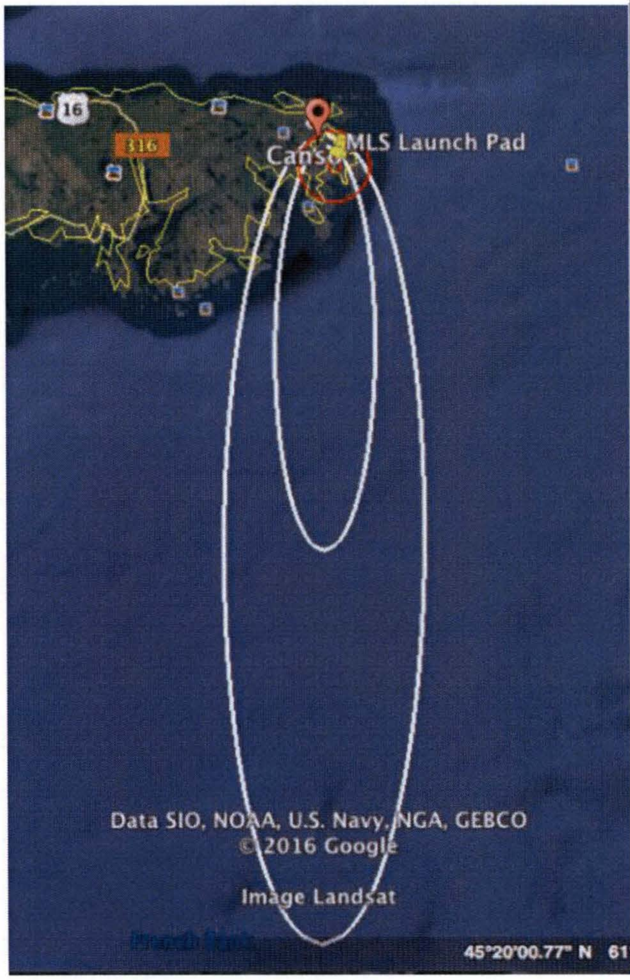
2.1.1.6 Nominal Trajectories

The majority of launches would be conducted between the hours of 7:00 a.m. and 12:00 p.m. MLS would conduct all launches, including pre-flight activities, and all launches would be coordinated with the Transort Canada and NavCanada. The C4M launch trajectory would be specific to each particular mission. However, all launches would be conducted to the south over the Atlantic Ocean, similar to what is depicted in Figure 16. The first depiction shows the 3 sigma safety zone for a polar/SSO trajectory south from the launch site. [redacted]

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)

As part of the permitting evaluation process, MLS and Transort Canada would conduct the appropriate reviews including a payload review, financial determination, and safety review. MLS would complete an Expected Casualty (E_c) Analysis and Flight Safety Analysis and Transport Canada would evaluate this analysis as part of the safety review to ensure the safety to the genral public. All approved trajectories would be based on specific launch vehicle performance and characteristics.



[redacted]

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

Figure 16 Planned SSO/Polar Trajectories

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2.1.1.7 Launch Failures

Although unlikely, a launch could fail. A launch vehicle failure on the launch pad represents the most substantial potential for impact. In the unlikely event of a launch failure, several scenarios are possible:

1. The entire launch vehicle, with onboard propellants, fails on the launch pad and an explosion occurs.
2. The entire launch vehicle, with onboard propellants, is consumed in a destruct action (refer to flight termination system below) during flight. The launch vehicle is largely consumed in the destruct action, but residual propellant escapes and vaporizes into an airborne cloud.
3. The launch is nominal through first and second stage burns and the payload reaches orbit but fails to deploy correctly.

The probability of any one of these scenarios is remote based on past performance. The performance history of Yuzhnoye's Cyclone 2 and 3 family of vehicles has a success rate of 98% over 208 mission with no first or second stage failures at all. Based on the proposed trajectories, if there were a failure of the first stage, the 3 sigma launch corridor (99.7% probability) shows that the launch vehicle would fall into the Atlantic Ocean, along with some scattered debris, on a trajectory due south from the launch site. MLS will produce a Ground Safety Analysis, which identifies each hazard, each associated cause, and each hazard control that will be established and maintained to keep each identified hazard from affecting the public. In the event of a launch failure on the pad, the debris impacts would be expected to be contained within an approved hazard area which for a fully fueled C4M rocket is less than 500 meters based on the US DoD Explosives Safety Manual 6055.

In terms of impact, for a nominal trajectory, there would be no overflight of populated areas. In the unlikely event of a launch failure during flight, the debris impacts would be expected to be contained within the approved launch corridor.

