

## Comment Index

### Canso Spaceport Facility Project

Publication Date: June 4, 2019

**Government**

Number	Source	Date Received
1	Nova Scotia Environment – Industrial Management Unit	16 April 2019
2	Nova Scotia Transportation and Infrastructure Renewal	23 April 2019
3	Health Canada	18 April 2019
4	Fisheries and Oceans Canada	24 April 2019
5	Nova Scotia Department of Business	25 April 2019
6	Nova Scotia Environment – Air Quality Unit	13 May 2019
7	Nova Scotia Environment – Inspection, Compliance and Enforcement Unit	23 April 2019
8	Nova Scotia Department of Agriculture	26 April 2019
9	Nova Scotia Department of Fisheries and Aquaculture	26 April 2019
10	Nova Scotia Environment – Water Management Unit	29 April 2019
11	Nova Scotia Office of Aboriginal Affairs	29 April 2019
12	Nova Scotia Environment – Resource Management Unit	29 April 2019
13	Nova Scotia Environment – Environmental Health	29 April 2019
14	Nova Scotia Environment – Industrial Management Unit	29 April 2019
15	Nova Scotia Department of Lands and Forestry	29 April 2019
16	Department of National Defence	29 April 2019
17	Nova Scotia Environment – Water Management Unit	29 April 2019
18	Nova Scotia Environment – Inspection, Compliance and Enforcement Unit	30 April 2019
19	Nova Scotia Environment – Climate Change Division	30 April 2019
20	Canadian Environmental Assessment Agency	30 April 2019
21	Nova Scotia Business Inc.	30 April 2019
22	Nova Scotia Department of Municipal Affairs	29 April 2019
23	Nova Scotia Environment – Protected Areas and Ecosystems	29 April 2019
24	Transport Canada	26 April 2019
25	Nova Scotia Department of Communities, Culture and Heritage	2 May 2019
26	Environment and Climate Change Canada	29 April 2019

27	Nova Scotia Department of Energy and Mines	7 May 2019
28	Municipality of the District of Guysborough	21 March 2019
29	Municipality of the District of Guysborough	25 March 2019

#### **Independent Consultant**

<b>Number</b>	<b>Source</b>	<b>Date Received</b>
1	Anonymous	22 April 2019

#### **Public**

<b>Number</b>	<b>Source</b>	<b>Date Received</b>
1	Anonymous	19 March 2019
2	Anonymous	20 March 2019
3	Anonymous	20 March 2019
4	Anonymous	20 March 2019
5	Anonymous	20 March 2019
6	Anonymous	20 March 2019
7	Anonymous	20 March 2019
8	Anonymous	20 March 2019
9	Anonymous	20 March 2019
10	Anonymous	20 March 2019
11	Anonymous	20 March 2019
12	Anonymous	20 March 2019
13	Anonymous	20 March 2019
14	Anonymous	20 March 2019
15	Anonymous	20 March 2019
16	Anonymous	20 March 2019
17	Anonymous	20 March 2019
18	Anonymous	20 March 2019
19	Anonymous	20 March 2019
20	Anonymous	20 March 2019
21	Anonymous	21 March 2019
22	Anonymous	21 March 2019
23	Anonymous	21 March 2019
24	Anonymous	21 March 2019
25	Anonymous	21 March 2019

26	Anonymous	22 March 2019
27	Anonymous	22 March 2019
28	Anonymous	22 March 2019
29	Anonymous	22 March 2019
30	Anonymous	22 March 2019
31	Anonymous	22 March 2019
32	Anonymous	22 March 2019
33	Anonymous	22 March 2019
34	Anonymous	23 March 2019
35	Anonymous	23 March 2019
36	Anonymous	23 March 2019
37	Anonymous	24 March 2019
38	Anonymous	24 March 2019
39	Anonymous	24 March 2019
40	Anonymous	24 March 2019
41	Anonymous	24 March 2019
42	Anonymous	24 March 2019
43	Anonymous	25 March 2019
44	Anonymous	25 March 2019
45	Anonymous	25 March 2019
46	Anonymous	25 March 2019
47	Anonymous	30 March 2019
48	Anonymous	31 March 2019
49	Anonymous	1 April 2019
50	Anonymous	2 April 2019
51	Anonymous	2 April 2019
52	Anonymous	3 April 2019
53	Anonymous	3 April 2019
54	Anonymous	5 April 2019
55	Anonymous	6 April 2019
56	Anonymous	6 April 2019

57	Anonymous	7 April 2019
58	Anonymous	7 April 2019
59	Anonymous	8 April 2019
60	Anonymous	9 April 2019
61	Anonymous	9 April 2019
62	Anonymous	9 April 2019
63	Anonymous	9 April 2019
64	Anonymous	10 April 2019
65	Anonymous	10 April 2019
66	Anonymous	10 April 2019
67	Anonymous	11 April 2019
68	Anonymous	11 April 2019
69	Anonymous	11 April 2019
70	Anonymous	11 April 2019
71	Anonymous	12 April 2019
72	Anonymous	12 April 2019
73	Anonymous	12 April 2019
74	Anonymous	15 April 2019
75	Anonymous	9 April 2019
76	Anonymous	11 April 2019
77	Anonymous	15 April 2019
78	Anonymous	15 April 2019
79	Anonymous	15 April 2019
80	Anonymous	16 April 2019
81	Anonymous	17 April 2019
82	Anonymous	17 April 2019
83	Anonymous	15 April 2019
84	Anonymous	19 April 2019
85	Anonymous	19 April 2019
86	Anonymous	19 April 2019
87	Anonymous	19 April 2019
88	Anonymous	20 April 2019

## Environment

---

Date: 16 April 2019

To: Candace Quinn, Environmental Assessment Officer

From: Brent Baxter, P.Eng., Engineering Specialist, Industrial Management Unit

Subject: Canso Spaceport Facility Project

---

I have reviewed the Focus Report for Environmental Assessment provided by the proponent, Maritime Launch Services (MLS). I have focused on the areas dealing with storage and handling of petroleum products and other dangerous goods noted by MLS as being used for the project as currently proposed (primarily Section 3.0, Dangerous Goods Management, in the Responses to Focus Report).

The proponent has provided significant additional information on hydrazine and UDMH and justification for their continued use in this proposed project. This information, along with additional information on the qualifications of the individuals involved including corporate partners, would, in my opinion, indicate that the proponent is knowledgeable about these substances and is capable of storing and handling them in a manner that would protect the immediate environment at the proposed project site if the proper terms and conditions are included in any potential approval. It should be noted that my review does not extend to accidental or incidental releases from the launch vehicle after the launch has occurred.

There are, however, significant gaps in the information on how most dangerous goods will be stored on the proposed site, other than how they will arrive in approved shipping containers or transport vehicles. There are references to distances between incompatible materials such as fuels and oxidizers as well as projected quantities of these materials onsite at any time but there is no information on permanent onsite tankage, piping, secondary containment, spill monitoring or other environmental and safety controls. As well, helium and liquid nitrogen are not included in the table of dangerous goods although the report highlights that these substances will play a substantial role in the operation of the proposed program and large quantities will be stored onsite.

Information on transferring dangerous goods to and from the launch vehicles is also limited. For example, MLS proposes to use nitrogen to move fuel to or from the launch vehicle rather than the more conventional method of pumping but provides no details on how the proposed system will be designed and constructed to handle additional pressure and how the nitrogen will be vented safely to provide protection from release of excess fuel vapours into the environment. There is also no detail about handling

cryogenic materials like liquified oxygen (LOX) and the unique risks that must be accommodated. Information from other launch facilities notes that loading and unloading of cryogenic materials is time-sensitive and can have significant impacts, including destructive failure, on the safety of the launch vehicles if it is allowed to remain in the launch vehicles or associated systems longer than necessary.

It is my recommendation that these deficiencies be addressed by the proponent either through a request for additional information or as conditions of any potential environmental assessment approval. Please feel free to contact me if you require additional clarification on my comments.

**From:** [Colomb, Sylvie](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 23, 2019 3:54:43 PM

---

Hi Candace,

NSTIR staff have review this Focus Report and from a transportation perspective, there are no comments to provide for the Focus Report beyond what was commented on for the original EA.

Thank you for the opportunity to review this document.

Regards,

*Sylvie Colomb*

Environmental Analyst/French-language Services Coordinator  
Environmental Services Group  
Nova Scotia Transportation and Infrastructure Renewal Department  
Johnston Building, 3rd Floor, 1672 Granville Street, P.O. Box 186  
Halifax, Nova Scotia, B3J 2N2  
Phone: (902) 424-8143

Fax: (902) 424-7544

E-mail: [sylvie.colomb@novascotia.ca](mailto:sylvie.colomb@novascotia.ca)

**Please consider the environment before printing this e-mail. /**

***“A Healthy and Safe Environment: Everyone, Everywhere, Every day”***

---



Environmental Health Program  
Regulatory Operations and Enforcement Branch  
1505 Barrington Street, Suite 1625  
Halifax, NS B3J 3Y6

April 18, 2019

Candace Quinn  
Environmental Assessment Branch  
Nova Scotia Environment  
1903 Barrington Street  
Suite 2085  
PO Box 442  
Halifax, Nova Scotia, B3J 2P8

Subject: Health Canada's Response – Canso Spaceport Facility Environmental Assessment  
Focus Report Document<sup>1</sup>

---

Dear Candace:

Thank-you for your e-mail dated March 20<sup>th</sup>, 2019, requesting Health Canada's review of the above-mentioned Environmental Assessment (EA) Focus Report document<sup>1</sup> with respect to issues of relevance to human health. Since this is the first commercial spaceport to undergo an environmental review in Canada, we note that Health Canada has no past experience evaluating spaceport projects. Health Canada has reviewed the document and is providing the following information with respect to receptor location(s), noise, and air quality for your consideration. Health Canada previously provided comments on the registration document on August 3, 2018.

**Receptor Location(s):**

Table 11.2.1 of the Focus Report lists the distances between the launch site and processing complex to the nearest human receptors. The closest receptors are two fishing camps located (510 m) east of the proposed launch site (and 1300 m from the processing complex) on Crown land. In addition, there is a campground within 2150 m of the launch complex (1860 m from the processing complex) and the nearest residence is 3073 m from the launch site and 2210 m from the processing complex.

- The campground and fishing hut receptors are within a close proximity to either/both the launch pad and/or processing complex. In particular, the fishing huts are within 510 m of the launch site. Given that the fish hut owners are likely to continue to intermittently use these properties, Health Canada recommends that the Province confirm the agreement

---

<sup>1</sup> AECOM Stantec. 2019. Canso Spaceport Facility Focus Report. Prepared for Maritime Launch Services, March 2019.



between Maritime Launch Services (MLS) and the owners is clear as to when and how these locations will be accessible during the launch year.

## **Noise:**

### **Noise Model:**

Noise modelling information was discussed in Section 7.2 of the Focus Report. The report indicates that noise modeling was completed using a program known as *Launch Vehicle Acoustic Simulation Model* (RUMBLE) by the consultant Blue Ridge Research and Consulting, LLC (BRRC).

Section 7.2 of the Focus Report notes the model limitations:

*Their[BRRC's] modeling programs are designed to generate contours and figures, not traditional output sheets. The generated contours and figures from the modeling were incorporated into the original report that was provided with the EA*

- Although the RUMBLE model has no model output sheets, the various assumptions that went into the modelling (e.g. atmospheric conditions, wind direction, temperature, ground attenuation factor(s), topography assumptions, etc.) were not identified in the Focus Report. Given that there is no information in the report about the assumptions used in developing the contours and figures, Health Canada was unable to evaluate the results of the noise model.

## **Air Quality:**

### **Spill Emissions Model**

Section 6.0 of the Focus Report cites a 2011 report entitled *National Aeronautics and Space Administration (NASA) Environmental Assessment for Launch of NASA Routine Payloads at Cape Canaveral Air Force Station (CCAFS) and Kennedy Space Centre (KSC)*. This 2011 environmental assessment report uses a model known as the *US Air Force Toxic Chemical Dispersion Model (AFTOX) Version 4.0* to predict air dispersion concentrations of propellants during an accident event.

Section 6.0 of the Focus Report cites the (NASA, 2011)<sup>2</sup> environmental assessment for the maximum distance downwind that would require evacuation of the public in the Cape Canaveral Air Force Station and Kennedy Space Centre locations.

Table 6.3 of NASA (2011) outlines the mean hazard distances for the various propellant spills based on quantity, wind speed and time of day:

---

<sup>2</sup> NASA 2011. Final Environmental Assessment for Launch of NASA Routine Payloads. November 2011. Accessed at: <https://repository.library.noaa.gov/view/noaa/12540>

**Table 6.3. Mean Hazard Distances to SPEGL (1-Hr Average) Exposure Limits as Predicted by AFTOX for Payload Maximum Liquid Propellant Spills at CCAFS and KSC**

<b>Chemical (SPEGL)</b>	<b>Spill Quantity</b>	<b>Wind speed</b>	<b>Day (32°C [90°F])</b>	<b>Night (5°C [41°F])</b>
<i>Hydrazine (0.12 ppm)</i>	<i>1,000 kg (2,200 lb)</i>	<i>2 m/s (6.6 ft/s)</i>	<i>655 m (2,148 ft)</i>	<i>669 m (2,194 ft)</i>
		<i>10 m/s (33 ft/s)</i>	<i>1,493 m (4,897 ft)</i>	<i>747 m (2,450 ft)</i>
<i>MMH (0.26 ppm)</i>	<i>1,000 kg (2,200 lb)</i>	<i>2 m/s (6.6 ft/s)</i>	<i>641 m (2,102 ft)</i>	<i>769 m (2,522 ft)</i>
		<i>10 m/s (33 ft/s)</i>	<i>1,452 m (4,763 ft)</i>	<i>773 m (2,535 ft)</i>
<i>NTO (1.0 ppm)</i>	<i>1,200 kg (2,640 lb)</i>	<i>2 m/s (6.6 ft/s)</i>	<i>1,230 m (4,034.4 ft)</i>	<i>2,574 m (8,443 ft)</i>
		<i>10 m/s (33 ft/s)</i>	<i>5,680 m (18,630 ft)</i>	<i>3,411 m (11,188 ft)</i>

*Note: AFTOX predicts that NTO liquid spills would be gas releases at 32°C (90o F) ambient temperature. For modeling purposes, the gas release was assumed to have a duration of 5 minutes. In summary, all mean hazard distances for toxic air releases from payload accidents at CCAFS and KSC would be less than 5.7 km (3.4 mi) for the meteorological conditions considered. This would be the maximum distance downwind that would require evacuation and control by Range Safety authorities. SPEGL=Short-Term Emergency Guidance Levels. Source: NASA (2011)*

- Using the AFTOX model and applying the propellant quantities expected to be stored and used during vehicle launch at the Canso spaceport, Health Canada would be interested if the proponent could calculate the maximum distance downwind that would require evacuation in the event of a spill and compare it to the current receptor locations.
- If the evacuation distances are over an area larger than the nearest receptor location(s) such as the campground and nearest residence(s), the forthcoming site-specific emergency response plan should describe how these receptors will be evacuated in the event of a spill.

If you have any comments/questions, please contact the undersigned at your convenience.  
Sincerely,



Lance Richardson-Prager, BSc MSc.(A), JD  
Health and Environment Specialist  
Health Canada, Atlantic Region  
[lance.richardson-prager@canada.ca](mailto:lance.richardson-prager@canada.ca)

cc: Rick O’Leary, Manager, Environmental Health Program, Health Canada, Atlantic Region  
cc: Allison Denning Regional Environmental Assessment Specialist Health Canada, Atlantic Region

**From:** [Delaney, Leanda](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 24, 2019 2:14:02 PM

---

Good afternoon Candace,

Thank you for the opportunity to review the document.

With regards to physical impacts to fish and fish habitat, our understanding is that two watercourses will be crossed to construct access roads. Any watercourse alteration from road construction must be permitted by the Nova Scotia Environment (NSE). As part of our regulatory partnership with NSE, DFO will review the NSE Watercourse Alteration Approval Application to assess the specific impacts of the proposed works on fish and fish habitat. DFO will notify NSE and the proponent should a Fisheries Act and/ or Species at Risk Act authorization be required. To expedite review of the proponent's NSE watercourse Alteration Approval Application, it is recommended a fish habitat assessment be completed for watercourse 2, similar to what was done for watercourse 1.

If you have any questions, you can reach me at the coordinates listed below.

Kind regards,

**Leanda Delaney, M.Sc.**

Senior Fisheries Protection Biologist  
Fisheries and Oceans Canada  
Bedford Institute of Oceanography  
1 Challenger Dr., P.O. Box 1006  
Station B410, Dartmouth, NS  
B2Y 4A2  
Tel: (902) 499-4372  
Fax: (902) 426-1489  
E-mail: [Leanda.Delaney@dfo-mpo.gc.ca](mailto:Leanda.Delaney@dfo-mpo.gc.ca)

---

**From:** [Tan, Minh](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** DoB comments on Canso Focus Report  
**Date:** April 25, 2019 10:11:06 AM

---

Hi Candace,

There was nothing in the Focus Report that was in DoB's mandate for us to comment on. If you wish, you could say "The Focus Report is not inconsistent with DoB's mandate", but it's not like there was anything to compare. Thank you.

Minh

## Environment

---

Date: May 13, 2019  
To: Candace Quinn, Environmental Assessment Officer  
From: Program Administration Officer, Air Quality Unit  
Subject: Canso Spaceport Project

---

I have reviewed section “6.0 Air Quality” of the document provided by Maritime Launch Services (MLS) titled, “Responses to Terms of Reference for the Preparation of a Focus Report Regarding the Canso Spaceport Facility Proposed by Maritime Launch Service Ltd.” (the ‘Response’) and dated March 2019.

The Terms of Reference provided by the Nova Scotia Environment (NSE) to MLS asked the proponent to:

6.1 Quantify emissions of air contaminants (e.g., total particulate matter, fine particulate matter, sulphur dioxide, nitrogen compounds, carbon monoxide, hydroxyls, organic compounds, etc.) from Project related activities.

6.2 Quantify the ambient concentrations from Project emissions, as well as the secondary formation of pollutants (e.g. total suspended particulate formed through the condensation of primary emissions, acid deposition products formed through reactions with primary emissions of SO<sub>x</sub> and NO<sub>x</sub>, and/or ground-level ozone formation resulting from primary emissions of NO<sub>x</sub>, VOCs) using an appropriate methodology (e.g., air dispersion modelling) considering routine operation as well as accident and malfunction scenarios including potential catastrophic launch failure.

6.3 Provide and update suitable avoidance, mitigation and/or monitoring measures (where necessary) to confirm impact predictions, and to prevent and minimize potential Project impacts on air quality.

These questions were intended to elicit information that was not adequately provided by MLS in their original Registration Document in order to determine if the undertaking will have air emissions that cause adverse effects or environmental effects, and to provide information on measures to prevent and minimise potential impacts. In the Response, MLS makes claims that emissions from the construction and operation of the facility “are expected to be negligible”, “have minimal impact to air quality”, and be “managed using best management practices”. However, adequate information to validate their claims is not provided. What MLS did provide was a scattering of information cut and pasted from reports for other launch facilities, without providing a rational analysis of the relationship between the information provided and the proposed activity at Canso.

The information provided by MLS is not adequate to determine if the project at Canso will have adverse impacts, or not, or if the proposed prevention and mitigation activities are adequate for the project. However, the information provided by MLS in combination with a report from a consultant (‘consultant’s report’) retained by NSE to determine if the “focus report sufficiently assess the potential project related impacts on [the environment and] whether MLS’ proposed mitigation, management and/or monitoring are appropriate” does provide a more complete package of information for making a determination.

From the consultant’s report it is found that, “it will be the exhaust plume from the first stage of the launch vehicle that constitutes the primary impact to the vicinity of the launch site” and the primary fuel of the first stage of the proposed rockets launched from the facility will be RP-1, which is a highly refined form of kerosene. Rocket engines tend to “have more complete combustion than other kerosene-burning engines” in the aerospace industry, and “the total kerosene burned annually [as proposed by MLS] is comparable to what is burned at a relatively small international airport in about 3-days of operation. In other words, on an annual basis such an airport would be expected to contribute emissions, soot and particulate from burning a quantity of kerosene (Jet-A/Jet-A1) that is more than 120 times greater than all planned annual launches from the proposed Canso spaceport.”

In addition to being asked to characterise the immediate impacts of rocket exhaust, MLS was asked to provide more information on the potential long-term impacts of acid deposition (of acids formed from sulphur and nitrogen by-products of combustion). MLS did not directly address this issue, but the consultant reported that “information on soil pH impacts from rocket launches specifically is difficult to find, but no EAs that we are aware of have listed it as an issue for [the type of engines

proposed to operate from the Canso spaceport]. It is an issue for solid-propellant rockets..., but MLS does not propose to operate such vehicles from their site.”

Based on the information provided by both the MLS Response and the consultant’s report, it can be assumed that the annual air emissions from *routine* operations at the proposed Canso spaceport would likely have small and manageable impacts to the local environment. In addition, the risk of exposure to the exhaust plume from individual and launch events can be assumed to be managed by undertaking emissions modelling to adjust “launch go/no-go criteria”, as proposed by MLS, to avoid situations where local populations will be directly impacted by exhaust plume dispersion. It is recommended that this proposed mitigation action be fully developed and be a requirement for operation of the Canso spaceport, if the activity is approved.

In addition to the air emissions and impacts to ambient air quality from routine launches, MLS has provided some information on the potential impacts from non-routine releases, including spills or a catastrophic failure of a rocket on the launch pad. MLS’s Response presents model outputs for Cape Canaveral and the Kennedy Space Centres that show the potential ranges of spills for various substances, including a range up to 5.7 km for an uncontrolled spill of dinitrogen tetroxide (NTO). In addition, the consultant’s report highlights that the acute toxicity of NTO “is far greater than any of the hydrazines” and that the spill size provided by MLS is based on a volume of NTO that six-times less than the amount that MLS anticipates using and that, “Modelling of dispersion in the event of a toxic spill and development of launch go/no-go criteria must place a heavy emphasis on the NTO, and safe storage, piping system design of the facility and operation.”

For explosions, MLS minimises the type and impact of emissions saying only that “emissions during an explosion would include carbon monoxide and nitrogen oxide” and “exceed threshold limit values for CO (25 ppm) and NO<sub>x</sub> (3 ppm) covering an area 3-10 km long by 1.5 km wide, lasting 5 to 20 minutes...” It is not clear if this model output is for the Canso area or taken from another model report, or where the limit values are from. In addition, other substances are not considered.

Rockets are routinely launched from several facilities around the world, and MLS does reference materials developed from the experience gained from some of those facilities, but adequate information is not provided to determine if the dispersion of pollutants from non-routine occurrences will have adverse impacts, or not, and what mitigative actions can and will be taken to minimise potential risks and impacts at the proposed spaceport at Canso. The consultant’s report

provided several recommendations to develop “more in-depth analysis of failure case for the Cyclone-4M specifically, at their specific launch site”, and for “more details on design and operations at the processing facility”. It is recommended that these recommendations, at a minimum, be considered as essential for the approval of a safe facility at Canso.



## Environment

---

Date: April 23, 2019

To: Candace Quinn, Environmental Assessment Officer

From: Regional Engineer, ICE Unit

Subject: Canso Spaceport Facility (MLS) Project – Focus Report

---

The following comments are limited to the review of the focus report provided by Maritime Launch Service Ltd. (MLS) for the Canso Spaceport Facility Project.

- Additional details regarding launch commit criteria need to be provided. For example, wind has been considered but the details are not provided. Site specific considerations and mitigation measures should also be provided to support the launch commit criteria.
- The basin design, including sizing and liner details, needs to be provided.
- Secondary containment details throughout the site need to be provided (e.g., for hydrazine, UDMH, NTO).
- Hydrazine, nitrogen tetroxide, etc. have been identified as substances of high concern. More detailed analysis of potential failure cases for the Cyclone-4M at the proposed location should be provided.
- A site-specific contingency plan needs to be provided and accepted by NSE prior to launch.
- A site-specific Environmental Protection Plan (EPP), including an environmental monitoring plan, needs to be submitted and accepted by NSE prior to launch.
- Additional baseline studies for Watercourse 2 and soils are required prior to launch.
- A site-specific Emergency Response Plan (ERP) needs to be submitted and accepted by NSE prior to launch. Given the remote location of the facility, the plan needs to demonstrate the necessary resources to implement the plan are available.
- Where would water and soil samples for trace contaminants (e.g., hydrazine) be analyzed? Are these laboratories certified?
- A Waste Management Plan (WMP), for hazardous and non-hazardous waste management needs to be submitted and accepted by NSE prior to launch.
- What best management practices (BMPs) do they plan to use to manage air emissions?
- The report includes a summary from the Final Environmental Impact Statement for the Mars 2020 Mission that concludes airborne emissions from a normal launch would not be expected to result in adverse impacts to the public, but for this site

the nearest residential area is about 10 km. The nearest residential area to the proposed facility is about 3 km. Can MLS confirm the statement regarding the impact of air emissions on the public is still valid at this shorter distance?