Flight Termination System

The launch vehicle would be equipped with an autonomous flight safety systems (AFSS) to command a destructive flight termination system, in the event the vehicle varied from the planned trajectory. The vehicle would break up and debris could land in the Atlantic Ocean.

2.1.1.8 Recovery Efforts

First Stage

After a launch, the first stage of the C4M would land in the Atlantic Ocean, [redacted] 15(1)(k) 18(1)(b)

Second Stage

The second stage would go into orbit with the payload. It would be left in orbit and safed per international standards, such as venting the vehicle and ensuring that the batteries would discharge.

2.1.2 Construction Activities

MLS plans to construct facilities, structures, and utility connections in order to support the launch of the C4M launch vehicles. The facilities would be located in two areas: a vertical launch area and launch vehicle processing/control center area. The command and control functions for a launch are required to be conducted at a safe separation distance from the actual launch pad, which is approximately 2.5 kilometers away. As a result, the proposed control center area is approximately 2.5 km west from the vertical launch area (Figures 2 and 3).

While the majority of the construction would occur during the day, small amounts of construction, such as pouring of concrete, could occur at night. All construction staging areas are planned to fall within the proposed project boundaries and no additional areas would be required for staging. The proposed schedule for all construction activities is an 18-month period from start to finish. Construction activities would not begin until after the environmental approval, DNR approval, Transport Canada approval and other required consultation and permitting requirements are complete.

2.1.2.1 Launch Facility Area

Proposed facility and infrastructure construction at the vertical launch area would include the following:

- Launch pad and stand with its associated flame duct
- Water tower
- Lightning protection towers (four total)
- Retention basin for deluge water
- Propellant storage and handling areas
- Workshop and office area
- Warehouse for parts storage
- Roads, parking areas, fencing, security, lighting, and utilities

The approximate 40-acre property proposed for lease by MLS, is located within the Crown land PID shown in Figure 1. The layout of the launch pad is designed to be a close to the ocean as possible and as far away from populated areas as possible so that as large a buffer as possible is available.

Development of the vertical launch area at this location would only occur in less than 10 acres of the entire 40-acre property. Construction at this location would generally involve placing fill material to elevate land levels high enough to avoid frequent flooding. Fill material would be sourced from on-site whenever possible. All on-site material would come from within the 10-acre project area. If necessary, additional clean fill material would be sourced from the local region. In addition, most of the larger facilities and those that must support heavy loads would be required to have pilings driven to support the facilities. The overall launch site layout is shown in Figure 17. The infrastructure list of facilities is shown in Figure 18.

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21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

[redacted]

Figure 17 Overall Launch Site Layout

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

[redacted]

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21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

[redacted]

Figure 18 LC Building Descriptions

Deluge Water System

One water tower would be installed at the vertical launch area for sound and vibration suppression. The water tower would contain at least 250,000 gal and would be approximately 250 ft high, which is required to provide sufficient pressure to the pad systems. During an actual launch, the water tower would discharge up to 100,000 gal of water for the C4M. During a launch, approximately half of the water would be vaporized. All water not vaporized would be contained in a retention basin underneath the pad. This water would then be sampled and analyzed to determine if the water contained controlled contaminants at levels that exceed water quality standards. Appropriate sampling protocols and water quality criteria would be developed in coordination with the environemnt department of Nova Scotia. Water containing contaminants that exceed the water quality criteria would be removed and hauled to an approved industrial wastewater treatment facility outside of the vertical launch area. All other water not containing prohibited chemicals would be pumped back to the water tower. All water (including deluge and potable water) would be either delivered by truck or withdrawn from a local source (well or lake) located adjacent to the water tower as approved by the provinvial authority.

Propellant and Inert Gas Storage and Handling Areas

The propellant and inert gas storage areas would include storage and handling equipment for the propellants and gases that fuel the launch vehicle. There are four primary areas: Oxidizer area, Fuel area, helium area, and nitrogen area.

Each area would include corrosion resistant storage tanks or vessels, including their supports and containment area where required; fluid pumps; gas vaporizers; and other components necessary to control flow to the launch vehicle. In addition, each area would include a concrete or asphalt parking area for delivery trucks for refill of the storage tanks

Access Roads and Infrastructure

A road and specialized LV transport rail are proposed to connect the launch site to the LV processing area. The roadway is planned as one lane in each direction with a shoulder that is asphalt paved. The rail line is strictly for the launch vehicle transporter/erector. The total width of the road and rail is approximately 30 meters wide by 2.4 km long for a total area of 18 acres. Under this transit route the utilities would be brought to the launch pad to provide access, power, and water to the facilities. The exact layout and area of required access roads would be determined by the final selected site layout and design that best avoids wetlands and and other sensitive areas; however, an estimation of the total parking and road area is approximately 1.5 acres. The combined parking areas of the vertical launch area would be designed to accommodate up to 100 personnel. The perimeter access road would be dirt/gravel. Throughout the area, there would be exterior lighting, security fences, and gates.

Utilities would include power, potable water, fire protection water, and a septic system. Primary power for the vertical launch area would be provided by commercial power from the LV processing/control center area to the vertical launch area. Power and data lines would be installed underground within the roadway/railway between the control center area and the vertical launch area. A total of approximately 1,000-3,000 kilowatts per hour (kW/hr) would be required by the vertical launch and control center areas during launch operations. Power needs will be brought in through the Sable Wind Farm control staion in Canso. Generator operations are expected to be used as emergency power sources that could be required at any time due to a power outage, and as supplemental power for use during the final stages of the launch schedule. It is anticipated that the generators could be used continuously for the final 48-hours prior to launch.

The site deluge water would also be used for fire protection. Potable water would either be delivered by truck to the water tower at the vertical launch area, or a well and water distribution lines would be installed within the boundaries of the vertical launch area to provide potable water to the area. The septic system could consist of a mobile above ground processing unit and holding tank, a standard below ground system or Alternative Treament Unit as permitted by the NS environment department.

Security

[redacted]

15(1)(k)
18(1)(b)

MLS

[redacted] 15(1)(k) 18(1)(b)

2.1.2.2 LV Processing/Control Center Area

The proposed LV processing/control center area would be located well outside any hazard zone from the launch pad and at the northeastern-most point of the Crown land PID. The proposed LV processing center general layout is shown in Figure 19. The LV processing facility serves to perform work with launch vehicle (LV) including LV elements acceptance, LV test and assembly, mating of payload unit and LV, performance of LV integrated test prior to transportation to launch pad, as well as work performance in case of launch cancellation (LV disassembly into elements, replacement of equipment, etc.). The LV facility building description is provided in Figure 20. Development of the LV processing/control center area at this location would only occur in less than 10 acres of the entire 40-acre property.

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

[redacted]

Figure 19 LV Processing Facility General Layout

[redacted]

[redacted]

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

Figure 20 LV Processing Facility Infrastructure

Launch Control Center Buildings

The one-story control center buildings would be approximately 1,400 m^2 and 10-15 M in height, and would be used for command and control of the launch vehicle, payload, and ground systems during launch and test operations. The control center building would consist primarily of several large rooms for control consoles, conference rooms, and support rooms. In addition, each facility would house office areas for site personnel.

Payload Processing Facilities

The payload processing facilities would be used to conduct final processing of payloads prior to integrating them with the launch vehicle. This processing would include final spacecraft checkouts, RF checks, payload fueling, and other activities as required. The facilities would be designed to support the processing of two payloads simultaneously, to allow for a better throughput.

RF Transmitter/Receiver

One or more antenna dishes would be required to receive data from the launch vehicle in flight, and to possibly communicate commands to the vehicle as needed. The most likely requirement would be for S-band reception. The antenna mounts would be approximately 8 m^2, and would be located within the site fence line in an optimal location for good reception. Antenna dishes would be no larger than 7 m in diameter and 8 m high.

Access Roads, Infrastructure, and Fencing

Similar to the vertical launch area, roads and utilities would be required to provide access, power, and water to the facilities within the LV processing/control center area. The exact layout and area of required access roads would be determined by the final selected site layout and design but will likely coincide with the current access road to the Sable Wind Farm for most of the portion of the access.

Roads would be constructed of asphalt. Throughout the area there would be exterior lighting, security fences, and gates.

Utilities would include power, potable water, fire protection water, and septic systems. Primary power for the control center area would be provided by the commercial power from the Sable Wind Farm substation in Canso. The specific requirements for the power lines and substation(s) necessary to meet the demands of the vertical launch and control center areas have not been developed.

Potable water would either be delivered by truck to holding tanks at the LV processing/control center area

2.1.3 Personnel Levels

[redacted]

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

Year	Full-time MLS Employees/Contractors Working On-Site	Full-time MLS Employees/Contractors plus Additional Local/Transient Workers during Launch Campaigns
2019	[redacted]	
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		

Figure 21 Project Employment Projections

2.1.4 Proposed construction and operation schedule

The first launch is currently planned for the Fall of 2019 based on the schedule for the spaceport development as shown in Figure 22. Following first launch, MLS will begin a launch pace that ramps up to an expected peak of 8 launches per year beginning in 2022.

21(1)(a)(ii)
21(1)(b)
21(1)(c)(i)
21(1)(c)(iii)

[redacted]

Figure 22 Spaceport Development Schedule with First Launch in Fall 2019