- The report refers to NASA modelling and analysis for spills but does not consider site specific details (e.g., wind and temperature assumptions). How do the site-specific conditions compare to the ones used in the NASA modelling and how would the results change?
- When will tree clearing be completed? What if a migratory bird nest is found?

Further questions and comments may arise as additional information is provided and the detailed design progresses.

**Environment**

---

Date: April 26<sup>th</sup> , 2019

To: Candace Quinn, Environmental Assessment Officer

From: Executive Director, Policy and Corporate Services, Nova Scotia  
Department of Agriculture, Fisheries and Aquaculture

Subject: Canso Spaceport Facility Project - Focus Report for Environmental  
Assessment

---

Thank you for the opportunity to review the Environmental Assessment Registration Document for the Canso Spaceport Facility Project - Focus Report.

The Nova Scotia Department of Agriculture does not have any further comments to add to what was submitted in July 2018.

## **Environment**

---

Date: April 26<sup>th</sup> , 2019

To: Candace Quinn, Environmental Assessment Officer

From: Executive Director, Policy and Corporate Services, Nova Scotia  
Department of Agriculture, Fisheries and Aquaculture

Subject: Canso Spaceport Facility Project - Focus Report for Environmental  
Assessment

---

Thank you for the opportunity to review the Environmental Assessment Registration Document for the Canso Spaceport Facility Project-Focus Report for Environmental Assessment.

The Nova Scotia Department of Fisheries and Aquaculture (NSDFA) has the following comments:

The project is in close proximity to several fishing ports including Canso, Little Dover, Queensport, Whitehead and Arichat / Isle Madame. Potential ecological / biophysical impacts to the marine environment of this project are best reviewed by Fisheries and Oceans Canada and Environment Canada.

There are 12 Aquaculture sites and 7 Licensed fish processing facilities within 25 km of the project area. Potential impacts to these operations due to the vicinity of the construction and launch should be considered.

## Environment

---

Date: April 29, 2019

To: Candace Quinn  
Environmental Assessment Officer

Cc: Acting Manager, Water Management Unit

From: Senior Hydrogeologist, Sustainability and Applied Science Division

Subject: Canso Spaceport Facility Project – Additional Comments on Focus Report

---

The proponent has addressed most of additional information requested relevant to groundwater by providing detailed descriptions in the Focus Report. However, the following additional comments are made.

1. Much information is provided concerning the chemicals to be used at the site. However, the potential for contamination to soil and water from incomplete combustion of released propellants (and potential for subsequent creation of degradation products) in the event of launch failures or spills is not thoroughly addressed. The unique features of the site need to be included in this as well (e.g. thin soil cover, fractured bedrock conditions, weather etc). Additional information requested includes:
  - Description and rationale of baseline soil, surface water and groundwater chemistry sampling to be conducted at the site prior to operation.
  - Detailed description of emergency measures and contingency plans to address soil and water contamination at the site should a release of any contaminants occur. Should include description/scope of delineation testing of soil/water, remediation measures and subsequent monitoring.
2. The information on accessing sustainable water supply and water treatment for the proposed site activity is not sufficiently addressed. Water resources in the area are limited and the site needs appear to be high. Information should include more details and analysis on the likely options for water supply – particularly concerning:
  - 1) the use of groundwater wells (numbers of wells necessary considering sustainable yields, total volumes required and the maximum short-term withdrawal rates needed); and
  - 2) the possible use of the Canso water supply (and implications to that approved system), or other area surface water sources.

Date: April 29, 2019

To: Candace Quinn, Environmental Assessment Officer

From: Gillian Fielding, Aboriginal Consultation Advisor

Subject: Canso Spaceport Facility Project – Focus Report

---

OAA has reviewed the Focus Report for the proposed Canso Spaceport Facility Project and has no comments at this time. OAA will however, continue to work with the EA Branch to address any comments submitted by the Mi'kmaq through the environmental assessment process.

## Environment

---

Date: April 29, 2019

To: Candace Quinn  
Environmental Assessment Officer

From: Chuck McKenna, Manager, Resource Management Unit

Subject: Canso Spaceport Facility Focus Report

---

Staff with NSE's Resource Management Unit have reviewed the Focus Report regarding the Canso Spaceport Facility. The information provided by MLS in this focus report along with the information originally submitted provides a high-level approach to how the risk associated with the activity will be managed. Detailed analysis of potential failures and facility design specifications to manage these risks is required. Prior to construction and operation of the facility the following information should be submitted for review and acceptance by the Department:

1. In-depth analysis of failure cases for the Cyclone-4M, including:
  - a. Detailed modeling; in collaboration with the rocket manufacturer; to quantify the failure of the launch vehicle on the pad and early stages of flight, including a rupture of the second stage. Quantify the potential volumes of rocket propellants this could involve, and model the resulting hazard zone, impacts to air, soil, water, and specific mitigation or response.
  - b. Detailed launch criteria that ensures that a worst-case vehicle failure or crash involving release of upper stage propellants does not pose a hazard to populated areas. This should include wind calculations, defining ideal and limit wind conditions for launch.
  - c. Proposed means of performing detailed hazard analysis prior to the actual launch that includes calculating the potential dispersion of toxic plumes and the resulting hazard zones as a function of quantity, environmental and wind conditions.
  - d. Potential for additional impacts or failures resulting from shrapnel from an explosion affecting buildings, tank farms, propellant spills leading to fires and other equipment. Include details on specific site design elements to limit these impacts.
2. Details on the de-fueling operation of the second stage.
3. Design details and detailed operating procedures at the launch pad area, including:
  - a. Liquid oxygen handling, including details on where it will be offloaded if de-fueling is required and how the risks associated with this activity will be managed.
  - b. Design features of the launch pad and area to ensure that in the event of a tank rupture or other spill, the propellant is safely collected and if a fire does occur that it cannot create a hazard to the launch vehicle. Include details on secondary containment and catchment features to ensure the maximum practical amount of propellant and other fluids can be captured and contained in the event of a large-scale spill or explosion on the pad. Include clear details as to the precise volume and extent of the spill that the containment features

can handle accounting for the first stage, upper stage, propellant storage tanks any credible combination of these. The containment area will also need to account for any potential volume of water or other fluids used to dilute a spill or used to combat an emergency.

4. Design details and detailed operating procedures at the processing facility, including:
  - a. Secondary containment and other features to prevent the release of a substances into the environment in the event of a catastrophic rupture of either the storage tank or the mobile fill unit.
  - b. Ventilation and filtration system to contain toxic vapours and to prevent a release to the external environment in consideration of worst-case internal spill.
  - c. Design features of the processing and storage facilities that ensure that any upset conditions of a substance do not pose a risk to adjacent structures and hazardous material storage areas.
5. Hydrogeological assessment of the site and surrounding area based on site design to determine potential
  - a. Pathways and receptors related to a release into groundwater
  - b. Impacts to potable groundwater and surface water receptors.
6. Baseline study of all media, including groundwater, that could be impacted by routine facility operations as well as upset conditions.
7. A list of potential contaminants of concern including the potential transition/decomposition products for the various reaction mechanisms. Include the potential environmental screening levels for these contaminates based on media. The list of potential contaminants of concern should consider, but is not limited to, the following:
  - Formaldehyde dimethylhydrazone)
  - Tetramethylhydrazine
  - Acetaldehyde dimethylhydrazone
  - N-Nitrosodimethylamine
  - 1,1,4,4-Tetramethyltetrazene
  - 1-methyl-1H-1,2,4-triazole
  - 1-Methyl-1H-pyrazole
  - Dimethylamine
  - 1-Methyl-1H-1,2,4-triazole
  - 1,3-Dimethyl-1H-1,2,4-triazole
  - Hydrogen cyanide
  - Dimethylamino acetonitrile
  - 1-Formyl 2,2-dimethyl hydrazine
  - Acetaldehyde
  - Trimethyl hydrazine
  - Formaldehyde dimethyl hydrazine
  - Acetaldehyde dimethyl hydrazine
  - Tetramethyl hydrazine
  - N,N,-Dimethyl formamide
  - N-Nitroso dimethyl amine
  - 1,1,4,4-Tetramethyl tetrazene
  - Dimethyl amine



- Trimethyl amine
- 1,1-Dimethyl hydrazine

8. Detailed Emergency Response Plan:

- a. In accordance with the Nova Scotia Environment Contingency Planning Guidelines.
- b. Appropriate to the site and the resources available in the area.
- c. Include provisions to evacuate or otherwise protect populated area in the event of a worst-case scenario including the release of a toxic propellant.
- d. Include provisions to review the plan prior to commencing launch operations as well as to confirm that all necessary resources are in place to execute any potential response.

# Memo

**To: Candace Quinn, EA Branch**

**Fr: Environmental Health, NSE**

**Date: April 29, 2019**

**RE: Canso Spaceport Focus Report DRAFT**

The Environmental Health program has undertaken a review of the above-noted report in consultation with the Medical Officer of Health, and offer the following comments;

## **General Comments**

### **Presentation of Evidence**

Overall, the evidence provided in the Focus Report and EARD demonstrate that spaceport facilities can be designed, constructed and operated in a manner where risks to the environment and human health can be sufficiently mitigated and managed. The evidence presented was primarily based on work that was undertaken by NASA at various locations throughout the U.S., often involving launch vehicles other than the Cyclone, though similar in design and operation.

Evidence presented in the focus report lacks site-specific and project-specific data. A significant amount of site and project specific work would be needed to determine whether risks associated with this project can be safely mitigated and managed.

### **Evidence Citation**

In several instances throughout the report information/data was presented without proper citations to support the data or any claims or conclusions made within the report based on the uncited data.

## **Targeted Comments**

### **Project Description**

Section 1.1 of the Report, page 1-2 states:

The Cyclone-4M will ramp up to a maximum of eight (8) launches per year over the first five (5) (*sic*) of operation. It is anticipated there would be one launch in the first year (2021) and an increasing number of launches each year up to a maximum of eight (8) by approximately 2026. The total number of launches under this project (2021-2030) is estimated to be 159.

Given that it's anticipated that one (1) launch will occur in the first year (2021) of the project, and the number of launches each year will increase to a maximum of 8 per year by year 2026, it would not be possible to carry out a total of 159 launches between the time period 2021-2030. Clarification and confirmation on the total number of launches is required.

### **Dangerous Goods Management**

Section 3.1 on page 3-1 provides a table listing the quantities of chemicals used for the project. For some chemicals used a significant difference exists between the quantity of chemical required for launch purposes and the quantity of chemical that is proposed to be stored on site. For example, the report states that 3.2 t of UDMH is required for a launch, however, it is proposed that 14t of UDMH will be stored on site. Also, 23t of NTO is proposed to be stored on site, while a single launch will only require 7.7t NTO. It is not clear why it would be necessary to store chemicals on site in quantities that far exceed the quantities required to carry out a launch. Please explain.

### **Water and Soil Resource**

Section 5.2 on page 5-3, second bullet states;

CO, CO<sub>2</sub> and nitrogen oxide (NO<sub>2</sub>) are the primary gaseous emissions during explosion. Applying the Gaussian model for the instantaneous source, ambient concentrations of combustion products generated by an explosion on the launch pad could exceed the threshold limit values for CO (25 parts per million [ppm]) and nitrogen oxides (NO<sub>x</sub>) (3 ppm) covering an area 3-10 kilometer (km) long by 1.5 km wide, lasting 5 to 20 minutes depending on meteorological conditions. Carbonic oxide may form from the combustion products.

It is unclear whether gaseous emissions listed are related to an explosion of first stage launch products only or whether secondary stage launch products were also considered? What is the potential impacts of a cascading effect that leads to secondary launch products were breached?

### **Air Quality**

Section 6.2, page 6-5 and 6-6 discuss impacts of spills based on predictive analysis carried out by NASA for hydrazine (1000kg), MMH (1000kg) and NTO (1200kg), concluding that a 1200kg spill of NTO under the conditions modelled would result in an evacuation distance of 5.7 km from the site of the spill, which easily falls within the distance between the project site and nearby communities of Canso and Little Dover.

The modelling was based on a 1200 kg spill of NTO. As provided in the Focus report, each launch will require 7.7t of NTO and a total of 23t of NTO is proposed to be stored on site. This project is proposing to use chemicals and/or quantities of chemicals other than what was modelled in Section 6.2.

Site-specific air modelling should be undertaken in consideration of the type and quantities of chemicals involved in all aspects of the operation, and impacts to the environment and health assessed for all worst-case scenarios resulting from an accident or malfunction.

## **Noise**

Section 7.3 on page 7-4 of the report the CCOHS noise limit guideline was adopted for purposes of this project. It should be noted that the CCOHS value is an occupation exposure guideline that is applied for workplaces. Normally, it would be inappropriate to apply a occupational guideline value to the general population due to the “healthy worker effect” principle. However, given both the length and frequency of noise associated with vehicle launches is very low, effect to the overall population is deemed to be negligible.

## **Human Health**

Section 11.1, page 11-1, states:

The probability of spill occurrence is  $1 \times 10^{-5}$  (for details see response to Item 3.3).

Section 3.3 does not address this. There is no reference or supporting material provided to support this statement.

## **Conclusions/recommendations**

Establishing safe separation distances between the project site and the public is essential to protecting public health and safety. Safe separation distances need to be established for all worse case failures associated with all conceivable accidents or malfunctions that may occur at any time during the operation of the facility. Impacts requiring assessment from a malfunction or accident include fires, explosions, spills, fragment throw and air quality impacts to human health.

Detailed launch criteria must be established to minimize the potential for public impacts. Launch (go/no go) criteria must consider atmospheric conditions, including wind speed and direction.

Detailed site-specific emergency response plans need to be developed to protect the public from worse-case scenario failures. The emergency response plan must identify worse case scenarios associated with all aspects of the operation, their potential impact on the public, and the interventions necessary to protect public health, including community evacuation plans. The emergency plan should identify the resources necessary should the need arise to activate the plan.

## MEMORANDUM

**To:** Paul Currie, Manager, Industrial Management Unit

**From:** Hydrologist, Industrial Management Unit, Sustainability and Applied Science Division

**Date:** April 29, 2019

**Subject:** Spaceport Focus Report Review Comments

---

### **Scope of review:**

The scope of this Environmental Assessment review from the NSE Sustainability and Applied Science Division Hydrologist is to assess the potential environmental impacts and proposed mitigations of the proposed undertaking on surface water quantity and management. While comments may also include considerations for impacts on general surface water quality, groundwater, freshwater fish habitat, and wetlands, appropriate technical specialists for these areas should be consulted for specific review and comment. This review is specifically focused on freshwater resources, and not on any potential marine impacts, and is focused on the contents of the Focus Report.

### **Documents reviewed:**

The documents outlined below formed the basis for this EA review, and is referred to as 'the submission' through the rest of this memorandum:

- Responses to Terms of Reference for the Preparation of a Focus Report – Regarding the Canso Spaceport Facility Proposed by Maritime Launch Services Ltd. Report Prepared by AECOM, MLS, and Stantec. Dated March, 2019, and accessed from <https://novascotia.ca/nse/ea/canso-spaceport-facility/>

### **Spaceport Focus Report submission comments:**

#### **Water quantity: Watercourses and Site Drainage**

- It is stated that the estimated water consumption needs at the launch site are on the order of 100 m<sup>3</sup>/day, with additional water requirements for operations specific uses (e.g., Up to 950 m<sup>3</sup>

per launch for the deluge water tower and 600 m3 for filling the common tank of the gas duct water cooling system and firefighting system of the launch complex; page 5-12).

- The submission outlines that the water would most likely be obtained from wells, with the Canso water supply system being provided as an alternative. At current, the submission does not provide information to assess the feasibility or sustainability of the water supplies that are proposed:
  - It is not clear whether the water requirements of the project could be met by either groundwater or the Canso water supply system.
  - There is no indication that an assessment of well yields in the area has been completed, or if the Canso water supply system has the capacity to supply the outlined water needs.
  - The quantity of water required is not necessarily excessive, but the information provided in the focus report does not provide enough information to assess whether the water is available or the potential for environmental impacts associated with the proposed options. As a result, it is not possible to gauge the potential environmental impacts associated with this part of the work; there is a risk that water will not be available and/or that a different option with potential for environmental impacts may be chosen down the line.
- The submission does not address any potential impacts to the sustainability of the water supply in the general Project area, in terms of the potential for impacts to the surface water drinking water supply at Southwest Lake. This water supply is part of the 'Canso – Walsh or Wilkins Lake Watershed Protected Water Area'.

### **Water Quality**

- It is stated that “The deluge water will be captured in the retention basin underneath the launch pad” (pg 5-13) and that “Deluge water will be sampled for contaminants that exceed water quality standards” (pg 5-13).

### **Conclusions and Recommendations:**

#### **Planning/Design Issues:**

- Insufficient details have been provided to address 5.3 of the terms of reference. It is recommended that additional details be provided to allow for a better understanding of whether the options presented are feasible/sustainable and the potential impacts (and appropriate mitigations) for these withdrawals.

#### **Operational Issues/Other Permitting Processes:**

- A detailed sediment and erosion control plan for the various activities proposed is to be developed by a qualified professional and is required to be submitted for NSE review and approval prior to construction activities, including clearing, grubbing, and stripping, take place.
- Watercourse alteration applications for watercourse crossings shall be accompanied with enough detail to illustrate how impacts to upstream and downstream watercourses and any existing water users will be mitigated as part of construction activities, supported by results of

fish and fish habitat assessments that the submission outlines are to be conducted prior to these activities taking place.

- A water withdrawal approval must be received prior to the works taking place.
- A stormwater management plan for the areas surrounding the launch pad is recommended, with a plan to convey and test runoff from areas of concern prior to discharge to the environment in line with what is planned for the deluge water and discharge from retention basin.

**From:** [Blackburn, Lori M](#)  
**To:** [Quinn, Candace M](#)  
**Cc:** [O'Brien-Latham, Lesley](#); [Boudreau, Louise O](#); [Geddes, Peter](#)  
**Subject:** FW: Request for advice: NSE question. Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** May 10, 2019 2:26:03 PM

---

Hi Candace:

We have consulted with L&F biologists for the clarity you requested on our comments on the Focus Report for the Environmental Assessment for the Canso Spaceport Facility Project with respect to the surveys on the abundance and diversity of birds. The Department acknowledges that the TOR indicated that *"8.1 Further baseline studies for shorebirds and seabirds will be required, and this requirement can be deferred before commencement of the Project, if the Project is approved."* However, our wildlife experts have advised that surveys for species as identified in the "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (<https://novascotia.ca/nse/ea/docs/EA.Guide-AddressingWildSpecies.pdf>) are important to have conducted prior to approval of the project.

Regarding your question on the use of the word "significant" in the following statement in the Department's original submission (i.e., "The project has the potential to have significant impacts on breeding and migratory birds through disturbance, operational and launch noise, and lighting"), given the legislative implications of "significant" this was not the best choice of wording. Changing the wording to "substantial" may be better in this situation.

These are the Department's recommendations for which you requested clarification, for NSE's consideration.

Thanks  
Lori

---

**From:** Quinn, Candace M <[Candace.Quinn@novascotia.ca](mailto:Candace.Quinn@novascotia.ca)>  
**Sent:** May 8, 2019 7:59 AM  
**To:** Boudreau, Louise O <[Louise.Boudreau@novascotia.ca](mailto:Louise.Boudreau@novascotia.ca)>  
**Cc:** O'Brien-Latham, Lesley <[Lesley.O'Brien-Latham@novascotia.ca](mailto:Lesley.O'Brien-Latham@novascotia.ca)>  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment

Hello Louise,

If possible, please look at the comment you identified in #1 considering that the terms of reference provided to the proponent for the focus report state "8.1 Further baseline studies for shorebirds and seabirds will be required, and this requirement can be deferred before commencement of the Project, if the Project is approved.". Additionally, clarification on "The project has the potential to have significant impacts on breeding and migratory birds through disturbance, operational and launch noise, and lighting" would be helpful. Specifically the word "significant" has particular meaning and nuance in our legislation that may or may not have been considered already.



Thanks,  
Candace

---

**From:** Boudreau, Louise O <[Louise.Boudreau@novascotia.ca](mailto:Louise.Boudreau@novascotia.ca)>  
**Sent:** May 7, 2019 2:15 PM  
**To:** Quinn, Candace M <[Candace.Quinn@novascotia.ca](mailto:Candace.Quinn@novascotia.ca)>  
**Cc:** O'Brien-Latham, Lesley <[Lesley.O'Brien-Latham@novascotia.ca](mailto:Lesley.O'Brien-Latham@novascotia.ca)>  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment

Hi Candace,

Thanks very much for contacting me.

1. Are these the comments that you would like clarification on:  
**“ Studies on the abundance and diversity of birds using this site during spring and fall migrations and during the shorebird/seabird/waterfowl breeding season (approximately 15 April to 31 July) be completed prior to project approval.”**
2. If so. Are you asking if its possible to reword it as a condition of approval rather than prior to approval?
3. Are there other comments that you need clarification on?

If a phone call would help I'm at my desk this afternoon. Please feel free to call me at: 424-3530

Cheers,

Louise

Louise Boudreau  
Policy Analyst  
Department of Lands and Forestry  
Founders Square | 1701 Hollis Street, 3<sup>rd</sup> Floor | Halifax, NS B3J 2T9 |  
424-3530

---

**From:** Quinn, Candace M <[Candace.Quinn@novascotia.ca](mailto:Candace.Quinn@novascotia.ca)>  
**Sent:** May 7, 2019 1:05 PM  
**To:** Boudreau, Louise O <[Louise.Boudreau@novascotia.ca](mailto:Louise.Boudreau@novascotia.ca)>  
**Cc:** O'Brien-Latham, Lesley <[Lesley.O'Brien-Latham@novascotia.ca](mailto:Lesley.O'Brien-Latham@novascotia.ca)>  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment

Hello Louise,

The EA branch is looking for clarification on Lands and Forestry's comments for the Spaceport Focus Report and in particular those around the need for additional surveys and the timing of those surveys in light of the Terms of Reference developed for the Focus Report in consultation with your Department.

Many thanks, Candace Quinn

---

**From:** Boudreau, Louise O <[Louise.Boudreau@novascotia.ca](mailto:Louise.Boudreau@novascotia.ca)>

**Sent:** April 29, 2019 5:24 PM

**To:** Quinn, Candace M <[Candace.Quinn@novascotia.ca](mailto:Candace.Quinn@novascotia.ca)>

**Cc:** O'Brien-Latham, Lesley <[Lesley.OBrien-Latham@novascotia.ca](mailto:Lesley.OBrien-Latham@novascotia.ca)>

**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment

Hi Candace,

Attached please find the Department of Lands and Forestry response to the Canso Spaceport Facility Project Focus Report. If you have questions please do not hesitate to contact me.

Warm Regards,

Louise

Louise Boudreau

Policy Analyst

Department of Lands and Forestry

Founders Square | 1701 Hollis Street, 3<sup>rd</sup> Floor | Halifax, NS B3J 2T9 |

424-3530

---



## Lands and Forestry

---

### MEMORANDUM

**TO:** Candace Quinn, NS Department of Environment  
**FROM:** Department of Lands and Forestry  
**DATE:** April 29, 2019  
**RE:** Canso Spaceport Facility Project

---

The Department of Lands and Forestry provides the following comments on the above project and recommends the following mitigation measures be considered as conditions of approval for the project:

#### **Crown Lands:**

The infrastructure of this project is partially located on Crown land (being a portion of PID 35096320). Therefore, should the project be approved, it will require a land lease from the Minister of Lands and Forestry. The Crown Land Lease will contain specific terms and conditions which the applicant will be required to adhere to. Specific terms and conditions may include but are not limited to approval to survey the boundary lines of the lease area and liability insurance which may vary from the coverage specified in the Focus Report.

Approvals from Land Administration may also be required if the applicant requires access for preliminary testing etc. Authority for restricting land use on Crown lands will require an approval of some form (yet to be determined). Authorization will also be required for the Crown lands in use on launch days, this will likely be some form of letter of authority (blanket). This authorization would likewise include specific terms and conditions for the temporary use of the Crown lands.

It does not appear from the information provided, that a right of way or easement will be required for access or utilities; however, any pipelines or utilities over Crown land that will not be included in the lease lands (i.e., lands that are outside the leased land area, or submerged Crown land) will require authority.

Note Figure 5.3 incorrectly indicates municipal land (35204023 & 35204031) as Crown land.

## **Wildlife, Wildlife Habitat and Surveys:**

The “Responses to Terms of Reference for the Preparation of a Focus Report for the Canso Spaceport Facility” provides much relevant detail on the risks and management of dangerous fuels but does little to address concerns regarding potential impacts to flora and fauna as expressed in the Departments response to the EA and the requirements of the TOR.

### **1) Conduct further baseline studies for shorebirds and seabirds**

The project has the potential to have significant impacts on breeding and migratory birds through disturbance, operational and launch noise, and lighting. Section 5.6 of the EA makes statements acknowledging the importance of the area to birds as:

- an important stopover for waterfowl, shorebirds and passerine species during spring and fall migration (also see Sable Wind Farm EA <https://novascotia.ca/nse/ea/sable-wind-guysborough.asp>);
- an overwintering site for sea ducks including the endangered Harlequin Duck (NS ESA) and other waterfowl;
- a healthy breeding population of willet and possibly other shorebirds;
- a congregation area for various seagulls, cormorants and terns; and
- having mixed species of seagull colonies and tern colonies in the area.

Despite acknowledging the importance of this site, surveys for shorebirds and seabird colonies were insufficient to quantify the diversity and abundance of species. Three of the four survey sites for shorebirds were distant to the launch site. Spinney Gully was the only shorebird survey site within 1 km of the project site. No surveys were completed on adjacent coastal islands despite the presence of a tern coastal colony designation in the *Nova Scotia Significant Species and Habitat* database within 1 km of the project footprint. (Nova Scotia Significant Species and Habitat database):

The EA mentions possible indirect and direct impacts on birds both breeding and non-breeding, but neither the EA or the Focus Report state when or if any avoidance of impacts would be applied through timing space launches with attention to seasons or other forms of mitigation. The EA notes that the proposed operations would consist of up to eight launch operations per year but does not provide any detail on when these launches would occur. It is not clear if the launch operations will be evenly spaced throughout the year or focused on a particular time period. If the majority of launches are scheduled during the nesting season for shorebirds and seabirds (15 April to 31 July) the potential for impacts on coastal colonies due to nest abandonment from launch noise could be substantial. Launches scheduled during spring or fall migration periods could impact migratory birds through the use of extra lighting and activity at the site.

The Department recommends:

- **Studies on the abundance and diversity of birds using this site during spring and fall migrations and during the shorebird/seabird/waterfowl breeding season (approximately 15 April to 31 July) be completed prior to project approval. Studies should include thorough radar, acoustic, and observational surveys of nocturnal and diurnal migration density and the behaviour of migratory and breeding birds. The potential impacts to bird populations must be assessed in detail considering survey results, scientific evidence, research and the frequency of launches during these key periods.**

**Analysis must include a consideration of the potential cumulative impacts of noise, lighting and the proximity of the Cape Sable Wind Farm, located immediately to the north of the Project site, on migratory birds. It is possible that migrating birds disorientated by the Project's lights may be put at an increased risk of interacting with the wind farm, resulting in injury or mortality. Potential for cumulative effects and mortality of birds given proximity of a wind farm is acknowledged in the EA, yet no potential mitigation options are discussed. The proponent must identify mitigation measures it is planning to take to reduce this risk.**

- **A Lighting Management Plan should be developed prior to site construction that is based on the results of all radar, acoustic, and observational studies and consideration of the proximity to the wind farm.**

## **2) Assess potential noise impacts on birds and other wildlife**

Section 8.2 of the Focus Report provides further information on the potential noise impacts to nesting shorebirds and concludes that the noise impacts should be similar to that seen during thunderstorms at 100-120 dB. However, noise levels at the launch site are stated to be much higher, at around 170- 200 dB. The launch site is 170 m from the shoreline and 300 m from the nearest coastal island that provides nesting habitat for shorebirds, seabirds and waterfowl. Section 7.3 of the Focus Report notes that "*seasonal cottages within 1.1 km of the launch site will receive noise exposure in excess of 115 dBA*" and that "*Maritime Launch Services Ltd has made arrangements with the cottage owners to ensure no one will be in these areas during launch activities*". If exposure during launches is deemed too loud for people at 1.1 km of the launch site, what is the impact on wildlife at 170 m?

The EA states in Section 5.6.5 that "*The Launch vehicles are expected to generate high peak noise levels that will cause a sensory disturbance to birds in the area, which may result in temporarily disorienting the birds, or scaring breeding birds off their nests, leaving the eggs or young vulnerable. Some birds may even be discouraged from foraging or nesting in the area*". No data, literature, research or analysis was provided to anticipate the response of wildlife to noise at these levels and to account for potential damage to auditory function post-exposure to launch noise.

- **The Department requires further information to assess risks posed to migrating birds, breeding birds and other wildlife from acoustic sound associated with project operations and launches in close proximity (as near as 170 m) to the launch site, including reference to scientific evidence, research, and reports. Analysis should include scientific evidence for the physical and behaviour effects to wildlife to sound at 170-200 dB.**

“The C4M launch trajectory would be specific to each particular mission, but they will all be conducted to the south over the Atlantic Ocean” (EA pg 20). It is predicted that the sonic boom will occur 60 km from the launch site over the Atlantic Ocean and may occur near or over Sable Island.

- **The Department recommends potential impacts of the sonic boom to wildlife and seabird colonies on Sable Island be considered and appropriate mitigations be put in place.**

### **3) Assess potential impacts of hydrazine related chemicals and/or its byproducts or daughter products on wildlife and wildlife habitat, from routine project operation and/or accidents involving these chemicals**

The proponents appear to rationalize the risk to terrestrial wildlife, aquatic organisms, and vegetation from a contaminant spill with the statement “*Wildlife would like avoid close proximity to the launch complex because of lighting and human activity*”. The nearest lake is 400 m from the UDMH container and 700 m from the launch site and the marine shoreline is 170 m from the launch site. While the results of laboratory studies from exposure to UDMH are provided in the Focus Report, the potential impact to aquatic organisms and wildlife in the vicinity of the spaceport has not been clearly established.

- **The Department requires further information to assess risks posed to vegetation, aquatic organisms and wildlife in the event of a contaminant spill or accident, including predictive modeling of the potential impacts in a field environment based on scientific evidence from laboratory exposures. Modeling should include an assessment of the dispersion of the vehicle’s exhaust plume during a nominal launch, as well as the potential toxic cloud during a worst-case propellant spill, explosion or crash as a function of weather and wind conditions. The analysis should include potential impacts of hydrazine/UDMH and dinitrogen tetroxide (NTO).**
- **The Department recommends a detailed Environmental Protection Plan (EPP) be completed and reviewed by Lands and Forestry prior to construction to permit further assessment of the protective measures that will be used. The EPP should include potential impacts to aquatic and terrestrial habitats and wildlife.**

**4) Provide more details regarding mitigation, management and/or monitoring measures to confirm impact prediction, and to mitigate potential impacts on wildlife and wildlife habitat**

The response to this topic is covered in one-page and repeats statements found elsewhere in the Focus Report noting the safeguards for fueling. As stated previously, the Focus Report does not adequately assess risks posed to migrating birds, breeding birds and other wildlife associated with the project construction and operation nor does it provide any detail regarding mitigation, management and/or monitoring measures to lessen potential impacts on wildlife and wildlife habitat.

- **The Department recommends a detailed Wildlife Management Plan and an Avian Management Plan be developed and reviewed by Lands and Forestry prior to construction that considers all scientific evidence, research, reports and experience elsewhere that may afford opportunities for effective mitigation for potential impacts to wildlife and wildlife habitat.**

**From:** [CarolLee.Giffin@forces.gc.ca](mailto:CarolLee.Giffin@forces.gc.ca)  
**To:** [Quinn, Candace M](#)  
**Cc:** [Deanna.Brewster@forces.gc.ca](mailto:Deanna.Brewster@forces.gc.ca); [+N48FormationSafetyandEnvironment@forces.gc.ca](mailto:+N48FormationSafetyandEnvironment@forces.gc.ca)  
**Subject:** For your review: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 29, 2019 7:49:19 PM  
**Attachments:** [Review of the Canso Spaceport Facility Focus Report 23april19.pdf](#)  
[2018-000397.pdf](#)  
**Importance:** High

---

As requested by Nova Scotia Environment, DND has reviewed the following documents:

- Responses to Terms of Reference for the Preparation of a Focus Report: Regarding the Canso Spaceport Facility proposed by Maritime Launch Service Ltd.
- Review of the Canso Spaceport Facility Report

DND was asked to review the documentation to provide applicable comments in terms of the “Other socio-economic VEC”...specifically military related operation. DND has no further comments on the document beyond our July 2018 letter requesting a Point of Contact for the facility, as well as, notification to both NOTAM and NOTMAR.

#### Carol Lee

Carol Lee Giffin, M.A.Sc (Chem Eng)

MARLANT Safety and Environmental Officer, MARLANT Safety and Environment  
Maritime Forces Atlantic  
Department of National Defence/Government of Canada  
[carollee.giffin@forces.gc.ca](mailto:carollee.giffin@forces.gc.ca) / Tel: 902-427-1419 /

Officier de la sécurité et de l'environnement des FMAR(A), Sécurité et environnement des FMAR(A)  
Forces maritimes de l'Atlantique  
Ministère de la Défense nationale/Gouvernement du Canada  
[carollee.giffin@forces.gc.ca](mailto:carollee.giffin@forces.gc.ca) / Tél: 902-427-1419

---



## Environment

---

Date: April 29, 2019

To: Manager, Water Management Unit

From: Senior Surface Water Quality Specialist, Water Management Unit

Subject: Canso Spaceport Facility Focus Report - Review Comments & Recommendations

---

### Scope of Review

As Senior Surface Water Quality Specialist with the Nova Scotia Environment (NSE) Sustainability and Applied Science Division, the following Canso Spaceport Facility Environmental Assessment (EA) – Focus Report review focuses on the following subjects:

- Surface water quality & its management
- General surface and groundwater resources, and fish and fish habitat & their management

The following review considers whether the environmental concerns associated with the above subjects and the proposed mitigation measures have been adequately addressed in the Environmental Assessment – Focus Report submission. The recommendations provided below are meant to supplement the actions outlined in the submission documents.

While general comments on fish and fish habitat, wetlands, surface water quantity, and groundwater quality and quantity may be included below, applicable technical specialists should be consulted for specific review and comment.

### Reviewed Documents

The following document was the basis for this EA review:

AECOM, Maritime Launch Services Ltd., and Stantec. 2019. *Responses to Terms of Reference for the Preparation of a Focus Report*.

### Comments

#### *Surface Water Resources*

- Baseline studies of surface water resources that may be impacted by Project activities was requested in the Terms of Reference (5.1). The Proponent proposes to conduct a baseline monitoring program prior to the start of construction of the project of these surface water resources, particularly Watercourses #1 and #2, and Publicover Lake.

- The Section 5.3 response addresses potential Project impacts on sustainability to water supply by providing estimates of water use volumes at the site, and potential sources (on-site groundwater wells or the Canso surface water supply). There is no assessment of whether project water needs can be met by either the site groundwater supply or from the Town of Canso.
- There is no discussion on Project activities within Section 5.3 with respect to risk to the Canso surface water supply (Wilkins Lake) from a quality perspective. Other sections of the report speak to potential water quality impacts to surface water resources closer to the Project site than Wilkins Lake, which is applicable to assessing potential effects.

#### *Surface Water Quality*

- The response to Term of Reference 5.1 references the Guysborough County Inshore Fisherman's Association water monitoring program. No details are provided on whether the existing or proposed expanded program monitors watercourses within the project development area. No reference is provided to the historic program and reporting conducted by the Organization.
- Section 4.1 provides details on the potential contaminants of concern within the deluge water retention basin and the management of the deluge water prior to release or disposal at an approved facility. The specific parameters to be monitored and associated discharge criteria are not listed in the response, including the deluge monitoring program discussion in Section 5.4.
- Particulate matter, carbonic acid and RP-1 are listed as potential contaminants of concern associated with the deluge water. The exhaust cloud is described as potentially condensing with a minimal volume of water around the site. There is no discussion on the potential for drift of particulate matter within this cloud outside the deluge water retention basin area and the settling of the particulate matter in the environment. There is potential for the particulate matter to be transported via surface water runoff into nearby surface water features (freshwater and marine), along with its potential contaminants of concern (e.g., suspended solids, metals).
- 1,1-dimethylhydrazine (UDMH) and dinitrogen tetroxide (NTO) are proposed as the propellants for the second stage, and Section 5.2 discusses several failure scenarios associated with the launch event, explosions at the launch site, exhaust and re-entry debris fallout. The section refers to major spills (e.g., filling, rupture of second stage), but no assessment of potential impacts to surface water or other potential valued ecosystem components (VECs) are discussed. Rocket plume emissions and air dispersion modeling is proposed to be conducted as part of detailed design in Section 6.3. No modeling was proposed for the major spill scenario. If UDMH and NTO were released into the environment during a major spill there would be potential for volatilization of these compounds into the air (Section 3.1) and under certain wind conditions transport outside the project area, where they would potentially interact with various VECs, including surface water resources.
- Section 5.2 discusses re-entry debris fallout, including that the second stage, which contains potential residual UDMH and NTO will remain in orbit. It would be expected that the orbit of the second stage begin to decay upon entry and eventually re-enter the earth's atmosphere before returning to the earth's surface. There is no discussion provided on the potential risks associated with re-entry and if there is potential for residual UDMH and NTO compounds to be

discharged into surface water resources or effect other VECs.

#### *Fish and Fish Habitat*

- No baseline studies on freshwater fish and fish habitat were specifically conducted for the project. The information gathered with respect to the characteristics of Watercourse #1 indicate that it is not conducive to fish presence (Section 5.1; Section 8.1). The Proponent proposes to conduct a baseline fish and fish habitat monitoring program prior to the start of construction of the project, particularly Watercourse #2.

#### *Groundwater Quality*

- Section 5.2 discusses several failure scenarios associated with the launch event, explosions at the launch site, exhaust and re-entry debris fallout. The section refers to major spills, but no assessment of potential impacts to groundwater are discussed. If a UDMH and NTO major spill event occurs that is not within a secondary containment area there is the potential for seepage into the groundwater system, particularly for UDMH and its breakdown products.

### **Recommendations**

#### *Planning/Design*

The activities conducted in supporting the Project effects assessment in the Focus Report for surface water and groundwater resources are inadequate to determine the significance of effects, particularly related to quantity. A revised and detailed assessment related to surface water and groundwater quantity resources is potentially required to adequately assess the significance of the Project impacts on them.

The following are associated recommendations for each of the above listed VECs:

1. Assess groundwater resources within the project area to determine whether there is a sustainable quantity available for the estimated Project needs. Desktop and modeling techniques could potentially be used to support the assessment; and/or
2. Assess surface water resources (e.g., lakes within Project area, Town of Canso) to determine whether there is a sustainable quantity available for the estimated Project needs. Desktop and modeling techniques could potentially be used to support the assessment.

#### *Operational Issues/Other Permitting Processes*

##### *Surface Water Resources*

- If part of the Project surface water quality and/or quantity monitoring programs established to support this Project include additional or existing monitoring results from the Guysborough County Inshore Fisherman's Association water monitoring program, the monitoring activities and reporting structures should be submitted to NSE staff for review and approval, including the supporting quality assurance/quality control program.
- A surface water quality and quantity monitoring program should be established to monitor potential effects from the site activities. This plan should be submitted to NSE staff for review and approval prior to implementation. Annual water quantity/quality monitoring reports with assessment of potential effects from project activities and updates on the implementation and efficacy of mitigation

measures should be prepared and submitted to NSE staff for review and approval during the operations phase.

#### *Surface Water Quality*

- A baseline surface water quality, and fish and fish habitat monitoring program should be developed to monitor surface water quality and confirm fish and fish habitat within watercourses and associated waterbodies that will be potentially affected by project activities. The baseline program and its results should be submitted to NSE staff for review and approval prior to starting construction activities at the Site.
- An erosion and sediment control plan developed by a qualified professional should be submitted for NSE review and approval prior to the start of construction and operation activities, including clearing, grubbing and stripping.
- The deluge water retention basin should be designed with a secondary containment to mitigate against potential leakage from the basin or spillage outside. The storage volume should be designed with adequate additional capacity to hold the deluge water, potential spill events and design precipitation event additions that may be received during the holding period while chemical analysis is being conducted. The deluge water retention basin design and its management plan, including proposed discharge parameters and criteria should be submitted to NSE staff for review and approval prior to the construction phase.
- A stormwater management system for the immediate area around the launch pad should be designed by a qualified professional to control surface water runoff in the vicinity of the launch pad area and its proposed deluge water retention basin. This will capture particulate matter and other potential contaminants of concern that drift outside the deluge water retention basin area. Pond design should consider potential scour impacts to the receiving water environment. Appropriate mitigation measures should be implemented to support surface water management, including matching pre- and post-development surface water runoff discharge rates. The storage volume should consider spill containment related to project activities as a potential contingency measure. Pre-discharge effluent monitoring requirements and criteria should be developed as part of a Project site stormwater management program. The stormwater management system and its program should be developed in consultation with, and submitted for review and approval by NSE staff prior to the construction phase.
- In support of the emergency management and site spill contingency plans, water quality monitoring parameters should be developed that capture the potential contaminants of concern associated with the Project, along with applicable remediation criteria based on baseline monitoring results and regulatory guidelines. These plans should be submitted to NSE staff for review and approval prior to the Project construction phase.
- Major spill air dispersion modeling should be conducted for NTO and UDMH as part of detailed design for the project to assess potential impacts to surface water resources and other VECs. Appropriate mitigation measures as part of detailed design should be developed to prevent spills from occurring and/or reduce the potential effects. The dispersion model and its results, along with detailed design of applicable mitigation measures should be submitted to NSE staff for review and approval prior to the construction phase.
- Mitigation measures to prevent UDMH and NTO compounds from entering the

earth's orbit from the second stage eventual re-entry into the earth's atmosphere should be provided to NSE staff for review and approval prior to the Project operation phase.

*Groundwater Quality and Quantity*

- The spill contingency plan developed for the Project should include mitigation measures to reduce the potential for UDMH and NTO spills from seeping into the local groundwater system. Mitigation measures, including the secondary containment, deluge retention basin and stormwater management system should be adequately designed and assessed to reduce the potential release of these spill materials into the environment. The spill contingency plan and detailed design of spill containment measures, including assessment of containment volumes, should be submitted to NSE staff for review and approval prior to the Project construction phase.

**From:** [Gillis, Sean I](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 30, 2019 8:28:24 AM

---

Candace

I have no comments on the Focus Report.

Sean

---

**From:** [Miller, Michelle](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 30, 2019 8:47:46 AM

---

Hi Candace

The Climate Change Division does not have any comments in the Focus Report.

Michelle

---

---

**From:** [Savard, Micheline \(CEAA/ACEE\)](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 30, 2019 9:33:13 AM

---

Candace,

I do not have any comments to submit on the Focus Report for the Canso Spaceport Facility Project.

Micheline Savard  
Project Manager, Atlantic Region  
Canadian Environmental Assessment Agency / Government of Canada  
[micheline.savard@canada.ca](mailto:micheline.savard@canada.ca) / Tel : 902-426-4180

Gestionnaire de projets, région atlantique  
Agence canadienne d'évaluation environnementale / Gouvernement du Canada  
[micheline.savard@canada.ca](mailto:micheline.savard@canada.ca) / Tél : 902-426-4180



Government  
of Canada

Gouvernement  
du Canada

Canada

---



**From:** [Harvey Doane](#)  
**To:** [Quinn, Candace M](#)  
**Subject:** Re: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** April 30, 2019 10:12:13 AM

---

Candace:

NSBI will not be submitting comment regarding the MLS focus report.

Thanks,

Harvey

Get [Outlook for iOS](#)

---

---

**Date:** April 29, 2019  
**To:** Candace Quinn, Environmental Assessment Officer  
**From:** Gordon Smith, Provincial Director of Planning  
**Subject:** **Canso Spaceport Facility Project**

---

As requested, the Department of Municipal Affairs has reviewed the *Responses to Terms of Reference for the Preparation of a Focus Report* and the *Review of the Canso Spaceport Facility Focus Report* relating to the proposed Canso Spaceport Facility Project.

Although we have found nothing of concern respecting the Department's areas of mandate, we suggest ensuring that the proponent undertakes adequate consultation with the Municipality in order to confirm compliance with municipal planning policies and by-law provisions.

Thank you for the opportunity to review the documents for this project. Should you require additional information, please feel free to contact either Alan Howell, Senior Planner (902-483-3746), or me (902-424-7918).

Yours truly,



Andrew Paton  
A/Provincial Director of Planning

c: Alan Howell, Senior Planner, DMA

## **MEMORANDUM**

**DATE:** April 29, 2019

**TO:** Candance Quinn

**CC:** Neil Morehouse, Jeremy Higgins, Rob Cameron

**FROM:** Director, Protected Areas & Ecosystems

**SUBJECT:** Spaceport Guysborough County

---

---

The Protected Areas and Ecosystems Branch have reviewed the Environmental Assessment for the **Spaceport Project**

### **Wetland comments:**

General design of the site, safety procedures, proposed mitigations (containment) and launch go-no go criteria are stressed as the primary methods to reduce the potential impacts to surface water, wetlands and groundwater as a result of spills and/or accidental releases of associated fuels (and by products) proposed for use. As such, design of these features and preliminary siting of any of the "additional features" to mitigate spill/release/fire should be provided by the proponent. This could include identification of proposed ponds or infrastructures designed to capture and contain spills or reduce potential for fire associated with spilled propellants.

Criteria to determine when launch deluge wastewater would be characterized as non-hazardous should be proposed. If discharge of waste deluge water is to be released, as mentioned in the focus report, the proponent should identify these proposed locations and identify any aquatic habitats that may be directly receiving these discharges.

It is unclear if the work associated with the Guysborough County Inshore Fishermen's Association (CFIA) identifies additional sensitive habitats (tidal or coastal wetlands) or how this project will contribute to assessing baseline conditions in the vicinity of the project. For example, is water quality information for Watercourse 1 and 2 included? Additional information relating to this work would be beneficial to understand what baseline conditions are known relating to in-shore areas.

It is unclear if wetland soil/sediments quality in the vicinity of the launch pad are included in baseline and operational monitoring to address project related impacts on soils.

Along with clarification of how the probabilities of worst case incidents were determined, the proponent should discuss wetlands/watercourse associated with the surface waters (lakes) identified in Section 5.0 as a result of failure scenarios within the areas anticipated to be impacted based on these scenarios.

### **Protected Areas Comments:**

The response for additional information regarding protected areas does not provide adequate content to assess potential impacts. For example, Section 10.2 states “Given the distance between the national parks and the launch site, the project is anticipated to have minimal effect on these areas.” While the nearest national park is 145 km away, there is a protected wilderness area less 3 km away and two the 2 provincial parks <5 km away. All potentially affected (nearby) parks and protected areas should be identified and mapped in the report and considered in the analysis. This information is widely available or can be provided by government. The absence of mention of the wilderness area raises concerns as to the extent to which the protected area was considered in drawing conclusions.

There had been two major concerns from the previous review: a) planning for launch failure; and b) ecological impacts to the adjacent protected wilderness area.

The report presents two conclusions regarding protected areas in section 10.1: a) no negative impacts given the distance; and b) no impacts from launch failure. However, reasons are not given to support these conclusions. In the absence of rationale, these conclusions cannot be evaluated.

The map in Figure 5.2.2 on Page 5-8 shows two trajectories “ground tracks”, one of which crosses directly over Andrews Island Provincial Park. The map in Figure 10.1.1 referenced above shows only one generalized track for Trajectories 2 and 3. Trajectory #1 which goes directly over Andrews Island Provincial Park is not shown. The statistical odds given (Table 5.2.6) for debris from an in-flight explosion impacting Snyder lake in Canso Coastal Barrens Wilderness Area is assessed to be low using flight Trajectories 2 and 3. While such odds may be low, consideration should still be given to the potential impacts to the wilderness area.

With respect to planning for launch failure, additional information should be provided on how the analysis in section 5.2 – Launch Failure; relates to the adjacent protected areas. For example, Table 5.2.6. provides probability of Fall of Failed Integrated Launch Vehicle or Its Fragments Containing Propellants into The Lakes. One of these lakes is in Canso Coastal Barrens Wilderness Area. This illustrates the ability to provide a more in-depth analysis of probability of failed launch in the wilderness area and what those effects might be.

With respect to ecological impacts to the adjacent protected wilderness area, additional information is needed to assess how wildlife, particularly birds, use the protected area and the adjacent launch site. For example, this would aid in clarifying whether birds nesting in the protected area forage in the

adjacent launch site or near the launch facility – or vice versa. This type of assessment should also consider whether such animal movement will be impacted by launch facility construction and use.

There is currently not enough data and analyses from these reports to fully understand the potential impacts of this development to the adjacent wilderness area. To address this gap, we suggest that:

1. As part of baseline data collection, the proponent be required to study the avifaunal use between the wilderness area and the development site. Included with this requirement should be suggested mitigative measures if birds are found to be using both sites.
2. The contingency plan requirements include clean-up and restoration of adjacent wilderness area should a crash impact the wilderness area. The clean-up – restoration plan should consider means of access this remote area, how debris and hazardous materials would be removed, and how impacts of the removal on the ecosystems (e.g. soil and vegetation removal) will be avoided and/or restored.

The report does not mention the ecologically sensitive, rare and unique Jack pine coastal woodland ecosystem that will be damaged by this project. The recumbent jack pine (*Pinus banksiana* var. *procumbens*) occurs in only one place in the world, Guysborough County. It forms a unique ecosystem - the jack pine coastal woodland - also only found in Guysborough County. Although a jack pine coastal woodland community occurs on the proposed construction site, no mention is made of it in any EA documents. While there are no conservation ranks or legislative protections for ecosystems in Nova Scotia, information on the project's impacts to this ecosystem should be included.

From previous comments, Canso Coastal Barrens Wilderness Area, together with other coastal lands (mostly Crown land and provincial park properties), including the proposed launch site, offers a valued wilderness kayaking/boating/camping/coastal hiking experience. The focus report includes no analysis of potential impacts of the project on this outdoor recreation/tourism resource, whether related to noise, visual effects (industrial vs natural setting) or other factors. Assessment of potential impacts of the project in relation to protected areas should consider impacts to such recreational uses.

Analysis in the focus report on impacts of noise to humans is limited to nearest residents and seasonal cottages. Analysis should also consider other recreational uses and associated commercial operations such as kayak tour outfitters. Consideration should be given to potential impacts to users seeking experiences in quiet nature, particularly during launch days. Information on potential mitigations, like some sort of notification system for those planning recreational experiences in this area, should also be considered.



Date: 26 Apr, 2019  
To: Candace Quinn, Environmental Assessment Officer  
From: Inspector R. Trerice, CAI-3  
Inspector M. Cordeau, CAI-3  
Subject: Canso Spaceport Facility Project

---

**27 April 2019**

### **1. Ref Project Description Page 1-21**

"Requirements for launching high power rockets in Canada can be found at the following web link:

[http://www.canadianrocketry.org/files/tc\\_hpr\\_reqs\\_jan00.pdf](http://www.canadianrocketry.org/files/tc_hpr_reqs_jan00.pdf)

Applications for authorization to launch high power and advanced high power rockets can be found at the following web link:

<https://www.tc.gc.ca/media/documents/ca-standards/26-0660.pdf> "

### **Comment**

These references are for high power rockets that are used by researchers and hobbyists. They are not applicable for the size of rocket proposed by MLS.

These references should be taken out of the report.

Also, the authority for TC to authorize rocket launches is in Part VI of the CARs found at the following link.

<http://www.tc.gc.ca/en/transport-canada/corporate/acts-regulations/regulations/sor-96-433.html>

### **2. Ref Human Health Page 11-6**

"The campground location is more than double the distance of the worst-case scenario..."

**Comment**

MLS has currently planned an personnel exclusion radius of 2 km from the launch pad during launches. Although the campground is outside this distance at 2.15km, further analysis will be required to determine if additional safety measures are necessary that could impact campground activities during launch events.

**3. Ref Contingency Planning Page 12-5**

“As part of the permitting evaluation process, MLS and Transport Canada would conduct the appropriate reviews including a payload review, financial determination and safety review.”

**Comment**

To protect Canada from potential claims for third party damages, Transport Canada, under its authorization process for launching rockets, would require demonstration of financial responsibility and insurance coverage by launch proponents to indemnify Canada against claims for third party damages.

**From:** [Cross, Anna](#)  
**To:** [Weseloh McKeane, Sean](#); [Quinn, Candace M](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** May 2, 2019 9:05:07 AM

---

Hi Candace,

regarding this project.

I did not receive any comments

Thanks,  
Anna

---

---

---





Environment and  
Climate Change Canada

Environnement et  
Changement climatique Canada

Environmental Stewardship Branch  
16<sup>th</sup> Floor Queen Square  
45 Alderney Drive  
Dartmouth, NS B2Y 2N6

April 29, 2019

Candace Quinn  
Environmental Assessment Officer  
Nova Scotia Environment  
1903 Barrington Street, Suite 2085  
PO Box 442  
Halifax, NS B3J 2P8

Dear Ms. Quinn:

**Re: Canso Spaceport Facility – Focus Report**

Thank you for providing Environment and Climate Change Canada (ECCC) the opportunity to review the Focus Report required for the above-noted project which was submitted by the proponent on March 11, 2019. The review of report is based on the department's mandated interests under the *Canadian Environmental Protection Act, the Fisheries Act (Sec. 36(3)), the Migratory Bird Convention Act, and the Species at Risk Act*.

Many areas of the Focus Report do not include sufficient information to address the questions raised through the Terms of Reference (TOR). In some cases, such as sections on migratory birds and protected areas, ECCC has presented recommendations for meeting these information requirements. In other areas, in particular information on contingency planning and emergency response, the proponent has presented examples from other facilities but has not fully described the specific work being undertaken for this project. In using our comments, the province may wish to differentiate those which identify potential risks, which ECCC believes, would be required to be better understood to support initial decision making and those related to operations which could be deferred.

The proponent has identified requirements for various federal permitting and approval processes led by Transport Canada and other agencies, but it is not clear from the level of information provided whether requirements for those permits would help to address the issues identified in the TOR and the gaps in the Focus Report.

This project consists of two distinct phases, the construction of the proposed Spaceport and its related infrastructure, and the individual launches, with both having their own concerns. Since it is still not clear how environmental issues might be addressed at the individual launch phase, we have included recommendations for both phases. Upon receiving more certainty on how individual launches will be regulated, we will be able to identify those aspects which could be better addressed during the launch phase.

Please feel free to contact me if you have any questions.

Yours truly,

*Original signed by Stephen Zwicker*

Stephen Zwicker  
Environmental Assessment Section  
Environmental Protection Operations Directorate, Atlantic

cc: M. Hingston  
R. Gautreau  
R. Kotchorek  
MT Grant

## **Environment and Climate Change Canada Comments on Focus Report for the Canso Spaceport Facility Project**

### **Chemical Substances**

As noted in ECCC's August 3, 2018 comments on the EA Registration, all chemical substances to be imported, manufactured, processed, stored or used as part of the project must be identified and described in a manner to confirm applicable regulatory requirements. In the Focus Report, the proponent acknowledges the requirement for Notification under the New Substances Notification Regulations. Based on the information in the Focus Report (Section 1.0), it appears that Unsymmetrical Dimethyl Hydrazine (UDMH) may be stored on site in quantities that exceed the threshold of 1000 kg/yr requiring notification. It is indicated in Section 3.1 that up to 14 000 kg will be used in association with launch activities, however it is not clear what amounts will be stored on site at any one time.

The Focus Report also notes that Federal Environmental Quality Guidelines (FEQG) have been established for hydrazine (p.1-22), but are voluntary unless prescribed in permits or other regulatory instruments. The Guidelines themselves acknowledge these FEQGs apply to the ambient environment and are not effluent limits, but may be used by regulators to derive effluent limits. The limits in the Guidelines are 2.6 micrograms per litre for freshwater aquatic life and 0.2 micrograms per litre for marine aquatic life.

Pollution prevention and control provisions of the *Fisheries Act* are administered and enforced by ECCC. Subsection 36(3) of the *Fisheries Act* prohibits "anyone from depositing or permitting the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter such water". It is the responsibility of the proponent to ensure that activities are managed to prevent the release of substances deleterious to fish. In general, compliance is determined at the last point of control of the substance before it enters waters frequented by fish, or, in any place under any conditions where a substance may enter such waters.

### **Migratory Birds**

#### **Bird Surveys (Section 8.1)**

In order to adequately characterize local migratory bird populations that might be affected by the project, ECCC recommends that complete breeding migratory bird surveys be undertaken prior to project activities commencing as directed in the TOR. ECCC recommends that bird surveys be conducted within the proposed footprint areas of the control centre, the assembly area and the launch site. As it is understood that launches will be in a southerly direction, it is also recommended surveys be conducted south of the launch area.

Maps clearly showing locations where species at risk and species of conservation concern (SOCI) are observed should also be provided. Based on ECCC's review of information provided to date and the department's knowledge of the area, specific survey recommendations are provided below:

## Seabird Colonies

Gulls and terns were observed on surveys conducted and seabird colonies were assumed to be present where congregations were noted. Maps showing seabird colonies in the areas should be provided

## Waterfowl

Harlequin Duck is listed as Special Concern under Schedule 1 of the *Species at Risk Act* (SARA) and the launch site is in the vicinity of Common Eider colonies and wintering areas for waterfowl. Dedicated waterfowl surveys of coastal areas should be undertaken. Incidental observations of waterfowl were noted during shorebird and passerine surveys, but these surveys provide little useful information on waterfowl.

## Shorebirds

The methodology for initial shorebird surveys was first explained as point counts within four hours of sunrise in section 5.6.2 of the EA Registration Document, but was later described as area searches (page 84-86). It should be explicitly stated how surveys were undertaken.

The selection of shorebird survey sites was not adequate for Whimbrel monitoring. Shorebird survey sites seem to be selected based on where one would normally expect to find shorebirds (i.e. in coves and bays), but the project location is a rocky coastline and few shorebirds will be using it overall. The habitat in the project area that are of greatest importance for fall shorebirds are the local bogs. These were not surveyed for shorebirds. The Canso area is optimal habitat for migrating Whimbrel, so if surveys were completed correctly it would be expected that more than a single detection would have been indicated in the report.

Purple Sandpiper overwinter in the Canso area. That the winter surveys for shorebirds for the environmental assessment did not detect Purple Sandpiper is not unexpected because inappropriate methodology was used. Ground surveys are a poor monitoring method for Purple Sandpiper because one often cannot detect them from the shore, and the proponent surveyed coves whereas Purple Sandpiper would use headlands, shoals and offshore islands. It is better to survey the shoreline from the water or from the air for this species.

The shorebird surveys in general were not performed properly, so any characterization undertaken for shorebirds is unreliable based upon the surveys described in the environmental assessment.

## Direct Launch Impacts

The EA Registration Document (page 96) identifies the possibility of bird mortalities occurring because of the flames and steam generated during vehicle launches, but indicates that the possibility is remote and does not present any further discussion. Mitigation measures are not proposed to avoid harm of migratory birds.

Ground nesting species of landbirds (including, but not limited to, Savannah Sparrow, Dark-eyed Junco, and White-throated Sparrow) and species that like to nest on human structures such as American Robin should be discussed in the environmental assessment. These species may be found close to or within the immediate launch area and could be quite susceptible to destruction during launches, especially from May through August. The proponent should identify proposed mitigation measures to avoid harm to migratory birds.

### Noise Impacts (Section 8.2)

Section 8.2 of the Terms of Reference direct the proponent to “Assess potential noise impacts on birds and other wildlife”. As it stands, there is not adequate evidence in the Focus Report to support the conclusion that the level of disturbance from noise will not cause high magnitude effects. The proponent should provide references for its statements regarding effects of noise on birds, or lack thereof, presented in this section. The potential effects of noise should focus on those species for which noise disturbance may be more likely to have a high magnitude adverse effect such as colonial nesters, species at risk, species of conservation interest, and areas of concentration of birds (e.g. coastal staging/wintering populations).

This section also does not appear to include a consideration of the potential effect of the sonic boom in the area between the mainland and Sable Island. Of particular concern are potential effects to Ipswich Sparrows, a species listed as Special Concern under Schedule 1 of SARA, at times of migration, and to seabirds. Utilizing the work undertaken to characterize noise (including the sonic boom) in Appendix C of the EA Registration Document, the proponent should better demonstrate whether there could be any impacts on migratory birds extending to this area. This would also help support the rationale in limiting consideration of “significant habitat features related to birds” to a radius of 5 km.

### Lighting Impacts

Section 8.4 of the TOR directs the proponent to “Provide additional details regarding mitigation, management and/or monitoring measures to confirm impact prediction, and to mitigate potential Project impacts on wildlife and wildlife habitat...” including lighting. Pages 24 and 97 of the EA Registration Document discusses general mitigation opportunities to avoid bird attraction to lights, and notes details would be finalized during lighting design. A wind farm is located between the coast and the proposed launch sit, and under certain conditions, light attraction to the launch site could bring migrating birds into contact with the wind farm. A complete plan for lighting design at the facility and mitigating potential effects of light on migratory birds should be submitted prior to commencement of any project activities.

The potential interactions of a fully-lit spaceport, a nearby wind farm, and nearby seabird colonies and migrating birds of all types could have potential population-level consequences on migratory birds. There has been no mention of conducting additional migratory bird surveys at the nearby wind farm. If the area of the spaceport is lit, surveys should not only occur at the spaceport, but also at the wind farm. Another key consideration of light attraction and cumulative effects is that

a light curtailment plan is being considered for key periods of the year, but the assessment only identifies low visibility periods during fall migration. The entire fall and spring migration periods should be considered for potential periods of low visibility, as well as the breeding season of nearby storm-petrels.

### Bird Species at Risk

The consideration of effects on bird species at risk is incomplete. For example, potential effects on bird SAR such as Harlequin Duck and Ipswich Sparrow are not given particular consideration, and there is no mention of a monitoring plan. These species should be specifically assessed and a follow-up monitoring plan proposed. An assessment focused on SARA listed species and COSEWIC assessed species should be provided including:

- The identification of the adverse effects on the species and its critical habitat.
- Measures that are consistent with applicable recovery strategies and action plans that could be taken to avoid or lessen those effects.
- Specific monitoring to confirm the assessment and/or ensure effectiveness of proposed measures.

### Potential Impacts of Chemical Substances on Wildlife and Wildlife Habitat (Section 8.3)

Section 8.3 of the TOR directs the proponent to “Assess potential impacts of all chemical substances used in launch activities and/or its byproducts or daughter products on wildlife and wildlife habitat from routine Project operation and/or accidents involving these chemicals.” Birds do not appear to have been considered in this assessment.

The EA Registration Document identified (page 95): “Exposure to pollutants, including unsymmetrical dimethylhydrazine (UDMH)” as a potential interaction or effect to birds. However, the environmental assessment then appeared to dismiss this potential effect on page 96 with the following explanation: “... the second stage is not expected to fire until the launch vehicle is in the upper atmosphere and hundreds of kilometers away from the Canso area, so any direct localized effects of this substance on birds is extremely unlikely”.

This statement does not consider the potential for effects to migratory birds as a result of accidents on land or at sea, or the effects of regular operations on seabirds in the area of the drop zone. A clear description of the effects of exposure of each rocket propellant to migratory birds (landbirds, birds in freshwater systems, birds in the nearby colonies, and birds at sea) at the project area and in the drop zone should be provided.

On page 24 of the EA Registration Document, it was stated that: “C4M LV drops the first stage and upper stage fairing just over 2000 km south of the launch site. The upper stage and satellite payload enter and remain in orbit. As is typical in the industry, the first stage and fairing are not recovered and sink to the bottom of the ocean.”

#### Mitigation and Monitoring (Section 8.4)

A comprehensive and detailed list of proposed measures to mitigate effects on wildlife and wildlife habitat during all project phases should have been provided in this section, as well as details of a proposed monitoring program with a commitment to adaptive management in the event of unanticipated impacts. Instead, the proponent has only provided a list including three “engineering and design safeguards” and brief mention that a monitoring program would include “Fauna and flora in areas of possible launch site effect”. Further details should be provided.

#### Protected Areas and Parks (Section 10)

Sable Island National Park Reserve and Important Bird and Biodiversity Areas (e.g. Country Island Complex) do not appear to have been considered. The assessment of potential project impacts, including cumulative effects and effects from accidental events, should be revised to include all protected and designated areas (and the habitats and species which they are meant to protect) potentially affected by the project.

### **Accidental Events and Emergency Management**

#### Contingency Planning

Spill Preparedness is a necessary component of any project proposal that poses a risk of spills to the environment. Development of a ‘preparedness package’ is typically based on a risk analysis derived from an assessment of the likelihood of a spill incident and its potential consequences. Components of such a package would normally include:

- **qualitative assessment** of potential worst-case accident scenarios and their potential consequence impacts, including possible environmental receptors and pathways;
- **quantitative assessment** of potential alternative accident scenarios, including spill frequency and volume estimates;
- **mitigation strategies** (passive and active) to limit or contain such impacts; and
- **integrity management plans** for critical infrastructure and safety equipment.

ECCC encourages proponents to prepare Emergency Response Plans and Spill Contingency Plans that reflect a consideration of potential accidents and malfunctions and that take into account site-specific conditions and sensitivities. Proceeding on the assumption that a catastrophic incident is not only plausible, but rather likely to occur during the lifespan of a project, ECCC recommends the proponent commit to certain mitigative strategies, contingency plans and response capabilities commensurate with their project’s environmental risks that include, but are not limited to:

- contingency plans based on “worst-case” and “alternative” accident scenarios;
- training and exercise programs;

- staff certification and continuous improvement programs;
- environmental sensitivity identification and mapping;
- contaminant trajectory and dispersion modeling for all seasons of the year;
- spill counter-measures testing and practice;
- multi-organizational mutual aid agreements;
- community awareness and education initiatives;
- community notification and communications procedures; and
- spill research and development programs.

The Focus Report does not include information on the expected effectiveness of spill response measures nor of reversibility of environmental consequences resulting from spills of hydrazine, NTO or UDMH. A discussion on the expected effectiveness of spill response measures would help in understanding the extent of any environmental consequences including the potential for long-term impacts and required monitoring.

The Focus Report does not include a discussion of a potential failure involving the launch pad infrastructure that could result in an off-axis launch that would result in an unplanned or undesirable flight path. Such a plausible malfunction would be expected to be detailed in a Hazard Identification and Quantitative Risk Assessment. Such an assessment would be useful to identify public safety aspects and other potential environmental receptors to a spill or release of hazardous substances from the Project.

The Focus Report does not indicate the proponent has conducted, or has committed to conduct atmospheric transport and dispersion modelling for worst-case explosion, explosion fall-out, and spill vapour scenarios involving hydrazine, NTO or UDMH on the launch pad or in lower-level failure incidents. Such modelling, conducted through all seasons of the year, would help establish the geographic footprint of a worst-case scenario on which the proponent should base emergency preparedness and response planning and associated equipment capacities.

Section 5.2, Other Major Accident and Malfunctions, provides no details on the potential propagation of failures/effects, details on contributing and complicating factors, nor details on the potential effects to adjacent structures and hazardous materials storage areas, including what facility design features would help to prevent and/or mitigate such consequences. This level of detail helps in understanding the extent of what a worst-case accident or malfunction scenario could entail, and thus provide a more complete picture of the environmental consequences that may be possible beyond the project property.

While safeguards such as fixed fire suppression and wash-down capabilities with secondary containment are indicated on page 11-7 of the Focus Report, there are no details provided on the actual type of fire suppression system and possible effects that such a system could have on the environment. While it is understood that detailed project design specifications are not confirmed at this stage of project planning, the proponent should be aware that the use of certain fire suppression systems might cause possible adverse effects to aquatic receptors. Under the *Canadian Environmental Protection Act* (CEPA) the use of firefighting foams containing PFOS



and PFOA is prohibited (<https://www.canada.ca/en/environment-climate-change/services/management-toxic-substances/list-canadian-environmental-protection-act/perfluorooctane-sulfonate/film-forming-foam-prohibition-toxic-substances.html>).

The proponent should consider how to avoid or minimize the risk of introducing other persistent organic compounds from chemical based fire suppression systems (e.g. by using water curtains and/or other environmentally-friendly fire suppression alternatives) in order to safeguard water quality to the maximum extent possible

The Focus Report provides limited detail on the maximum expected quantities of rocket fuels, oxidizers and other hazardous substances that would be present on the launch pad, and thus available to be released to the environment should a major accident or malfunction incident compromise the launch vehicle assembly during a launch sequence.

ECCC recommends that the proponent provide more specific detail on the maximum quantities of the substances that would be present on the launch pad as well as the maximum volume and extent of spills that the launch pad catchment system would be able to effectively contain in the event that not all substances would be combusted during a failed launch attempt.

Section 12.1 Contingency Planning, does not appear to adequately address the requirement of the of Terms of Reference that MLS: *“Provide a detailed contingency plan that includes a full hazard identification and qualitative risk assessment associated with the Project construction and operation, including those which have or may have an environmental impact (directly or indirectly).”* Specifically:

- The provision of a full hazard identification would help develop a better understanding of all the hazards that are possible for the Project.
- The provision of a “qualitative” risk assessment would help provide the site-specific context needed to understand the potential biotic receptors that would likely be impacted by accidents or malfunctions.
- The proponent references a “quantitative” risk assessment that included an expected casualty analysis, flight safety analysis, and ground safety analysis, and indicated this was *“reviewed and accepted by Transport Canada”*. Some detail of that assessment, if not the complete product would help provide some necessary context
- The provision of a quantitative risk assessment would help to better understand the probabilities, spill frequencies and spill quantities possible to result from major accidents and malfunctions and thus the probabilities and extent of the resulting environmental consequences occurring.

It is noted in Section 12.2, that the proponent has committed to developing an agreement with the Municipality of the District of Guysborough to place a paid staff (in place of the current volunteer based-fire department) that would be able to respond to emergency incidents at the project site. It is also noted that the proponent will help in evaluating the emergency medical response service capabilities in place at the local hospital against the potential response scenarios and address

any necessary additional training or skill levels increases. Such augmentations of local capacities however, may still only provide for a fraction of the resource levels that are in place to support other established spaceport facilities in North America.

From an environmental perspective, ECCC is of the view that similar commitments to augment environmental spill response capacities in the project area are warranted given the relative remoteness of the project site, given the time-sensitive nature of effective spill response, and given the potential consequences that a spill of hydrazine, NTO and/or UDMH may pose to the natural environment. Specifically, ECCC recommends:

- The yet-to-be developed Emergency Response Plan be scaled and augmented in relation to the locally available resources and their general training and equipment capacities.
- An Emergencies Communications Plan and Emergency Procedures be developed for surrounding communities that would likely be impacted by the consequences of a significant emergency incident. Emergency procedures should ideally include a combination of urgent immediate actions, (such as public notification of safety issues, shelter-in-place and evacuation directions), as well as longer term actions (such as general website and hotlines, incident status updates, injured wildlife reporting, *etc.*).
- A standing contract be put in place with a spill response organization that is adequately equipped to develop tactical response plans for toxic substances and that is able to fully respond to spills of hazardous fuels and oxidizers in an expeditious manner.
- A commitment to any long-term environmental monitoring of soil, water, flora and fauna should an accident or malfunction scenario ever result in any off-site environmental consequences.

On p.12-4 the report states: *“If the situation warrants it, the Province will request help from the federal government through the Office of Critical Infrastructure Protection and Emergency Preparedness Canada (EPC). EPC is the federal liaison between the provincial and municipal emergency preparedness communities (Municipality of the County of Antigonish 2019).”*

It should be noted the Office of Critical Infrastructure Protection has not existed for a number of years. This reference should be changed to Public Safety Canada.

#### Key References Related to Emergency Response and Contingency Planning

ECCC encourages proponents to prepare Emergency Response Plans and Spill Contingency Plans that reflect a consideration of potential accidents and malfunctions and that take into account site-specific conditions and sensitivities. The Canadian Standards Association publication, *Emergency Preparedness and Response, CAN/CSA-Z731-03<sup>1</sup>*, is a useful reference for this.

---

<sup>1</sup> Canadian Standards Association. *CAN/CSA-Z731-03, Emergency Preparedness and Response, (R2014).*

ECCC recommends that the proponent document worst-case accident and malfunction scenarios in a manner that is consistent with one or both of the OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response<sup>2</sup>, and the CRAIM 2007 Risk Management Guide for Major Industrial Accidents<sup>3</sup>.

ECCC recommends that the CRAIM (2007) guidance be followed for estimating impact distances for alternative accident scenarios. The Proponents may use any appropriate model to estimate the impact distance for a regulated toxic substance, however, site-specific conditions must be used, including typical weather conditions, and consider active and passive mitigation measures. Proponents must use the appropriate toxicity thresholds available for each substance (hazard level) as stipulated in CRAIM (2007).

ECCC encourages proponents to refer to both the OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response, as well as its addendum, and to integrate the relevant follow-up guidance aspects into their Environmental Impact Statements and project design plans whenever feasible.

ECCC appreciates when proponents commit to developing and adhering to Environmental Management and Safety Management Systems that include Emergency Response Plans (based on *CSA Standard CAN/CSA Z731-03 (R2009) Emergency Preparedness and Response*) detailing all relevant roles and responsibilities of their response personnel.

### **Other Regulatory Requirements**

The proponent should also be reminded of other potential regulatory requirements identified in ECCC's August 3, 2018 comments including the Environmental Emergency Regulations and the National Pollutant Release Inventory.

---

<sup>2</sup> *OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response, 2003 No. 10.*  
<http://www.oecd.org/env/ehs/risk-management/publicationsintheseriesonchemicalaccidents.htm>

<sup>3</sup> Major Industrial Accidents Reduction Council (CRAIM), 2007. *Risk Management Guide for Major Industrial Accidents*. Page 177

**From:** [Lamb, Tom](#)  
**To:** [Quinn, Candace M](#)  
**Cc:** [MacPherson, George E](#); [Hennick, Ernie W](#)  
**Subject:** RE: Canso Spaceport Facility Project - Focus Report for Environmental Assessment  
**Date:** May 7, 2019 8:55:56 AM

---

Hello Candace,

The Mineral Management Division of the Department of Energy and Mines has no comment on the Focus Report for the Canso Spaceport Facility Project.

Thank you for the opportunity to provide comment.

Regards,

**Tom Lamb | Mining Engineer | Mineral Development and Policy Section**  
**Department of Energy and Mines | Geoscience and Mines Branch**  
Founders Square  
1701 Hollis St., 2<sup>nd</sup> Floor  
PO Box 698  
Halifax, NS B3J 2T9  
 902-424-4911 |  902-424-7735 |  [Tom.Lamb@novascotia.ca](mailto:Tom.Lamb@novascotia.ca)

---

22 April 2019

## **Review of the Canso Spaceport Facility Focus Report**

## 1.0 Introduction

This report is submitted to Nova Scotia Environment (NSE) and summarizes the authors' review of the environmental Focus Report that was prepared for NSE by Maritime Launch Services (MLS) related to their proposed Canso spaceport facility.

Specifically, this report assesses:

- Whether the Focus Report meets Sections 1.2 and 5.2 of the Terms of Reference and, where needed, provides comments on the accuracy of the information provided;
- Whether the focus report sufficiently assesses the potential project-related impacts on soil, sediment, surface water, groundwater and air quality, from both nominal operations and credible worst-case accident and malfunction scenarios;
- Whether MLS' proposed mitigation, management and/or monitoring measures are appropriate, and if not, provides comments on the types of follow-up measures that are necessary to verify impact prediction and ensure environmental protection; and
- Whether the Focus Report sufficiently assesses the potential project-related impacts on soil, sediment, surface water, groundwater and air quality related to the breakdown products of UDMH, including N-nitroso-dimethylamine (NDMA), should they be released to the environment.

It is recognized that while this would be the first orbital spaceport in Canada, such facilities exist in other countries. In evaluating the MLS Focus Report, the practices and experiences at other operational spaceports were considered, both to provide context and to assess whether the proposed Canso spaceport meets, or could meet, the required safety standards.

The primary focus of this report is on the hazards related to the use of 1,1-dimethylhydrazine (UDMH) and dinitrogen tetroxide (NTO) as the propellants in the second stage of the Cyclone-4M launch vehicle which MLS proposes to operate from the site, as well as the use of smaller quantities of hydrazine in the propulsion systems of payloads to be launched. This was due to the toxic nature of these chemicals, combined with the fact that there is little prior experience in Canada with their use.

## 2.0 Background

### 2.1 Space Launch Operations

Satellites and space-based infrastructure have over the course of the past 60 years become an increasingly significant component of how we communicate, navigate, and learn about and monitor our environment, our planet, and the universe beyond it. Originally driven by government space programs in the USSR and United States, space has become increasingly vital commercially. As the cost and size of electronics has been reduced and their capabilities increased, new national and private-sector players have been rising to prominence worldwide in a rapidly growing international space economy. This growth is driving demand for more low-cost launches, and in recognition of that demand, and of the growing reality that space-based assets represent increasingly vital national infrastructure, there has been a notable surge of efforts to develop new launch vehicles and new spaceports from which to launch them.

## 2.2 Launch Vehicle Propellants and Staging

Considerable amounts of energy are required to launch a spacecraft and accelerate it to the velocities necessary to remain in orbit. Providing that energy requires lightweight vehicles and large amounts of energetic propellants: a fuel, and an oxidizer that combusts with the fuel. In most cases a greater amount of oxidizer is required than fuel, by mass, often double or more, so the oxidizer typically represents 2/3 or more of the total propellant mass on board.

All current launch vehicles employ two or more “stages”, each stage consisting of its own engine(s) and propellant. When one stage has consumed all its propellant, the stage is dropped off to reduce the dead weight that the launch vehicle must carry, and the next stage engine ignites to power the vehicle through the next phase of flight. The process continues until the final, or “upper” stage completes the insertion of the payload into its orbit. The first stage is always by far the largest, both in terms of the mass of propellant it carries and the thrust of its engines. It is the first stage that propels the launch vehicle when its total weight is greatest, lifting it off the pad and powering it through the first phase of flight. By the time the first stage shuts down, the vehicle is typically 50 – 100 km or more downrange, traveling at several times the speed of sound at an altitude greater than 50 km. It’s not uncommon for different stages of the same rocket to use different propellants.

Rockets are often referred to by the physical state of their propellants. A liquid rocket employs a fuel and an oxidizer in the liquid state, stored separately in tanks, while a solid rocket employs a solid fuel (metal powders and rubber binders, most commonly) and solid oxidizer (often ammonium perchlorate or ammonium nitrate), premixed together and cast into a chamber. Within both of these categories, there are several propellant combinations that are particularly common.

The most common liquid propellant combinations currently in use (oxidizer and fuel) include:

- Liquid oxygen (LOX) and kerosene (typically a highly refined grade known as RP-1)
- Liquid oxygen and liquid hydrogen (LH2)
- Storables, including UDMH and NTO.

LOX/RP-1 is among the most common combinations, particularly for the first stages of launch vehicles. SpaceX’s Falcon 1, Falcon 9 and Falcon Heavy launch vehicles are notable examples that use this combination for both their first and second stages.

LOX/LH2 is a higher performance combination, but is complicated by the fact that LH2 is deeply cryogenic and very low density, requiring larger (and therefore heavier) tanks to store it. The American Delta IV launch vehicle and the ECA variant of the European Ariane 5 are notable examples of vehicles employing LOX/LH2 in their first stage. This propellant combination is particularly common for upper stage use on US and European launch vehicles.

Storable propellants are those which, unlike LOX or LH2, are liquids at room temperature. These are typically hypergolic, i.e. chemicals that ignite spontaneously on contact with each other without the need for any additional ignition source, and in most cases are also highly toxic.

The most common such fuels are hydrazines (hydrazine, UDMH, monomethyl hydrazine (MMH), and blends of them), with dinitrogen tetroxide (NTO) and red fuming nitric acid (RFNA, a blend of nitric acid, NTO, and a small amount of water) being the most common such oxidizers.

In spite of the hazards, their storable nature made them desirable historically as it allowed a vehicle to remain fueled and ready for launch indefinitely, which is not possible with cryogenic propellants like LOX or LH2. This was particularly important for military missiles, and it carried over into space launch vehicles that were derived from them.

Their hypergolic nature has been the second major reason for their use, avoiding the added weight, complexity and failure modes of a separate ignition system. When used for upper stages, this greatly simplifies starting the engine multiple times, which some missions require.

Russian and Chinese vehicles in particular have tended to make considerable use of storable propellants. In the West, the US Titan series of launch vehicles used NTO and a 50/50 blend of UDMH and hydrazine known as aerazine-50 for its first stage. The Delta II used the same propellant combination in its second stage. Most versions of the European Ariane 5 used NTO and MMH for their upper stages, and the current European Vega launch vehicle uses NTO and UDMH for its upper stage.

The Cyclone-4M that MLS proposes to operate is an example of a 2-stage launch vehicle, with both stages employing liquid propellants. The first stage makes use of LOX and RP-1 kerosene (or equivalent), while the second stage employs NTO and UDMH.

### 2.3 Launch Vehicle Hazards

While the term “spaceport” suggests parallels with other transportation infrastructure such as airports and sea ports, there are notable differences. The frequency of launch operations is much lower: the MLS Focus Report notes ramping up to a planned flight rate of up to 8 per year, compared to hundreds or thousands of flights every day at most airports.

During nominal operations, the environmental impact is largely a function of the exhaust products of the lower-stage engine(s), and any residual propellants left in those stages when they are dropped off. The upper stage meanwhile only operates at very high altitudes and speeds, meaning that any exhaust products are extremely dilute and pose no hazard on the ground. When that stage is jettisoned, it remains in orbit for a time before eventually re-entering the atmosphere at high speed and burning up. Typically its tanks are vented to the vacuum of space to ensure there is no remaining pressure or propellant on board by the time the stage re-enters.

The very low flight rates of these vehicles tend to mean that on an annual basis, the emissions produced by launches from a spaceport are quite low, and at current flight rates are orders of magnitude lower than what is produced by aircraft.

The more severe environmental hazards come from potential launch vehicle failures. While typical launch vehicle flight rates are low, they are complex, high-performance systems with much higher probability of failure than a modern aircraft. The recently retired United Launch Alliance Delta II medium-class launch vehicle, for example, represented one of the highest demonstrated reliabilities of any US launcher, at about 98%. [1] (p.216). Because of the large quantities of very energetic and sometimes toxic propellants on board, there is the potential for release of some of that energy and some of those propellants in the case of a failure on the launch pad or in flight.

Therefore from a hazard standpoint, the low launch rate is counterbalanced somewhat by the greater probability of failure of a given launch, and the likely explosion, projection of fragments, and propellant release if a failure does occur. The degree to which such a failure poses a hazard to the public or the



environment depends on what point in the flight the failure occurs, where the launch site is located, what the launch trajectory is, and specifics of the launch vehicle in question and its propellants.

Standard practice when siting and designing any spaceport calls for consideration of a worst-case failure of the largest launch vehicle planned to operate from the site, quantifying it as far as possible, and ensuring that it will pose no hazard to the public. The means of achieving this typically include:

- Calculating the required safety clear distances from a worst-case exploding rocket, considering both the blast wave and fragment throw distances and ensuring that the uninvolved public is well outside of this.
- Use of a highly reliable flight termination system onboard the vehicle to terminate engine thrust or otherwise destroy the vehicle as soon as it begins to deviate from a nominal trajectory.
- Developing modeling tools to assess the dispersion of the vehicle's exhaust plume during a nominal launch, as well as the potential toxic cloud during a worst-case propellant spill, explosion or crash as a function of weather and wind conditions, and developing launch commit ("go - no go") criteria to ensure that if the weather is such that either the exhaust or the cloud from a spill or explosion could pose a hazard to population centers, the launch shall not proceed.
- Considering the propagation of failures, and designing the launch facility to ensure that one failure does not lead to larger ones.
- Maintaining detailed contingency and emergency response plans to respond to all possible failure cases, and ensuring the necessary manpower with the necessary training is available to execute them.

## 2.4 Hydrazine Use in Launch Vehicles and Payloads

Hydrazine and its variants are used for both launch vehicle and spacecraft (satellite) propulsion applications, and it should be emphasized that these are distinctly different applications in terms of the quantities of propellants involved and the reasons for their use.

### 2.4.1 Launch Vehicles

For launch vehicle applications, UDMH is the most widely used hydrazine variant. In the US, a blend of hydrazine and UDMH called aerazine-50 has been the most common hydrazine-based fuel.

Hydrazine on its own is typically unsuitable as a launch vehicle fuel due to its poor thermal stability when used to cool a large rocket engine. Launch vehicles employing hydrazine will most commonly make use of NTO as the oxidizer, this combination being hypergolic (i.e. will ignite spontaneously on contact).

UDMH/NTO and aerazine-50/NTO propulsion systems have historically been used on all stages of launch vehicles, but in most cases are being used less frequently on the first stage in particular. They remain somewhat more prevalent in upper stage applications.

Lower stages contain significantly larger propellant quantities than upper stages, and tend to fall back to earth with residual propellants still on board, often without significant breakup. When hydrazines are used on first stages in particular, they directly expose the launch site to exhaust products that tend to be more toxic than that produced by LOX/RP-1 or LOX-LH2 engines, and have the potential of releasing very large quantities of their toxic propellants in the event of an accident. This can lead to significant site contamination, as has been seen in the vicinity of launch sites such as the Baikonur Cosmodrome in

Kazakhstan where vehicles having UDMH/NTO first stages have been widely used. For these reasons, hydrazine use for lower stages is becoming less common.

In spite of the toxicity and handling complications, hydrazines still see some use for upper stages where the quantities involved are lower, normal operation only occurs well away from the launch site and at high altitude, and the stage reaches orbit before eventually re-entering the atmosphere at high speed and largely burning up. Significantly, the hypergolic nature of the propellants ensures reliable ignition without the added weight and complexity of a separate ignition system, and makes re-starting the engine in orbit after a coast phase simple and reliable.

The European Vega launch vehicle employs UDMH and NTO in its upper stage, as one example. The highly reliable and successful US Delta II vehicle employed aerzine-50 for its upper stage as well, but recently completed its last launch after 30 years in service due mainly to cost [2].

#### 2.4.2 Spacecraft Propulsion

In-space propulsion systems very commonly employ hydrazine as a monopropellant (i.e. without the use of an oxidizer, employing a catalyst to exothermically decompose it). Monopropellant hydrazine is less fuel efficient than bipropellant systems, but for spacecraft use it offers simplicity, low weight, low cost, and very fast and precise control. In applications that require higher efficiency and often higher thrust, MMH or UDMH are also commonly used as part of a bipropellant system with NTO or MON (Mixed Oxides of Nitrogen).

There are efforts underway internationally to find a less toxic replacement for monopropellant hydrazine for spacecraft applications, typically involving propellants based on hydroxyl ammonium nitrate (HAN) or ammonium dinitramide (ADN). These efforts have not yet succeeded in supplanting hydrazine, as they tend to require much more costly hardware and have their own drawbacks.

At the present time, and likely for several years to come, hydrazine remains by far the most popular propellant for in-space use, and any commercial launch operator that cannot handle and launch spacecraft using these propellants would find their potential customer base significantly limited. As such, it is likely that for the time being, it will be difficult for a spaceport to avoid the necessity of handling at least spacecraft quantities of hydrazine.

It should additionally be emphasized that these efforts are targeted specifically towards replacing monopropellant hydrazine for in-space use. They would not be suitable for stage engines on a launch vehicle and have not been proposed for such.

### 2.5 Oxidizer Hazards

It is noted that the hazards posed by hydrazine were the main emphasis in the *Terms of Reference for the Preparation of a Focus Report (Regarding the Canso Spaceport Facility, Proposed by Maritime Launch Service Ltd., September 17, 2018)*. It must be stressed however that both of the oxidizers (liquid oxygen and NTO) also present their own hazards that must be considered from a safety standpoint. By far the most acutely hazardous propellant is the NTO.

#### 2.5.1 Dinitrogen Tetroxide (N<sub>2</sub>O<sub>4</sub>)

Commonly referred to interchangeably as either dinitrogen tetroxide or nitrogen tetroxide. It is also essentially the same substance as nitrogen dioxide (NO<sub>2</sub>), also known as nitrogen peroxide, since they

exist in equilibrium and one converts to the other quite freely depending on conditions. In a tank under pressure, most of the liquid exists as  $N_2O_4$ ; in open air, most of the vapor is  $NO_2$ .

NTO's boiling point is about  $21^\circ C$ , so it is normally stored in closed tanks under slight pressure to keep it liquid at room temperature. At almost any likely temperature it has a sizable vapor pressure (for example, even at  $-10^\circ C$  it's still at about 20 kPa), so it will escape into the air very readily if given the chance, and secondary-containment systems must be designed to trap the vapor as well as the liquid. However, at Canadian winter temperatures it would boil away relatively slowly, so it could still flow for a considerable distance as liquid.

NTO is non-corrosive if kept absolutely free of water, but in the presence of even small amounts of water it reacts to produce nitric acid. The acid can then attack metal tanks and plumbing; not only is this a direct problem, but the metal nitrates that result can dissolve in the NTO and precipitate out elsewhere, and there is a notorious problem with NTO valves failing to reseal perfectly on closing because of obstruction by nitrate crystals. Special valve designs exist which can help. Acid formation is also obviously an issue for secondary-containment systems.

The reaction with water also occurs in the lungs when NTO is inhaled, which is why NTO's toxicity is greater than some World War One war gases.

Another complication is that the effects on humans from exposure are delayed and often there are no immediate symptoms to warn of the danger. "A few breaths ... in a concentration of 200-700 ppm will produce severe pulmonary damage which may result in fatal pulmonary edema [developing] after 5-8 hours or more have elapsed." (Matheson Gas Data Book, 6th ed.)

Much of the concern about the proposal has emphasized hydrazine and related compounds, perhaps because they have had considerable media attention, and this was clearly reflected in what was asked for in the Terms of Reference for the Preparation of a Focus Report. It should be stressed that greater attention is warranted to their companion propellant, NTO. From an environmental standpoint, it does indeed lack most of the longer-term issues that are present with hydrazines, since it is quite volatile and very reactive and thus doesn't remain around for long. In a large body of water it will form nitric acid and quickly become diluted. It's also not thought to be carcinogenic, unlike the hydrazines. The price for this is that it is difficult to control once it gets loose, and its acute toxicity is far greater than any of the hydrazines.

These issues are touched on only very lightly in the Focus Report. One place where NTO does appear is Table 6.3, which shows hazard distances for NTO spills several times those of the hydrazines, reaching multiple kilometers in a brisk wind. The spill quantity assumed in the table is 1200 kg, which is a reasonable number for a sizable *spacecraft* propulsion system, but page 3-1 indicates that the Cyclone-4M second stage contains 7700 kg of NTO -- six times as much. The Focus Report also does note the toxicity of NTO in its discussion of human health in section 11.

Given its volatility and toxicity, NTO, and not hydrazine/UDMH, is likely to be the worst immediate chemical hazard after a major handling accident or a low-altitude launch failure. Modeling of dispersion in the event of a toxic spill and development of launch go-no go criteria must place a heavy emphasis on the NTO, and safe storage, piping system design and containment of both liquid and vapours in the event of a spill must be driving factors in the design of the facility and operation. While other spaceports have taken the necessary steps to manage these hazards, it is essential that MLS pay the necessary attention to detail to ensure that they do as well.

### 2.5.2 Liquid Oxygen

While liquid oxygen itself is environmentally benign, it does present hazards that must be catered for in the detailed design and operation of a spaceport or other facility, both as a cryogenic liquid and as a strong oxidizer. Primarily these hazards relate not to the oxygen itself but to the potential propagation of failures in the event of a spill. Oxygen-enriched atmospheres greatly encourage the ignition of materials exposed to them, and spills of liquid oxygen onto common materials such as asphalt can create a contact explosive. The very low temperatures of LOX also make some common structural materials brittle, and structural failures have occasionally transformed a minor LOX spill into a major accident. These hazards are readily manageable, and liquid oxygen is widely used in industry and well understood, but it should be emphasized that they must be properly accounted for.

## 3.0 Review of MLS Focus Report

### 3.1 Impacts due to Nominal Operations

The focus report discusses the project impacts to soil, sediment, surface water, groundwater and air quality in several different sections.

The most hazardous substances to be handled at the site, the hydrazine for payloads and the UDMH and NTO for the upper stage of the Cyclone-4M, would not pose a hazard during nominal operations or during minor spills so long as appropriate training, controls and containment, protective equipment, and engineering design of the facilities and propellant storage & handling equipment are observed.

The upper stage only operates at high altitudes (greater than about 50 km typically) and high speeds, well away from populated areas, thus any hazardous constituents in the exhaust plume do not pose a threat.

It should be noted that it is standard practice with modern launch vehicles to ensure that the upper stage propellant tanks are vented to the vacuum of space after delivering the payload to orbit. The focus report did not explicitly state that the Cyclone-4M does this, so MLS should confirm that it will. If this is done, any residual propellants in the tank would quickly vent to space, removing any concern of toxic contamination reaching the ground when the upper stage eventually re-enters the atmosphere.

Under normal operations, it will be the exhaust plume of the first stage of the launch vehicle that constitutes the primary impact to the vicinity of the launch site. The proposed Cyclone-4M burns LOX and RP-1 for its first stage. RP-1 is a highly refined kerosene, somewhat akin to Jet-A or other kerosenes but having lower sulphur, aromatics and other impurities in order to make it less prone to coking and polymerizing when it is used to cool the combustion chamber of the engine. RP-1 also leaves much less residue in the event of a spill. For its first stage, the Cyclone-4M employs a variant of the RD-870 rocket engine, a high performance oxidizer-rich staged combustion engine. Such engines typically have more complete combustion than other kerosene-burning engines.

To verify the assertion that the impacts to the site due to the first stage operation are likely to be insignificant, it is noted from Table 3.1 of the Focus Report that the Cyclone-4M contains 62 300 kg of RP-1. RP-1 is a more highly refined propellant than the Jet-A typically employed in aircraft turbine engines, but is similar enough that a comparison may be made.

The European Aviation Safety Agency (EASA) maintains a database of turbofan engine performance and emissions data [3]. It defines a standard LTO cycle (Landing and Take Off) which characterizes the typical operational conditions of an aircraft engine within the environs of an airport, including landing, taxiing and ground handling, shutdown, start, idling and taking off. This data is provided on a per-engine basis. Most modern commercial airliners employ two engines, though some use three or four. A relatively large airport such as Toronto Pearson International typically sees about 1250 departures per day [4], while a small domestic / international airport such as Buffalo Niagara hosts about 100 per day [5].

If we take a typical common turbofan engine such as the GE CF6 as representative, EASA reports this engine as burning 887 kg of kerosene during one LTO cycle. Assuming a smaller airport experiencing 100 twin-engine flights per day using engines of around this fuel consumption, that equates to about 177 400 kg of kerosene burned each day at the airport. This represents about three times the full fuel load of a Cyclone-4M's first stage.

Therefore, the total kerosene burned annually by all Cyclone-4M launches at the planned peak flight rate of 8 per year, as stated in the Focus Report, is comparable to what is burned at a relatively small international airport in about 3 days of operation. In other words, on an annual basis such an airport would be expected to contribute emissions, soot and particulate from burning a quantity of kerosene (Jet-A / Jet-A1) that is more than 120 times greater than all planned annual launches from the proposed Canso spaceport.

In fact, not all of the fuel consumption by the Cyclone-4M's first stage will occur in the vicinity of the spaceport, so this calculation is likely fairly conservative. This appears to support the assertion that compared to even a fairly small airport, the emissions from the proposed spaceport are not significant.

## **3.2 Focus Report Section 1.2: Hydrazine and Related Chemicals**

### **3.2.1 A Jurisdictional review of where hydrazine-related chemicals are used for similar spaceport facilities in developed countries, and a list of spaceports in developed countries where hydrazine related chemicals are used currently**

The focus report provides a good overview of the uses of hydrazines in both their space and industrial applications, and notes current Canadian uses of hydrazine as an agricultural chemical and for boiler water treatment in power plants.

It is worth noting that hydrazine has somewhat greater toxicity than UDMH.

The report correctly points out the wide range of uses for hydrazine on spacecraft, including both launch vehicles and in-space propulsion systems. They also rightly note that even SpaceX is employing it on their Dragon space capsule, and Orbital Sciences are using it on their Cygnus spacecraft.

They also correctly noted that almost every spaceport makes use of hydrazines in smaller quantities for spacecraft, larger quantities for launch vehicles, or both.

The list of "some of the larger government and commercial rocket design and launch service organizations and facilities" is somewhat confusing as it appears to be just a disorganized list, but having said that, it is true that hydrazine remains a common propellant, and is even used in thrusters being produced by new entrepreneurial space companies such as SpaceX in the USA.

### **3.2.2 Information on precisely how, and for what purpose, hydrazine related chemicals are used by facilities highlighted above**

The Focus Report correctly notes that hydrazines are used both as propellants in some launch vehicle stages, and more commonly, in the much smaller propulsion systems employed by many spacecraft. It is also rightly pointed out that the major reason for their continued use in spite of their toxicity is the simplicity and reliability of the resulting propulsion systems, owing to lack of a separate ignition system, simple fast restart capability, and the long-term storability of the propellants.

See also sections 2.2 and 2.4 for additional discussion of launch vehicle systems and hydrazine applications.

### **3.2.3 A discussion of current regulatory requirements and standards where hydrazine-related chemicals are used for spaceports in developed countries**

This section of the Focus Report provides an extremely lengthy but quite comprehensive survey of the regulatory requirements and standards for hydrazine use at spaceports. In addition to discussing the regulations and standards at spaceports, it demonstrates a good understanding of the current Canadian context and relevant Canadian regulations, as hydrazine is used on occasion for industrial applications. The discussion was detailed and quantified both its uses in Canadian industry as an oxygen scavenger / corrosion inhibitor in boiler water at power plants, as well as an intermediate in production of pesticides and agricultural chemicals.

It also noted that as in other countries, Canada rightly identifies hydrazine as a toxic substance and while no attempts are underway to eliminate it, its use is to be managed to prevent or minimize its release.

For its jurisdictional review of hydrazine use at spaceports, MLS proposed a scope that appears to be reasonable and comprehensive, including:

- General regulation of spaceports
- Transportation of hazardous materials
- Worker and public health & safety
- Hazardous materials management
- Hazardous waste management
- Air quality
- Water quality
- Spills & contingency planning
- Cleanup guidelines

The focus on the United States is reasonable since, as they note, hydrazine's use at spaceports is ubiquitous and the US standards are likely among the most stringent and the most directly applicable.

They correctly identify that the agency guidance provided by NASA is widely considered to be the standard for technical guidance and best practices to support regulatory compliance in the use of hydrazine in developed countries. Rigorous application of these standards and best practices to the MLS spaceport would help facilitate safety.

They correctly note that Cape Canaveral Air Force Station (CCAFS), Kennedy Space Center, Wallops Island and Kodiak are all known to support launches that employ hydrazines, either in the launcher or in the spacecraft [1]. This covers all the major currently-operating sites.

It should additionally be noted that Wallops Island is likely a particularly useful reference, as it is a coastal Atlantic spaceport that is situated a similar distance from its nearest neighbours as the proposed MLS site.

The Focus Report points to several US launch vehicles employing hydrazine, including the Athena series, the Delta II, the Minotaur, the Taurus II and the Titan II. It should be noted that not all of these vehicles are currently flying. The Titan and Athena family are no longer in service, and the Delta II was recently retired. As a minor note, the Titan II actually used considerably more than just the 41 kg of hydrazine stated. The first stage of the vehicle employed over 30 000 kg of Aerozine-50, which is a 50/50 mix of hydrazine and UDMH. The remaining listed vehicles employed various hydrazines in their baseline or optional upper stages only.

It should also be noted that the European Vega small launch vehicle currently employs a NTO / UDMH upper stage.

The report correctly identifies the general regulatory framework in the US, where the FAA Administrator for Commercial Space Transportation (FAA-AST) has authority to issue safety approvals for launch vehicles, re-entry vehicles, spaceports, safety systems and processes, and personnel qualification.

Site-specific guidances are developed to distill the applicable regulations into actionable or digestible documents, and the Focus Report identifies and provides links to these. It also provides a comprehensive look at worker health and safety, correctly noting the major hazards and the nature of hydrazines as probable human carcinogens and providing a good survey of the relevant Occupational Health and Safety standards, including OSHA, NASA, the US Army, the FAA, and the US Air Force, and the requirement for appropriate personal protective equipment and for toxic vapour detectors in facilities to monitor leaks. It should additionally be noted that UDMH in particular is somewhat less toxic than hydrazine and MMH.

This section rightly notes the hazardous nature of NTO, which is much more acutely toxic than hydrazine, but also shorter lived in the environment.

The section demonstrates an understanding of the regulations for transportation of hazardous materials, and for the storage of hydrazine.

The discussions of relevant federal and state environmental codes and regulations, and the management of hazardous materials were similarly comprehensive and included the relevant military and NASA standards.

Sections on air quality, water quality, and management of hazardous waste all provided comprehensive summaries of the relevant federal, state and site-specific regulations and approaches.

The hazardous material spill and contingency planning section did demonstrate an understanding of the hazards, and that spills, fires and explosions are possible outcomes from accidents during payload processing and could cause severe injuries or death if not appropriately managed. This discussion seems somewhat out of place in section 1.2 of the Focus Report and looks like it relates more to section 5.2, as it touches on spill and failure scenarios and their probable impacts.

They note that a catastrophic accident during processing is extremely unlikely, but it should be emphasized that in practice, this will depend on safe, redundant design, operation, and training. MLS does appear to recognize this and indicated their intent to design the facility accordingly, emphasizing that:

- Most propellant spills would be contained within the payload processing facility.
- Facility design would limit damage to the spacecraft and the transfer area.
- Toxic Hazard Assessment of the facility would provide additional protection by identifying safety clear areas during propellant operations

These are good general principles. It should be ensured that they are translated into specific design elements and processes as the MLS project progresses.

The Focus Report then turns to discussions of the Canadian regulatory environment, showing a comprehensive understanding of the present framework. It notes that in terms of launch licensing, there is currently very little definition with the Canadian Aeronautics Act, allowing for launches in principle but not defining any process or standards for obtaining launch approval.

Discussion of the Transportation of Dangerous Goods Act, Environmental statutes and regulations, and relevant Nova Scotia provincial regulations appear to be complete and accurate. In particular, it noted existing Federal Environmental Quality Guidelines for hydrazine, which defined water quality guidelines for hydrazine that are protective of freshwater aquatic life. It also noted that hydrazine was found not to meet the criteria for persistence and bioaccumulation and is considered to biodegrade quickly.

It should be emphasized however that unlike hydrazine, UDMH in particular will degrade into NDMA, which has its own hazards and is discussed elsewhere in the report.

#### **3.2.4 A discussion to justify why hydrazine related chemicals are needed for the project**

See comments below, and note discussion in section 2.4, above.

#### **3.2.5 A discussion regarding options to replace or reduce the usage of hydrazine-related chemicals**

The Focus Report is correct that the use of NTO and UDMH in the upper stage does allow simple and reliable restart capability, and an arbitrarily long coast phase before restarting, without any of the propellant boil-off concerns that would be present with liquid oxygen.

It should however be stated that it is not true that there are no options for restarting a non-hypergolic upper stage in orbit. Earlier versions of the Russian Proton vehicle employed a LOX/kerosene upper stage called the Blok D, and a modified commercial variant called the Blok DM, both capable of restarting, though this was replaced on some later versions of the Proton with a NTO/UDMH stage. The Zenit-3SL vehicle also makes use of the Blok DM.

In addition, the SpaceX Falcon 9 and Falcon Heavy employ a LOX/RP-1 upper stage that is capable of a fixed number of restarts.

Having said this, it is reasonable to note that the partnership with Yuzhnoye is a cornerstone of the MLS plan as presented, and the Cyclone-4M vehicle with its hypergolic upper stage is the vehicle that is on offer. Yuzhnoye does not currently produce a non-hypergolic replacement stage, and for them to develop one would undoubtedly be both costly and time-consuming, and might potentially be outside the current expertise within that organization. From that standpoint it might be the case that a non-



hypergolic upper stage is not viable for the proposed launch vehicle as presently conceived without a prohibitive impact to the business case, but the technology for such a stage does exist.

It would perhaps be worth exploring options to transition to a new non-hypergolic upper stage at some point in the future. This might even represent a possible collaboration with Canadian industry.

With respect to the options to replace hydrazine that were mentioned in the Focus Report, including the AF-M315E propellant, it should be stressed that this primarily applies to hydrazine's use as a monopropellant for spacecraft propulsion, and not to its other application as an upper stage propellant. See also the discussion of hydrazine use in Section 2.4, above.

### **3.3 Focus Report Section 5.2: Predictive and Conceptual Modeling for Each Credible Worst-Case Accident and Assessment of Impacts**

The scenarios considered in this section of the Focus Report include:

- Normal exhaust fallout
- Re-entry debris fallout
- Launch failure at ground zero (i.e. on the launch pad)
- Launch failure in flight
- Other major accident / malfunction, such as major spills or leaks on site

The proposed scenarios are indeed the ones that merit detailed analysis. Not all of the relevant discussion of these scenarios is presented in section 5.2, however, so our analysis of the Focus Report's treatment of these scenarios will refer to other sections that provide relevant information as well.

#### **3.3.1 Normal Exhaust Fallout**

The treatment of the exhaust from the first stage, which represents the primary driver of potential environmental impacts at the launch site during normal operations, appears to be accurate. It also points to the NASA EA for the SpaceX Falcon 9 and Falcon Heavy launch vehicles, which also employ LOX/RP-1 propellants but are much larger than the Cyclone-4M. It is noted that this NASA EA found that those rockets posed negligible impacts during a nominal launch. See the additional analysis in 3.1, above, of nominal operations.

In terms of overall emissions for LOX/RP-1 engines, the most complete listing of measured products that we are aware of is from an Environmental Assessment for SpaceX Falcon launches from Cape Canaveral Air Force Station [6], a larger vehicle than the Cyclone-4M. Table 4.5-1 lists the measured exhaust products. Because the Cyclone-4M employs an oxidizer-rich staged combustion cycle engine for its first stage, there should be very little particulate matter produced. Table 4.5-2 of [6] lists the per-launch emissions for several of the most relevant comparable vehicles, and the Atlas V, which is likely the best comparison for the Cyclone-4M due to its use of a similar but much larger oxygen-rich staged combustion LOX/RP-1 engine, notes 0 tons of particulate matter generated from a launch. Section 6 of the Focus Report includes additional information from the NASA Routine Payloads EA which provides specific data on pollution from the Atlas V, noting that they showed no VOCs, SO<sub>2</sub>, PM<sub>10</sub> or hydrogen chloride emissions.

Information on soil pH impacts from rocket launches specifically is difficult to find, but no EAs that we are aware of have listed it as an issue for LOX/kerosene engines. It is an issue for solid-propellant rockets employing ammonium perchlorate as their oxidizer, but MLS does not propose to operate such vehicles from their site.

It is also noted on page 6-7 that rocket plume emissions modeling will be conducted to help develop go/no-go criteria, and that MLS will conduct air dispersion modeling for any rockets launched from the site. They state that these results will be completed and provided to regulatory agencies well in advance of launch operations, which is reasonable.

It should be noted that the Focus Report does not discuss the combustion plumes from the upper stage in their analysis of normal exhaust fallout. Given that this stage normally operates at high altitudes (greater than 50 km) and considerable downrange distance, its exhaust appears unlikely to pose any significant hazards, and the NASA Routine Payloads EA [1] notes that the Titan II and Delta II, both of which had NTO / Aerozine-50 upper stages, were not considered to pose a significant impact from nominal operation of their upper stages. The Focus Report also notes this on page 6-5, pointing out that emissions from the second stage propulsion system of the Titan are dissipated at altitudes above 30 km and do not reach the Earth's surface.

### 3.3.2 Re-Entry Debris Fallout

The Focus Report notes that the first stage and payload fairings will impact in the Atlantic ocean, well offshore, and models both the nominal anticipated impact points and the impact areas. This analysis appears to be reasonable.

It also notes that the upper stage will remain in orbit. While it will certainly *reach* orbit and remain there for a time, it will not stay there forever: it will re-enter the atmosphere eventually. See also the discussion in section 2.3, above.

Common practice is to vent the propellant tanks to the vacuum of space after the upper stage completes its mission, and this should effectively evacuate any remaining propellant. MLS should confirm that the Cyclone-4M will be doing this.

### 3.3.3 Launch Failure at Ground Zero

While the Focus Report correctly identifies this scenario as a major driver of safety and provides a reasonable consideration of the blast and fragment distances (see also Focus Report sections 11.3 and 11.4), it does not directly address the fate of the second stage in such a scenario. It also only considers complete stoichiometric combustion of first stage propellants and does not address the likely spillage of a portion of those propellants, nor the likely spillage of ancillary chemicals such as hydraulic fluid, or the burning of launch support structure. Rocket explosions tend not to involve complete stoichiometric combustion of all propellants.

In practice, a launch failure will have a high probability of rupturing the second stage propellant tanks, which will likely result in some of the UDMH / NTO burning up, but a potentially large quantity escaping to the environment. It is however worth noting that the design of the Cyclone-4M second stage employs a common bulkhead between the NTO and UDMH tanks, with a large surface area. Compared to stages that employ independent fuel and oxidizer tanks, the common bulkhead design increases the probability of mixing between the two propellants in the event of a failure which is in fact usually desirable for hypergolic propellants. Mixing and combustion of as much of the UDMH and NTO as possible in a failure will reduce the amount that could spill to the environment.

It is noted in the Focus Report that containment will be in place at the launch pad to limit the escape of propellants to the environment. This is good, but as the detailed design of the site proceeds, the containment features will need to be carefully designed to ensure that the maximum practicable amount of propellant and other fluids can be captured and contained in the event of a large-scale spill or explosion on the pad, and MLS should provide clear details on the volume and extent of spill that the containment features can handle.

While the Focus Report notes the nearest body of water is about 700 m from the launch pad and that this is likely a safe distance in terms of blast and fragment projection, the accompanying toxic plume from the rupture of the second stage could easily travel that distance if the wind is blowing in that direction and “rain out” in the area.

The analysis also does not discuss the potential of a partial failure of the vehicle hold-down assembly causing the vehicle to launch off-axis and what features, if any, will be incorporated to prevent this.

While they are not discussed in Section 5.2, these considerations do receive some attention in other sections of the Focus Report. Notably, on p. 1-20, they correctly identified that the inadvertent release of toxic air contaminants is possible from accidents during processing, transportation and launch, and that the worst case would involve spillage of the entire quantity of propellant while lesser releases could result from fires or explosions that would consume significant amounts of the propellants. They correctly observe that releases from payload accidents would be relatively small compared to those from the launch vehicle. They point out that spill response planning procedures are in place at launch sites, and that the safety procedures in place at these sites ensure that spills are unlikely to occur, which is generally true, and they describe some of these.

They also reference chapter 4 of the 2011 Environmental Assessment for NASA Routine Payloads, which does provide an assessment of potential propellant spills at NASA launch facilities, from both payloads and launch vehicles. This EA receives additional discussion on page 6-5 of the Focus Report. While this is indeed a useful model, the air dispersion modelling described in the NASA EA assessed quantities of hydrazine and NTO that are relevant to what would be used on payloads, but much smaller than what would be used on the second stage of the Cyclone-4M. Elsewhere in the NASA EA however, on p.225, they do discuss the hazards of a Titan II launch failure, which represents a far greater quantity of hydrazine (aerazine-50) and NTO than what is present on a Cyclone-4M. They note that the full load of NTO from a Titan II on the pad would represent the most severe spill scenario. Under this failure, they note that the plume could reach about 4 km under adverse weather conditions before the NTO concentrations are lowered to 5 ppm, and could reach several miles farther before being lowered to 1 ppm. On p. 221, the EA also considers a failure of a Delta II, which is a fairly good comparison to the Cyclone-4M as it is a similar size and also employs a LOX/RP-1 first stage and a NTO/hydrazine second stage. For the release of the full upper stage load of NTO, the ground vapour concentration is predicted to reduce to less than 5 ppm at 150 m downwind of the site, and less than 1 ppm at 300 m. For an explosion, their assessment is that while much of the propellant would likely be consumed in the fireball, some NTO, NO<sub>2</sub> and UDMH would be released. Page 33 of that document notes that neither the Titan II nor the Delta II were deemed to contribute substantial impacts even in the case of a launch accident. So it does appear to be credible that such a release can be accommodated at the MLS site, but proper modeling will need to be performed for the Cyclone-4M at the site.

It is the case that under particularly adverse wind conditions, a toxic plume from a large spill can easily travel 3 km or more in the direction the wind is blowing before it disperses to below the short-term emergency guidance level. This is mitigated at launch sites by modeling the dispersion under various conditions and developing launch go-no go criteria that prohibit a launch under conditions where air dispersion modeling predicts a potential toxic hazard to the public. While MLS discussed development of rocket exhaust plume modeling in the original EA Registration Document (p.35), and also on page 6-7 of the focus report, and they commit to completing this and providing it to regulatory agencies well in advance of launch operations, they must confirm that they will perform similar modeling for the dispersion of the plume from a worst-case NTO spill.

In addition to the REEDM exhaust plume modeling code, the NASA EA made use of the AFTOX dispersion modeling program. The US EPA and NOAA also maintain a toxic dispersion tool for the modeling of hazard zones called ALOHA [7].

The Focus Report also provides a good reference to a NASA document summarizing historical spills of hypergolic propellants (NTO and hydrazines), including the famous spill and explosion of a Titan II missile at Little Rock, AK, the response to it and the lessons learned, and provides the spill response standards in force at Cape Canaveral Air Force Station and the Kennedy Space Center, so it appears that MLS is aware of these issues.

There is little question that a failure on the pad could result in a certain amount of UDMH and NTO release to the environment. Discussion in other sections of the focus report and the NASA assessment of similar and larger launch vehicles employing hypergolic propellants do suggest that the potential impacts from a failure at the pad can be managed, provided that the appropriate use of toxic dispersion modeling, careful detailed design of the facility, containment features and support equipment, and development of appropriately stringent launch go-no go criteria are completed. MLS also notes in section 5.1 and elsewhere that rigorous monitoring will be in place in the event of an accident to test and monitor air, soil, marine water and groundwater, as appropriate, so the proposed combination of site clean-up and monitoring to assess the spread of any contaminants and address them if needed ought to be able to reasonably address a release outside of containment. But MLS should work with Yuzhnoye to perform more detailed modeling to quantify the failure of their specific launch vehicle, including a rupture of the second stage, before commencing launch operations.

### **3.3.4 Launch Failure in Flight**

The discussion of in-flight failures provides a comprehensive overview of the likely sequences of events if a failure were to occur during the various phases of the flight, and they consider not only crashes into the ocean, but crashes onto land and into the small lakes in the general area of the launch site. They also correctly point out that the potential worst-case release of contaminants in these scenarios would be similar to what would be expected from a failure on the launch pad, so the comments in 3.3.3, above, are applicable to a crash onto land near the launch pad.

It doesn't directly address the inevitable release of NTO and UDMH that would result from an in-flight failure, though in cases where the failure is over water, any released propellants that don't react would be quickly diluted. The comments in the Focus Report regarding release of UDMH to air, water and soil apply.

It correctly notes that a vehicle crash into water would likely rupture the propellant tanks, and it considers the potential resulting blast, but it is making the assumption that all propellant will be consumed in this scenario. In practice, it is highly likely that a significant amount of the propellant will be released to the water. In sea water, NTO will form nitric acid which will be diluted relatively quickly. UDMH will similarly be diluted to harmless levels. Given that a large majority of the launch trajectory is over water, the vehicle (either largely intact or in fragments after breaking up in flight) is most likely to fall into the ocean.

The Focus Report also calculates the probability of the vehicle crashing into the small lakes in the area, and notes that these probabilities are very low. These values do appear to be about what might be expected, though the report does not provide any information on how they were calculated. Notwithstanding the very low probability, if the vehicle were to fall into such a small lake, depending on the volume of the lake, the contamination could be significant. The worst case would be if the complete propellant loads entered the lake. In practice, this is highly unlikely and it would be expected that even in a direct crash of a fully fueled and intact vehicle into the lake, a certain amount of the propellants would be burned off. As noted in section 3.1, the propellants will degrade over time, and likely the best that can be done is to monitor the area and ensure that nothing leaches into groundwater. NDMA, a main product of UDMH breakdown, can be broken down from drinking water by strong UV light, if necessary.

A crash onto land in the vicinity of the launch site would only be a possibility early on in the flight, and the result would be similar to a failure on the pad itself. All launch ranges require the use of a flight termination system to terminate thrust soon as a failure capable of creating a hazardous condition occurs, in order to prevent the vehicle from deviating from its planned trajectory in a way that could pose a danger to populated areas. Such systems typically either destroy the vehicle outright by firing explosive charges on board, or shut down the engines to terminate thrust. The Cyclone-4M incorporates the latter system. Assuming an anomaly was detected in the first several seconds after launch, thrust termination would lead to the vehicle dropping almost straight back down as its speed and thrust-to-weight ratio will be low.

The Focus Report is unclear about one aspect of the flight termination system: is the termination decision intended to be entirely autonomous, made solely by the vehicle's computers -- as was the case for most Soviet-era Russian/Ukrainian launch systems -- or will ground control have the ability to command termination, and the tracking data needed to do so? The difference is important for the case where the vehicle computers have been programmed incorrectly -- as happened on the 28 Nov. 2017 Soyuz-Fregat launch from Vostochniy and possibly the 25 Jan. 2018 Ariane 5 launch -- and the vehicle believes itself to be healthy as it proceeds in the wrong direction. Such a case can seriously affect hazard analyses which assume a vehicle failure occurs only on the intended flight path.

It would be assumed that this system is 100% reliable and redundant, and can respond fast enough to ensure that any anomaly capable of causing the vehicle to deviate dangerously from its nominal trajectory (taking it towards a populated area, for example) could be detected and thrust terminated before the vehicle can get far off course. This is an aspect of flight safety that will require assessment before final approval is granted for a launch, presumably by Transport Canada, but for the purposes of an environmental assessment it can be safely assumed that this system exists and is sufficiently reliable to stop a wayward rocket before it gets far: a launch would not be permitted to proceed otherwise.

Section 5.2 of the Focus Report also mentions a 1998 study by Schmalzer et al [8] which is particularly relevant, as it mentions the 1997 failure of a Delta II 13 seconds after launch at an altitude of 484 m. This vehicle is in a similar size class to the Cyclone-4M and also uses a LOX/RP-1 first stage and a

NTO/UDMH (aerozine-50) upper stage, with several additional solid-propellant boosters. The study noted that while it caused significant damage to facilities and structures, its impacts on the natural environment were limited. It also notes that an extensive cleanup of the debris was conducted, reducing any long-term threat posed by contaminated materials.

### **3.3.5 Other Major Accident / Malfunction**

The analysis presented in this section only considers explosion. As with the analysis of a failure on the pad, other sections of the Focus Report touch on the consequences of propellant release to the environment, and experience at launch sites in the US suggest that these failures are manageable, but a comprehensive analysis based on the proposed launch site and the Cyclone-4M vehicle ought to be completed prior to commencing launch operations. Moreover, the section did not discuss the potential propagation of failures, and how this propagation was to be prevented. Some of this might be inferred based on other sections of the Focus Report, but it is not explicitly discussed in this section.

In the discussion of the explosion (or rupture) of an RP-1 tank at the launch pad, it is presumed that the tank in question is the storage tank. Because of the flammability of RP-1 and the size of the storage tank, the failure of the RP-1 storage tank at the launch pad is most likely going to result in a running pool fire which could impact the adjacent structures and result in multiple fires. In the event that the launch vehicle is on the pad, the potential exists for the fire to weaken the vehicle support structure, causing the potential collapse of the vehicle. The upper stage propellants are loaded prior to moving the vehicle to the pad, so the collapse or destruction of the launch vehicle would then result in a spill and explosion of the upper stage contents.

This sequence of events can be mitigated with careful design, and MLS should ensure that the pad infrastructure is designed to prevent this scenario from occurring, ensuring that in the event of a tank rupture or other spill, the fuel is safely caught and any fire cannot create a hazard to the vehicle.

The Focus Report then considers the explosion of a UDMH container at the processing complex. This analysis is not the most likely event in the case of a pressure failure of the UDMH Tank. The most likely worst case event is a catastrophic rupture of either the storage tank or the mobile fill unit resulting in a fire and spillage of UDMH on the ground. In addition this analysis does not take into account the effects on adjacent structure and hazardous materials storage which would result in a propagation of failures. This can be addressed by proper containment and site design, and as detailed design proceeds, MLS should ensure that the facility is designed to prevent any release of UDMH in the event of the above-mentioned failure cases, and to prevent the propagation of failures.

It is noted on page 11-7 of the Focus Report that safeguards will be in place at the launch vehicle processing complex. In addition to the list provided in the third bullet, safeguards should also include fixed fire suppression and wash-down capabilities with secondary containment.

The NTO was not considered in this analysis, and if a rupture of the UDMH storage tank or mobile fill unit is possible, the NTO tank and fill unit are equally capable of failing in such a way. Again, the detailed design of the site must take these failures into account and prevent the release of NTO or its vapors while ensuring that the failure does not propagate and cause additional failures, exacerbating the situation. As detailed design proceeds, MLS should demonstrate how the facility incorporates specific design elements to address these failures. This is all the more critical for NTO given its extremely high acute toxicity.

We noted in 3.3.3, above, that it will be important for MLS to ensure that in addition to rocket plume dispersion modeling, they also perform modeling of toxic dispersion for explosions on the pad or failures early in flight that would result in the release of upper stage propellants. While launch go/no-go criteria are typically developed to preclude a launch when adverse wind conditions could cause the hazard zone to extend to a populated area, a rupture of NTO or UDMH storage could conceivably happen at any time. The emergency response plans should consider this scenario, and include provisions to evacuate or otherwise protect populated areas in the event of such a worst-case release, as improbable as it may be. The Focus Report did not include a discussion of the prevailing winds in the area, but the original EA Registration noted in 5.1.1 that the average wind speed is around 23 km / h (about 6.3 m/s) and the prevailing direction is westerly. This does suggest that under these nominal conditions there should be little toxic hazard to Canso or other populated areas.

There is additional discussion of propellant spills on page 11-1 of the Focus Report, noting that a procedure will be in place for collection and neutralization of spilled propellant, combined with proper use of personal protective equipment. It also states the probability of a spill at  $1 \times 10^{-5}$ , but there is no indication given of where this number comes from. It refers to Item 3.3, but that section did not include any demonstration of the probability of occurrence. In practice, the probability of a spill is likely to be difficult to quantify directly, though United Paradyne's experience might enable an estimate.

The Focus Report also notes that the nearest lake is about 400 m from the UDMH tank container, and it asserts that no adverse impact is expected. However, it does not appear that this takes into account the potential absorption of UDMH into the ground water and transport. MLS should confirm that the site will incorporate containment features that prevent this.

Lastly, the Focus Report considers the possible fire of spilled propellants, but it only considers the possible impacts to vegetation or bodies of water. This is not the primary hazard in these scenarios. There are scenarios where unless there is proper diking and containment then the fire will run to adjacent structures. As with the discussion of RP-1 tank rupture above, as MLS progresses through detailed design they should demonstrate that the site will include specific safety features that contain any potential fire of spilled propellants and prevent it from running into adjacent structures and causing additional failures.

### **3.4 Assessment of Proposed Mitigation, Management and Monitoring Strategies**

As indicated in section 3.3 above, there are elements of facility design that can be incorporated to ensure that the majority of failures can be contained, and it should be ensured that the facility is designed accordingly.

Even with such careful design, there are failures – particularly those involving the launch vehicle on the pad or in its early phase of flight – that could release propellants, most significantly NTO and UDMH.

While the Focus Report said very little about this in section 5.2, they do acknowledge the potential for such propellant releases to the environment elsewhere, and their proposed monitoring and mitigation appears to be quite comprehensive and reasonable. The level of detail seems reasonable for this stage of the project.

Section 5.4 of the Focus Report covers avoidance, mitigation and monitoring measures to limit potential impacts to water and soil. Several NASA studies are referenced that indicate that liquid-propellant

rocket launch operations at other US sites have not shown long-term impacts to surface water, groundwater or marine waters. The 1998 study by Schmalzer et al is particularly relevant, as it covers vehicles that employ UDMH (aerozine-50) and NTO in quantities comparable to and also much larger than the Cyclone-4M. The study also considers solid-propellant rocket boosters, which tend to have much more contaminants in their exhausts than most liquid engines. Significantly, the study also includes the 1997 failure of a Delta II shortly after launch at an altitude of 484 m, noting that while it caused significant damage to facilities and structures, its impacts on the natural environment were limited. It also notes that as would be expected, an extensive cleanup of the debris was conducted, reducing any long-term threat posed by contaminated material.

Section 5.4 also notes that emergency situations would be mitigated through the use of “adequate and appropriate secondary containment” to provide first level protection for soil and water. The specific features are not discussed in great detail, though some additional detail is provided later on, on page 6-7, which is perhaps not unreasonable at this stage. As was noted earlier, they should be elaborated on prior to commencing launch operations, and an assessment of the expected effectiveness of these features in limiting the release of hazardous materials in credible worst-case failures of the vehicle should be provided.

In addition, they stress that a detailed site-specific spill contingency plan will be developed. This is further emphasized on page 6-7, noting that the Environmental Protection Plan will also include an Erosion and Sediment Control Plan and additional contingency plans as necessary. These should be reviewed before launch operations commence, and it should be ensured that all the necessary resources to execute the plan are in place.

As was mentioned previously, and noted in the Focus Report, it should be emphasized that worst-case releases of propellants due to spills or explosions will lead to toxic plumes that can travel many kilometers easily, depending on the wind conditions. The NASA Routine Payloads EA referenced in section 6.2 and elsewhere showed that with 10 m/s winds, a moderately sized NTO spill could produce a mean hazard distance of nearly 6 km in the downwind direction. We noted in 3.3.3, above, that toxic plume modeling is essential in addition to the nominal rocket exhaust plume modeling that MLS has committed to undertake. The emergency response plans must address what will be done to evacuate or otherwise protect populated areas in the event that a spill coincides with highly unfavourable wind conditions that could extend the hazard zone to the populated area.

It does seem reasonable to assert that the deluge water is the primary potential contaminant during nominal operations, and MLS notes in the Focus Report that it will be captured and analyzed. See also the comments below.

### **Deluge Water**

Page 4-1 provides a reasonable discussion of deluge and waste water, the potential contaminants present, and the proposed capture and analysis of the water. It is normal practice at most spaceports to analyze deluge water as part of disposal and is usually a part of the disposal process to allow the waste to be properly characterized. Some larger spaceport facilities will have an on-site chemistry lab, but use of off-site labs for such analysis is also very common.

Table 2.2 of the original MLS EA Registration document noted that deluge water would be either delivered by truck or drawn from a local source (well or lake). Any of these approaches ought to be



reasonable, and use of typical chlorinated municipal potable water for the purpose is also quite common at spaceports. Cape Canaveral Air Force Station uses water from the City of Cocoa's municipal system under a long-term agreement, and reaction with chlorine is not considered to be a concern for deluge water for other launch vehicles.

### **Notification and Clean-Up Levels for Chemicals**

While not covered in section 5.4, MLS notes in section 5.1 that rigorous monitoring will be in place in the event of an accident to test and monitor air, soil, marine water and groundwater, as appropriate, and this is reinforced on page 8-5. Section 4.4 also implies that this testing will include toxics and NDMA. The proposed clean-up levels from Focus Report table 4.4.1 come from an EPA table [9] and appear to be correct and up to date. The Focus Report also did a good job of identifying laboratories with the capability of detecting trace levels of the identified chemicals, including NDMA, and provide further information on the lab and analysis techniques in Appendices E and F.

### **Emergency Response Plan**

Section 12 of the Focus Report provides additional discussion of contingency planning. On page 12-1, it notes that Transport Canada has been involved in risk assessment and requires a full quantitative risk assessment prior to launch site activation. This is reasonable, but it seems to be non-responsive to the question unless the Transport Canada assessment adequately addresses environmental impacts.

The discussion on pages 12-1 and 12-2 on prevention, mitigation and contingency measures and proposed contents for the site-specific emergency response plan appear to be reasonable. It is also noted that nominal launch trajectories are over the ocean, away from populated areas, and that the site meets accepted international safety standards. The discussion of engineering and design safeguards, combined with mistake-proofing and training, is reasonable, subject to our additional comments in 3.3.5, above.

On page 3-10 of the Focus Report, MLS notes United Paradyne's extensive expertise providing sourcing, transportation, storage and loading services for hypergolic propellants at many major spaceports. This does appear to make them an ideal partner for the MLS project, and suggests they have the proper expertise to ensure the facilities are designed with the necessary safety features and operated according to industry-standard safety practices. The included United Paradyne sample Emergency Response Plan in Appendix C is evidently from Vandenberg Air Force Base, and is detailed and sufficient for those operations. Page 4-10 of the Focus Report notes that a site-specific response plan will be created, using the sample plan as a starting point. It should be emphasized though that the sample United Paradyne plan presupposes that the personnel, infrastructure and support of a major Air Force Base are available. Adapting this plan to be sufficient for operations in rural Nova Scotia would in all probability require some significant changes beyond a mere "updating", given that MLS will not have the personnel and resources of an air base like Vandenberg at their disposal. While this is a good starting point, it is recommended that the MLS Emergency Response Plan be reviewed prior to the commencement of launches to ensure that it is sufficient for operations in rural Nova Scotia at a small standalone spaceport facility.

### **Health Services**

The discussion on health services (pages 12-3 and 12-4) considers the explosion of a vehicle on the pad, but does not discuss the fire plume and potential toxic fall-out. As was noted elsewhere, there should

be models which consider prevailing winds, foreseeable propagation of events, etc., as these will help to inform the emergency response resources that are likely to be required.

It is also noted that while the distances to hospitals are provided, the more relevant metric is the response times. Emergency planning will need to account for this. It is possible that having a helicopter pad at the MLS site might be a significant benefit for medevac, should it be necessary.

### 3.5 Potential Project-Related Impacts of Hydrazine / UDMH Byproducts

Table 3.1.1 in the Focus Report (page 3-2), summarizing UDMH and decomposition product hazard classes is unclear: it is not stated what these hazard classes refer to. It is recommended the UN Hazard Class be used. As such these are mis-categorized as Dimethylamine is a Flammable Gas and Nitrosodimethylamine is not an explosive but is a combustible liquid. If the UN Classifications were used then Dimethylamine would be a Class 2.1 (Flammable Gas) and Nitrosodimethylamine would be a Class 6.1 (Toxic Substance), UDMH would also be a Hazard Class 6.1 per its SDS. The table is also missing the formation of a carboxylic acid and its associated salt from the reaction with CO<sub>2</sub>.

As an aside, it should be noted that the listed decomposition products result from different reaction mechanisms that UDMH might experience. Dimethylamine is the result of a cleavage reaction. Tetramethyltetrazene is a condensation reaction product, and Nitrosodimethylamine (NDMA) is a partial oxidation product.

Table 3.1.2, discussing the persistence and ecotoxicity of UDMH and related products, is also unclear in its definition of "persistent". If this is for atmospheric release then it looks reasonable; however, if this is for release to the soil or water then the data is that NDMA is fairly persistent (half life of 12-24 months) and that UDMH degrades to NDMA. This can be seen in data reported in [Schmidt Page 1079] and in the EPA's document titled "Six-Year Review 3 Technical Support Document for Nitrosamines" Page 2-12. Additionally, the statement that NDMA is subject to "fast anaerobic biodegradation" depends on the definition of "fast. It is certainly not as fast as UDMH: [Schmidt Page 1079] indicates the half life of NDMA in anaerobic ground water is as high as 24 months and as low as 84 days compared to 8 to 32 days for UDMH, so referring to these both as "fast" seems somewhat misleading.

The discussion of NDMA on page 3-3 somewhat downplays the actual hazards associated with NDMA and somewhat mischaracterizes Rocz's paper. The first few sentences of his abstract which they quote almost verbatim are:

"Nitrosamines are known as the most potent group of carcinogens. Approximately 300 of these compounds have been tested, and about 90% of them have been found to be carcinogenic in laboratory animals. N-nitrosodimethylamine causes liver cancer, whereas some of the tobacco specific nitrosamines cause lung cancer. Volatile N-nitrosamines induce tumors in a variety of human organs, including the tongue, esophagus, lung, pancreas, liver, kidney and bladder. They are formed during reaction of secondary or tertiary amino compounds and nitrite or nitrogen oxides."

As an additional note, it is not clear what the source is for Table 3.1.3. [10] reports the half life of UDMH in sea water as approximately 12 days, and the half life in surface water as 8 – 22 days.

Focus Report section 8.3 discusses potential project impacts to wildlife and habitat from chemical substances used in launch activities, including accident scenarios. It does appear reasonable and

consistent with what has been observed at other spaceports that the hazards are very low during normal operations. The information provided on UDMH and hydrazine spread, degradation and toxicology appears to be accurate. While there is no direct assessment to quantify a worst-case release of UDMH from the MLS site, the Focus Report does emphasize that controls will be in place to prevent a release to the greatest extent possible and to contain anything that is released. Page 8-5 notes that the Environmental Protection Plan will include detailed measures to monitor and clean up the site after an accident.

Much of the provided details on NDMA are included in Appendix D. This includes a recent EPA summary document which provides an up to date overview of the chemical, its hazards and the various relevant US federal and state guidelines and health standards. It also covers detection and treatment methods, the latter indicating that should NDMA contaminate drinking water, it can be broken down with strong UV light, among other options. An additional State of California document is included that provides a more in-depth look at NDMA contamination, toxicology and the development of public health goals for NDMA in drinking water. These do a good job of summarizing the current state of understanding of NDMA and its characteristics. There is no question that NDMA contamination is undesirable and poses a threat to human health, primarily if it enters drinking water. As noted in the Focus Report, it is detectable, and it can be broken down if it does get into drinking water, but clearly every effort should be made to minimize the chance of its release. With proper site design, engineering controls and containment, it should be possible to ensure that the majority of failure cases can be handled such that they prevent UDMH release, and if it is released, response procedures should be in place to clean up the site as quickly as possible to minimize the amount that can escape and break down to form NDMA. It is noted that based on the experience of landlocked launch sites in Russia and China, where spent rocket stages with significant amounts of UDMH remaining in the tanks are frequently dropped onto land, UDMH and its transformation products like NDMA can linger for 30 years if not properly cleaned up [11]. In contrast, there have not been any known concerns about UDMH byproduct contamination at sites like Cape Canaveral, in spite of the fact that there have been failures of launch vehicles there that use it.

## 3.6 Additional Focus Report Comments

### 3.6.1 Focus Report Section 3: Dangerous Goods Management

It should be noted that while UDMH is to be employed in by far the greatest quantities, hydrazine is commonly thought to have the greater toxicity. Some reports suggest a hydrazine LC50 that is from 1/10 to 1/100 that of UDMH [10] (p. 1066, table 4.72), though some data reports the LC50's to be much closer. While the Focus Report states that hydrazine is to potentially be used as a spacecraft propellant, and various references are provided which discuss it, the MSDS for hydrazine was not included in Appendix B, and much of the discussion of section 3 focuses on UDMH. While the much larger quantities of UDMH plus its tendency to break down into longer-lived byproducts such as NDMA do make it the larger concern from an environmental standpoint, the acute toxicity of hydrazine should not be minimized. Hydrazine is included in some of the subsequent tables and discussion in the Focus Report, however.

On page 3-4, the discussion of the toxicity of hydrazine is accurate but somewhat minimizes the hazards. The following is from the MSDS prepared by Fisher Scientific:

*Potential Health Effects*

*Eye: May cause irreversible eye injury. Exposure to the vapors or liquid may cause temporary blindness. Causes severe eye irritation and burns.*

*Skin: May be fatal if absorbed through the skin. Prolonged and/or repeated contact may cause irritation and/or dermatitis. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Contact with liquid is corrosive and causes severe burns and ulceration. Contact with the skin may dissolve hair.*

*Ingestion: Harmful if swallowed. Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May cause liver and kidney damage. Causes digestive tract burns with immediate pain, swelling of the throat, convulsions, and possible coma. Exposure may cause anemia and other blood abnormalities.*

*Inhalation: Harmful if inhaled. Irritation may lead to chemical pneumonitis and pulmonary edema. May cause liver and kidney damage. Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. Vapors may cause dizziness, nausea, itching, burning, and swelling of the eyes.*

*Chronic: Repeated inhalation may cause chronic bronchitis. May cause cancer according to animal studies. Repeated exposure may cause sensitization dermatitis. May cause reproductive and fetal effects.*

The data in Table 3.1.4 discussing the toxicological properties of hydrazine and UDMH is presented without reference or context. In particular, toxicology numbers are meaningless unless they reference the host animal, the dose, and the exposure time. The MSDS for hydrazine from Sigma Aldrich states the LC50 for hydrazine at 252 to 320 ppmv / 4h for mouse. Their MSDS for UDMH reports the LC50 as 172 ppmv/4h for mouse. These values are close to what is presented in table 3.1.4 (when converted to mg/m<sup>3</sup>), making it appear that the numbers in the table are probably 4 hour exposures for mice, but it is important to state this clearly when presenting any toxicological data.

Beginning on page 3-6 of the Focus Report, transportation and handling of propellants and compressed gases is discussed. The transportation of hydrazine appears to be left up to the customer, with the only note being that tanks of no more than 200 kg shall be used. These tanks ought to be described. In the US, hydrazine is typically transported in a DOT / Transport Canada approved container called a 4BW. It is recommended that such a standard be adopted and enforced at the MLS site to ensure consistency and safety.

As was noted above in the discussion of the Focus Report section 5.2 failure cases, proper site and facility design features are critical to avoid propagation of failures. This is touched on on pages 3-9 and 3-10, where minimum separation distances between energetic liquids are discussed, which is indeed an important consideration. And it was noted elsewhere in the Focus Report that secondary containment and other features will be employed. But there is little detail provided here about those features, so it is recommended that as detailed design progresses, MLS should provide more information to show specifically how their site and facility design is implementing this.

**Propellant Loading**

Item 3.4 in the Focus Report requested “detailed procedures for fueling and de-fueling of rockets”. Strictly speaking, this could be interpreted as referring only to the fuel (RP-1 for the first stage, UDMH for the second), as the term “propellant loading” would be more technically correct if both fuel and

oxidizer were meant to be included. So from this standpoint the Focus Report complies with what was asked for by NSE in 3.4. But the oxidizer is certainly relevant as well. In the case of LOX, as was noted in 2.5, above, the environmental consequences of a spill are likely to be insignificant in and of itself, but the greater danger is if such a spill leads to additional failures. It should be stressed that the launch failures in recent years of the SpaceX Falcon 9 and the Orbital Sciences Antares vehicles both originated in the liquid oxygen systems of those vehicles, so from a safety standpoint at least, this is an area that requires appropriate attention. Discussion of the overall propellant loading and unloading operations, the order of operations (are the fuel and oxidizer loaded simultaneously or sequentially?) and the details of features in place to prevent the propagation of failures will be important prior to the commencement of launch operations. See also the discussion of the failure cases in 3.3, above.

Similarly, on page 3-12, first stage defueling operations are discussed. MLS should provide some information on where LOX will be offloaded to. In many cases at other spaceports, offloaded LOX is not recovered but sent to a drainage pond where it evaporates. If that is to be the case, reasonable safety features will need to be in place to ensure that the evaporating oxygen does not pose a risk of starting a fire.

In addition, the fueling of the second stage is covered and appears to be both detailed and reasonable. However the de-fueling operation and return of the propellant from the mobile fill units to the storage units is not discussed. There is also no discussion of what is involved in the case where during a launch scrub the second stage is de-mated and needs to be de-fueled. For the sake of completeness, these warrant some discussion.

3.4 only requested fueling and de-fueling information for “rockets”, and as such the MLS Focus Report only covers this, but it should be noted that propellant loading and un-loading of the *payload* is also a critical hazardous operation. While it appears that MLS is well aware of the hazards and can credibly address them, it is important that this be done

## 4.0 Conclusions and Summary of Recommendations

Overall, this review found that while many areas of the Focus Report were comprehensive and rigorous, some require more attention. Those areas in need of more attention have been highlighted and discussed. A primary objective was to determine whether any such deficiencies represent fundamental shortcomings with the project, or whether it is reasonable to conclude that the environmental impacts or risks are likely to be small if properly managed and can be addressed if the project proceeds to detailed design. It also aimed to identify specific actions to rectify any identified shortcomings.

In general, the planned site appears to be in line with accepted international standards. The hazards related to the launch site and the Cyclone-4M vehicle proposed for operation there are comparable to other North American spaceports, and the Focus Report did refer to EAs for such sites and similar or larger vehicles, including Delta II and the Titan operations at Cape Canaveral and Vandenberg Air Force Base, that suggest the environmental impacts can be acceptably managed, even in cases of spills or in-flight failures.

In most cases, the Focus Report does demonstrate a recognition of the relevant issues and at least a high level approach to manage them, and commits to do so as the design proceeds.

The most important shortcomings tended to relate to a lack of detailed analysis to quantify failures of the Cyclone-4M specifically, although the report did point to similar analyses for comparable launch vehicles and sites. It is perhaps reasonable to note that many of the recommendations presented here are elaborations of general actions or features that MLS had already indicated they would be implementing, either in the Focus Report or the original Environmental Assessment registration, and that many relate to design details and detailed analyses that would not necessarily be expected to be finalized at this early stage of the project.

The key recommendations going forward include:

1. More in-depth analysis of failure cases for the Cyclone-4M specifically, at their specific launch site. This should include:
  - a. More detailed modeling (in collaboration with Yuzhnoye as appropriate) to quantify the failure of the Cyclone-4M launch vehicle on the pad and in the early stage of flight, including a rupture of the second stage. This should quantify what that release of hypergols could involve, and model the resulting hazard zone, impacts to air, soil, water, and specific mitigation or response. NTO should be emphasized in toxic dispersion modeling due to its high acute toxicity and volatility. In particular, this should address the fire plume resulting from a failure and the resulting toxic fallout.
  - b. Confirmation that the second stage will be safed in orbit (i.e. both propellant tanks vented to evacuate residual propellant, batteries discharged) before re-entry.
  - c. Discussion of the predicted reliability of the Cyclone-4M and the capability and reliability of its flight termination system to quantify how close the vehicle could potentially get to public areas before the flight termination system terminates thrust and the vehicle impacts the Earth.
  - d. Confirmation of whether the flight termination decision is intended to be entirely autonomous (made solely by the vehicle's computers), or whether ground control will have the ability to command termination at least as a backup, and the tracking and telemetry data needed to do so.
  - e. Development of a reasonable set of launch commit criteria to ensure that a worst-case vehicle failure or crash involving release of upper stage propellants does not pose a hazard to populated areas. This should include wind calculations, defining ideal and limit wind conditions for launch.
  - f. Proposing a means of performing detailed hazard analysis prior to an actual launch, and in the case of any failure. NASA sites use a tool called REEDM (Rocket Exhaust Effluent Dispersion Model) for rocket exhaust plume analysis. Tools are also available to calculate the dispersion of toxic plumes and the resulting hazard zones as a function of quantity, environmental and wind conditions.
2. Details on MLS' proposed Range Safety organization, and the analyses it will perform related to hazard zones.
3. More analysis given to propagation of failures (e.g. shrapnel from an explosion affecting buildings, tank farms, other equipment, propellant spills leading to fires), and discussion of specific site design elements to limit the propagation of those failures.
4. Details on the de-fueling operation of the second stage.
5. More details on design and operations at the launch pad area, including:
  - a. Discussion of liquid oxygen handling, which was not covered in the Focus Report. This should include details of where LOX will be offloaded to if the need to de-fuel the vehicle arises. If, like many sites, it is sent to a drainage pond do evaporate, reasonable

- safety features will need to be in place to ensure that the evaporating oxygen does not pose a risk of starting a fire.
- b. Demonstration of detailed design features of the launch pad and area to ensure that in the event of a tank rupture or other spill, the propellant is safely caught and any fire cannot create a hazard to the vehicle. This should include secondary containment & catchment features to ensure the maximum practicable amount of propellant and other fluids can be captured and contained in the event of a large-scale spill or explosion on the pad. It should also include clear details as to the precise volume and extent of the spill that the containment features can handle. It should include account for first stage, upper stage, propellant storage tanks, and any credible combination of these.
  - c. It is noted that per the NASA Routine Payloads EA, propellant storage tanks are often within concrete containment basins designed to retain 110% of the storage tank volumes. If it is necessary to prevent a fire of any spilled fuel, as might be the case with UDMH, common practice would be to additionally dilute the spilled fuel with water to 50%, so in such cases the containment volume would need to allow for this as well.
6. More details on design and operations at the processing facility, including:
- a. Details of secondary containment and other features to prevent the release of hydrazine, UDMH and NTO in the event of catastrophic rupture of either the storage tank or the mobile fill unit resulting in a fire and spillage of UDMH or NTO on the ground.
  - b. In case of a large spill within the facility, the fumes will be contained and any ventilation and filtration system could easily become saturated and allow toxic vapours to “break through”, releasing the vapour to the external environment. As detailed design proceeds, this worst-case internal spill should be taken into account and the ventilation system designed accordingly.
  - c. Incorporation of containment features at the UDMH and NTO storage areas to minimize or eliminate any propellant escaping to soil and groundwater.
  - d. Safeguards should also include fixed fire suppression and wash-down capabilities with secondary containment.
  - e. Demonstration that the detailed design takes into account the effects on adjacent structure and hazardous materials storage which would result in a propagation of failures.
7. Fleshing out the Emergency Response Plan to be appropriate to the site and resources available in the area. The plans should also include provisions to evacuate or otherwise protect populated areas in the event of a worst-case release of toxic propellant at a time when the wind conditions are such that the hazard zone could extend to a populated area, as improbable as it may be.
- a. Plans should be reviewed prior to commencing launch operations, and it should be confirmed that the necessary resources are in place to execute all contingency plans.

## 5.0 References

- [1] Final Environmental Assessment for Launch of NASA Routine Payloads. November 2011. Accessed at: <https://repository.library.noaa.gov/view/noaa/12540>
- [2] Berger, E. "The Delta II rocket came, it saw, and for a time it conquered". September 2018. Accessed at: <https://arstechnica.com/science/2018/09/the-venerable-delta-ii-rocket-has-taken-flight-for-the-final-time/>
- [3] EASA Turbine Engine Emissions Databank. 30 May 2018. Accessed at <https://www.easa.europa.eu/sites/default/files/dfu/edb-emissions-databank%20v25a%20%28web%29.xlsx>
- [4] "Toronto Pearson: Canada's Gateway". September 2017. Accessed at: <https://www.toronto.ca/legdocs/mmis/2017/ed/bgrd/backgroundfile-107047.pdf>
- [5] Buffalo Niagara International Airport. Accessed at: <http://www.buffaloairport.com/> 22 April 2019
- [6] Environmental Assessment for the Operation and Launch of the Falcon 1 and Falcon 9 Space Vehicles and Cape Canaveral Air Force Station Florida. November, 2007. Accessed at: <https://apps.dtic.mil/dtic/tr/fulltext/u2/a611861.pdf>
- [7] NOAA Office of Response and Restoration. "ALOHA". Accessed at: <https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/response-tools/aloha.html> 22 April 2019
- [8] Schmalzer, P.A., S.R. Boyle, P. Hall, D.M. Oddy, M.A. Hensley, E.D. Stolen, and B.W. Duncan. 1998. Monitoring Direct Effects of Delta, Atlas, and Titan Launches from Cape Canaveral Air Station. NASA/RM-1998-207912.
- [9] EPA Regional Screening Level (RSL) Summary Table. November 2018. Accessed at: <https://semspub.epa.gov/work/HQ/197414.pdf>
- [10] Schmidt, Eckart W. "Hydrazine and its Derivatives, Preparation, Properties, Applications," Second Edition, Wiley Interscience, 2001.
- [11] Liao et al, "Biodegradation of Unsymmetrical Dimethylhydrazine in Solution and Soil by Bacteria Isolated from Activated Sludge", Applied Sciences, March 2016.



**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Maritime Launch Services  
**Date:** March 19, 2019 9:58:19 PM

---

To whom it may concern;

As a resident of the Guysborough County area I think we need the Maritime Launch Services Project very badly in this area. This area is desperately in need of jobs and a project of this magnitude would greatly benefit everyone. People coming to work at this project would be in need of places to live. Families would be looking for housing and families with young children moving to this area would increase our schools enrollment numbers.

As for tourism, just think of the boost this would give our area and the amount of money that would be spent when a rocket launch was taking place. Our economy would grow indefinitely and our new Chedabucto Lifestyle Complex would see an increase in the amount of people using the facility. I think everyone in this area would benefit from this Maritime Launch Services Project. Thank you.

Sincerely,

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Letter of support for MLS  
**Date:** March 20, 2019 7:19:43 AM

---

Good day, to whom it may concern.

I a life time resident of Little Dover and father of 2 young men, am writing this letter to bring forth my deepest concerns on the impact of the proposed MLS (space port ) in Canso. My concerns for our community of Little Dover and surrounding area Canso and Hazel Hill is that I have been watching our community slowly die for some time now. To clarify, my deepest concerns for our community is not directed to what if the MLS gets the approvals to go ahead for the space port in Canso. My concerns are what if the government and permitting authorities do NOT allow this mega project to go ahead or make it so difficult to get the approvals required to start construction that MLS have to move to another location.

My community that I live in and love so much as mentioned above is and has been dieing for years now and without our government support for mega projects such as MLS, a once in a lifetime opportunity for our community, this community we love so much will surely die off at a much faster rate than ever thought possible.

As most small communities along the coast of Atlantic Canada the fisheries have been the main life support. However with major changes to the fisheries in the past 30+ years, ( fish plants closed etc. ) the only thriving fisheries left is lobster and crab. As lucrative as lobster and crab fishing is in our community it only provides for a small fraction of population within our communities. Therefore the larger majority of our young adults like my two sons have no choice but to move away and start their lives elsewhere to raise and provide for their own families.

If you were to ever take the time to go house to house in Little Dover to talk to the home owners you may notice that the large majority are well past 50 years of age, you may also notice that a large majority of homes are only occupied by an aged single widow or widower as their younger family son & daughters have already been forced to move. You will only come across a very few home that young families still reside in.

The aged and dieing community we live in is no different than having our beloved community being diagnosed with cancer (lack of jobs opportunity's) and the cure for this cancer being new industry such as the MLS space port, a mega project that certainly would cure this cancer and bring life and young families back to our community. Please do not let our beloved community be denied by our government the cure we need and that is industry like MLS.

I know the sounds of rockets being launched and a mega project of this size brings concerns for some and those concerns may want some people to say no to this because it's something they are not familiar with. Please allow me to point out something we are all very familiar with in our community and that is risk for reward. A little background on myself may put these concerns and risk verses reward into perspective.

I have stared out back in the mid 80's as an offshore fisherman for several years, then went into diving for sea urchins when the government shut down our offshore fisheries and worked as a diver for 6 years in the winter months, then in 1999 I started work in the offshore oil & gas where I still work today off Sable Island. The main point I want to get out here is that each of my previous and present careers required me to take some risk for the reward. The below bullet point will highlight the risk and reward. The reward is always the same. And I truly want my sons and other young people of our community to have the chance to experience these same rewards that I have been so lucky to have throughout my career. (Reward = ability to provide for my family and live within our great community) of Little Dover and surrounding area.

- Risk = Sailing 200 nautical miles in a small 42ft wooden boat has risk that most everyone in our community can understand.
- Reward = ability to provide for my family and live within our great community.

- Risk = diving in cold rough waters off our coastline during the winter months.
- Reward = ability to provide for my family and live within our great community.
- Risk = flying offshore on helicopters and working on a gas platform near Sable Island (the burying ground of the Atlantic)
- Reward = ability to provide for my family and live within our great community.

There is nothing worthy in life that will not come without some risk, however with today's high focus on safety & SH&E, major companies like my present employer and companies like MLS have procedures and processes in place to eliminate / mitigate these possible risks and offer great rewards to all involved and also to the community as a whole.

Regards

**From:** [@ns.sympatico.ca](mailto:@ns.sympatico.ca)  
**To:** [Environment Assessment Web Account](mailto:EA@novascotia.ca)  
**Subject:** Proposed Project Comments  
**Date:** March 20, 2019 4:50:24 PM

---

Project: canso-spaceport-facility Comments: Please Approve this. We need this here. Jump to Sections of this page Other pages on Facebook Accessibility

Mr A. MLS has asked residents of Canso, Dover and surrounding areas to email letters of support to Nova Scotia Environment - Environmental Assessment Branch. EA@novascotia.ca below is a copy of my letter of support, I ask all to please also send in their own letter of support as well, thanks in advance Good day, to whom it may concern. I am a life time resident of Little Dover and father of 2 young men, am writing this letter to bring forth my deepest concerns on the impact of the proposed MLS space port in Canso. My concerns for our community of Little Dover and surrounding area Canso and Hazel Hill is that I have been watching our community slowly die for some time now. To clarify, my deepest concerns for our community is not directed to what if the MLS gets the approvals to go ahead for the space port in Canso. My concerns are what if the government and permitting authorities do NOT allow this mega project to go ahead or make it so difficult to get the approvals required to start construction that MLS have to move to another location. My community that I live in and love so much as mentioned above is and has been dieing for years now and without our government support for mega projects such as MLS, a once in a lifetime opportunity for our community, this community we love so much will surely die off at a much faster rate than ever thought possible. As most small communities along the coast of Atlantic Canada the fisheries have been the main life support. However with major changes to the fisheries in the past 30 years, fish plants closed etc. the only thriving fisheries left is lobster and crab. As lucrative as lobster and crab fishing is in our community it only provides for a small fraction of population within our communities. Therefore the larger majority of our young adults like my two sons have no choice but to move away and start their lives elsewhere to raise and provide for their own families. If you were to ever take the time to go house to house in Little Dover to talk to the home owners you may notice that the large majority are well past 50 years of age, you may also notice that a large majority of homes are only occupied by an aged single widow or widower as their younger family son daughters have already been forced to move. You will only come across a very few home that young families still reside in. The aged and dieing community we live in is no different than having our beloved community being diagnosed with cancer lack of jobs opportunity and the cure for this cancer being new industry such as the MLS space port, a mega project that certainly would cure this cancer and bring life and young families back to our community. Please do not let our beloved community be denied by our government the cure we need and that is industry like MLS. I know the sounds of rockets being launched and a mega project of this size brings concerns for some and those concerns may want some people to say no to this because it is something they are not familiar with. Please allow me to point out something we are all very familiar with in our community and that is risk for reward. A little background on myself may put these concerns and risk verses reward into perspective. I have stared out back in the mid 80s as an offshore fisherman for several years, then went into diving for sea urchins when the government shut down our

offshore fisheries and worked as a diver for 6 years in the winter months, then in 1999 I started work in the offshore oil gas where I still work today off Sable Island. The main point I want to get out here is that each of my previous and present careers required me to take some risk for the reward. The below bullet point will highlight the risk and reward. The reward is always the same. And I truly want my sons and other young people of our community to have the chance to experience these same rewards that I have been so lucky to have throughout my career. Reward = ability to provide for my family and live within our great community of Little Dover and surrounding area. Â· Risk = Sailing 200 nautical miles in a small 42ft wooden boat has risk that most everyone in our community can understand. Â· Reward = ability to provide for my family and live within our great community. Â· Risk = diving in cold rough waters off our coastline during the winter months. Â· Reward = ability to provide for my family and live within our great community. Â· Risk = flying offshore on helicopters and working on a gas platform near Sable Island the burying ground of the Atlantic Â· Reward = ability to provide for my family and live within our great community. There is nothing worthy in life that will not come without some risk, however with today's high focus on safety SHE, major companies like my present employer and companies like MLS have procedures and processes in place to eliminate / mitigate these possible risks and offer great rewards to all involved and also to the community as a whole. Regards

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** MLS space port project canso  
**Date:** March 20, 2019 11:02:14 AM

---

Good day,

I a life time member of little Dover Nova Scotia for all of 23 years a surrounding town of canso where the space port project is hopefully takeing pace. For these 23 years of livening here I have had many many friends move away for work and many more to leave yet all because of the lack of jobs and opportunities in are loveing small town , all of these young people as my self would love the opportunity to stay here where we love so much, a lot of these younger people are well educated and have found great careers that would be a great asset to the canso space port project also the businesses that this project would bring to are communities, Such as tourism- brings people and with people brings the need for example gas, food, places to stay, gifts etc. Brings jobs for the upcoming youth and former youth to move back. My self as one of the youth of this loveing community would love to stay here for many many years to come I currently work offshore in the oil and gas industry, a industry something like yours with some people not being the biggest fans but they don't understand the amount safety and environmental precautions and actions takeing to insure the safety of everything and everyone this project will impact  
Thanks you very much look forward to this project getting started  
Cheers

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Rocket launch project for Canso Nova Scotia  
**Date:** March 20, 2019 11:58:58 AM

---

We need this project desperately to save Canso and surrounding areas from extinction. Please approve this project.  
We need it desperately for our community to survive and for our children's, and grandchildren's futures.

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Fwd: Maritime launch services  
**Date:** March 20, 2019 12:12:09 PM

---

Sent from my iPad

Begin forwarded message:

**From:** [@xplornet.ca](#)>

**Subject: Maritime launch services**

Re:Proposed rocket launch project Canso..

I am writing this letter in full support of the above mentioned project..  
I am a retired business owner from Canso..had business in Canso and  
Guysborough...born and educated in Canso..and still live in the area..  
We are way overdue for development here....the majority of our citizens are now  
seniors....we need to bring our young people back...I have spoken to several..and  
there is nothing they want more than to be able to live here, work here and bring  
up their families here..in this beautiful town...

We have suffered way too long with no employment..we have churches,  
RCMP station..school...all of these will not be able to be sustained without the  
population growing....we need to fill our churches..support our children..and give  
them something to look forward too...  
Please consider the future of this community...it is a piece of paradise..appreciated  
even more by those who have had to leave to find employment...  
Looking forward to a positive outcome for our area..

Regards

Sent from my iPad



March 20, 2019

To Whom It May Concern:

The Canso Area Development Association (CADA) is pleased to support the Maritime Launch Services (MLS) proposed project for a Spaceport, in Eastern Guysborough County.

During numerous community open houses, Maritime Launch Services shared their business plan for the Canso Spaceport. They shared that there is the potential of eight launches planned by the year 2022 and that this spaceport would have a significant economic impact on Canso and surrounding area.

On behalf of our board we are requesting that once Maritime Launch Services (MLS) has met all the environmental benchmarks for the development of the Canso Spaceport Project they be given written approval. This medium range satellite facility in the Canso-Little Dover area will create both full and part-time employment.

Sincerely,

President (CADA)

P.O. Box 28, Canso, Nova Scotia, B0H 1H0

**From:** [Creative Networking - Atlantic](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** The MLS initiative in Canso, NS  
**Date:** March 20, 2019 3:24:20 PM

---

To whom it may concern:

My wife and I recently moved to Hazel Hill, NS and in the past two years have been alarmed at the aging population and loss of young families. Young men and women can not find gainful employment in this area, excepting the fishing industries, and move out to seek employment in the larger towns or cities.

Of course this negatively impacts our economy through lack of tax base, loss of local spending and substantial reduction in tradespersons, labour and services that would normally support a growing community.

Once of the driving forces to our selecting this area to settle was the proposed MLS spaceport, as we believed this would create jobs, attract younger families back to the area and see our community grow and develop, hopefully back to near what it was when the fish processing plant was booming here.

Please give positive acceptance of the MLS proposal, as it seems they have complied with and fulfilled all obligations of the various assessments and reviews.

Sinceely

**Creative Networking (Atlantic)**

Atlantic: (902) 366-2409

GTA: (416) 278-3906

**From:** @hotmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 20, 2019 3:51:09 PM

---

Project: canso-spaceport-facility Comments: A great opportunity for our wonderful area! Iâ?  
Tm a married mom of 5 small children and a very environmentally conscious person, after  
reading reports and hearing details, I donâ?Tt believe this would pose a threat to our pristine  
coast at all. My husband is a lobster fisherman and agrees with me! We believe this will have  
a huge positive impact in our area and fully support it! Name: Email:  
k@hotmail.com Address: Municipality: Canso Postal-Code:  
hone: ### ### - ##### Fax: ### ### - ##### email\_message: Privacy-Statement:  
agree x: 70 y: 35

**From:** @hotmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 20, 2019 8:22:27 PM

---

Project: canso-spaceport-facility Comments: Just dont think that the risk is worth the possibility of a few jobs. This area is in my opinion too close to our houses. These wetland areas are part of our watershed and need to be protected. I have a cabin in this general area and Im not even permitted to use home heating oil because of environmental issues in case of a spill. Like everyone in this area, I have children working away. It would be a great to have them working at home but there isnt really any guarantee that the local jobs will even be here. Either way, in such a small area, so close to our homes it just doesnt make sense to me to risk our health and environment for something with no real guarantee of solving our economic problems. Name: Email: @hotmail.com Address:

**From:** [@ns.sympatico.ca](mailto:@ns.sympatico.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Support for MLS  
**Date:** March 20, 2019 9:22:03 PM

---

To Whom It May Concern,

I am writing to endorse my support for Maritime Launch Services to commence construction of facilities and add equipment required to offer the services of launching satellites. I believe this project has a lot to offer all communities in the surrounding area. The jobs, indirect jobs and tourism attention will definitely benefit all surrounding communities. Many people will come to watch the launches providing more business for existing businesses and a potential for new business to develop in the area. I also believe it will influence the services that we take for granted. For example, our hospital in Canso. With the influx of population in the area, we may not be a hasty target for closure in future, as this project requires a hospital close by.

I believe this project will be as beneficial to the area as the Stan Rogers Folk Festival is. But multiple times during the course of a year.

Thus far, MLS has provided satisfactory answers to any questions we bring them. They are generous to offer open houses to inform and answer any questions the general public may have. They show respect and dedication to our community where there is no demand for it.

I believe this could be a new beginning, if you will, for our little communities that are now, slowly fading as our seniors leave us. This could be an avenue to rebuild our once thriving communities!

Best,

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** MLS  
**Date:** March 20, 2019 9:38:41 PM

---

I really think this would be good for our community, please consider this project. Without this, our community is threatened by losing our school, bank and even hospital. Canso could really use this to help our town.

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Maritime Launch  
**Date:** March 20, 2019 9:42:43 PM

---

This letter is in support of the proposed Launch site in Canso, it's time for our community to have new industry, new people, young people. I am a senior and live within a few miles of the project and am hopefully awaiting the new development. Sincerely hope it will be approved. Thank you

Sent from my iPad

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** SUPPORT FOR MARITIME LAUNCH SERVICES  
**Date:** March 20, 2019 9:43:13 PM

---

To Whom It May Concern,

I am writing to endorse my support for Maritime Launch Services to commence construction of facilities and add equipment required to offer the services of launching satellites. I believe this project has a lot to offer all communities in the surrounding area. The jobs, indirect jobs and tourism attention will definitely benefit all surrounding communities. Many people will come to watch the launches providing more business for existing businesses and a potential for new business to develop in the area. I also believe it will influence the services that we take for granted. For example, our hospital in Canso. With the influx of population in the area, we may not be a hasty target for closure in future, as this project requires a hospital close by.

I believe this project will be as beneficial to the area as the Stan Rogers Folk Festival is. But multiple times during the course of a year.

Thus far, MLS has provided satisfactory answers to any questions we bring them. They are generous to offer open houses to inform and answer any questions the general public may have. They show respect and dedication to our community where there is no demand for it.

I believe this could be a new beginning, if you will, for our little communities that are now, slowly fading as our seniors leave us. This could be an avenue to rebuild our once thriving communities!

Best,

Sent from my iPhone



**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Support for MLS Spaceport  
**Date:** March 20, 2019 9:44:02 PM

---

To Whom It May Concern:

Please accept this letter as my vote of support for the proposed MLS spaceport.

I am a permanent resident of Little Dover, Guysborough County and have lived here most of my life. When I was 18 I had to leave to gain education and tried to make a life away from my beloved community but it kept drawing me back. My love for this community and its people is evident everyday in the way I live and in my extended family members whom have decided to stay through what some may call "recession like" situations with the cut backs in the ground fishery and the closure of the local fish plant. For the last several months, even years, there has been a significant downturn in the population of our community which has had a bristling affect on local businesses and even the amount of nurses and doctors at my local hospital. They are pushing through with skeletal staff in order to provide admirable care to our local residents but it is becoming increasingly hard to do as it is not possible to maintain employment for spouses of perspective hires for these positions due to lack of employment and recreational activities. With industry comes employment...increase in local business gains...spin offs to restaurants and motels...and tourism. It all snowballs.

Do I have environmental concerns?...absolutely.. we do live in a serene and beautiful place and am I putting faith in the hands of a company to do the right thing by this community with putting the proper protections in place?...definitely. Saying that, everyday I see the health concerns of our residents from side affects from being out of work and burdened by stress due to not being able to care for their families the way they would want to. They are such hard working wonderful people who just need a purpose. I do not need to be a nurse to see that...it is evident on any given day when you know how proud they once were.

My husband, also a permanent resident has lived here all of his life and also supports the proposed spaceport. He feels that in another 10 to 20 years there will be no village left except for a few fisher people. There is no work, so unless the children of these fisher people stay here to continue the legacy they will also have to leave. We need other types of employment in this area outside of the fishing industry. We cannot survive with just that any longer. My husband worked at the Canso Seafoods Plant all of his life until it closed. He then had to travel to work 1 1/2 hours each way until he could retire..that was often 6 to 7 days a week. Most of the young people in the area are out-migrating to other provinces to make a life...but would prefer to be here making one. I know this spaceport isn't the answer to all of our problems but it sure is a great place to start. What I see for the future without employment for this community and surrounding areas is bleak. Please consider this in your decision.

Best regards..

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Canso Spaceport  
**Date:** March 20, 2019 9:47:40 PM

---

As a long time member of this community, I have seen first hand how the fishing industry prospered for years and then collapsed in the early nineties, and after that our town has suffered from young adults leaving in search of jobs and from many of our seniors passing, this has lead to a once large town fall into a small village. I believe that with this spaceport that to an extent, our town may once again prosper as it will give us more people living in it and more supporting our businesses, as well as providing jobs. Please consider this request.

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Cc:**  
**Subject:** ward2u re The Canso Rocket Launch Facility  
**Date:** March 20, 2019 9:52:58 PM

---

**To:**  
Margaret Miller, MLA  
Minister of the Environment  
Nova Scotia, Canada

**From:**

[@gmail.com](#)

**Re: The Proposed Canso Space Launch Facility**

Date March 20, 2019

Dear Minister Miller:

I have recently become aware of the proposed launch facility sought to be located between the wind turbine farm and Mud Hole, just south of Canso. Although the proposal sounds intriguing, several important points seem absent or glossed over in the released public information.

- 1.** A close reading reveals that the Nova Scotia Government is proposing to install a decommissioned Soviet RS-20 MIRV ICBM missile launch system two miles south of a populated area.
- 2.** On land, these rockets were designed to be launched from large railway cars, and the proposal alludes to the inclusion of these elements of the launch system, as well as a horizontal assembly building similar to the Wallops facility in Virginia east of the Goddard Space Flight center, and the SpaceX facility at the Kennedy Space Center in Florida.
- 3.** Although the Ukrainian company Yuznoye, a well-respected Russian military and private contractor is correctly identified as the manufacturer, the proposal neglects to mention that the RS-20 was phased out more than 30 years ago. The Soviets replaced it in the 80's with the RS-36 or something. It should be noted that the launch system has undergone extensive updating and testing of the AJ motors over the years as part of NASA's Antares/ISS/SpaceX mission in Wallops, Virginia. However, the Nova Scotia taxpayer has been given no assurance of launch contracts to breathe life into what is otherwise just another 'make work program' attached to a glorified dump for old Soviet missiles.

Also worthy of note is that it will never be able to compete with SpaceX's relaunchable Dragon vehicles that NASA appears committed to, and which seem

superior in four ways:

**a)** The Dragon is technologically more advanced, physically newer, and has a superior lift profile. Tell me if I'm wrong, but I'd bet that your system was an 'also-ran' in the NASA ISS resupply contract challenge.

**b)** The RS-20 is a two stage rocket. The first stage runs on LOX and kerosene, the old standbys of liquid rocket propellants. But the RS-20's second stage ran on hydrazine, which is a highly unstable and explosive combination of ammonias that is difficult to handle and quite hazardous to humans. If this rocket's second stage still runs on hydrazine, a launch failure at MECO could present a huge hazard to the people of Canso who are only two miles down range.

**c)** The Department of Environment's FAQs link mentions nothing of the potential environmental hazards of this proposed project, presenting only generic babble about government environmental investigative processes.

**d)** Why is this facility being located in Canso anyway? You would obtain a higher lift capability with greater orbital launch opportunities in a safer less populated area if you located the facility in, say, White Rock Mines north east of Yarmouth.

Anyway, those are the more obvious concerns of a far away amateur. Thanks for listening.

Respectfully submitted,

[Soviet RS20 ICBM](#)

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** In support of Maritime Launch Services  
**Date:** March 20, 2019 10:43:18 PM

---

Hello,

I would like to offer some words of support for the proposed Maritime Launch Services space port in Canso.

I am from the UK originally having immigrated to Cooks Cove Guysborough The part of England I am from suffered tremendously after the collapse of the Mining and Steel industry in the early 80's. An industry which provided direct employment to many as well as benefit from the smaller but no less significant supporting micro industries and services that grew from it.

Since moving to Canada I have made a number of friends and acquaintances from the rural area of Canso who support my understanding that it has undergone a similarly dramatic and impactful economic decline to the one I recall growing up through.

Having resided and worked for 11 years in Guysborough I am more than confident in the inherent qualities and abilities of its residents to effectively manage any and all risk associated with such an undertaking and to do so for the betterment of all who live in Canso, extending such benefit to the Province as a whole through spin off support services and facilities the extent of which should not be underestimated.

This project has my wholehearted support.

Best Regards

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Maritime Launch Services, Letter of Support  
**Date:** March 20, 2019 10:44:00 PM

---

20 March 2019

To Whom It May Concern,

I am writing in support of the Maritime Launch Services project that is proposed to be constructed in the areas of Hazel Hill, Little Dover and Canso.

I believe that this project would inject a vital boost to the local economy. The construction of the infrastructure and launch vehicle development is a global opportunity right here on our doorstep!

The completion of this project would encourage growth in population, commerce, infrastructure as well as tourism.

I do believe that the Maritime Launch Services have been transparent in their interactions with the local people in addressing the fears and concerns that naturally arise from such a foreign concept as having rockets being launched over our fishing grounds and forestry.

I write in support and the greatest of hope that the governmental departments involved will support this project as well. It is a wonderful opportunity that the area desperately needs to survive and grow.

Thank you for your time.

Respectfully,

, property owner, Little Dover, Nova Scotia

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Supporting Maritime Launch Services  
**Date:** March 20, 2019 10:50:41 PM

---

To Whom it may concern,

I am writing to throw my support behind Maritime Launch Services (MLS). Although I no longer live in the community I was born and raised and still have family there. I think this is a huge opportunity for the whole county of Guysborough and the Province of Nova Scotia and not just localized to Canso, Little Dover etc. Imagine if this were to actually take place, the jobs that would be created to build the compound, the jobs to maintain it after construction and these jobs bring revenue into the community and revenue creates more jobs. Then there are the tourists who will come to watch and all of these people combined will need more accommodations, restaurants, gas stations, grocery stores etc just to meet the demand of this whole development and eventual rocket launches.

Canso and the surrounding communities have been dying slowly for years and this is just the boost it needs to get back on it's feet and thrive, a project like this could literally put the area in the forefront of development and boost economics for the entire province. Please listen to the people and give them a chance to be hopeful again.

Sincerely

**From:**  
**To:** [Environment Assessment Web Account](#); [Environment Assessment Web Account](#)  
**Subject:** NO SPACEPORT  
**Date:** March 21, 2019 12:04:37 AM

---

To whom this my concern:

Hi my name I'm a resident from Canso, I am and I have been living here for my whole life and recently just bought a house in this community and just had a beautiful baby

I also have went to NSCC and successfully took

and I have learned about environmental assessments and I'm a fishermen in this community, I know that we do not have much in this community but I know that our air is not polluted and our waters are not polluted!!! But if this Spaceport comes here our waters and air will never been the same!! This community and surrounding areas live off the ocean here and to even think of something that may and will pollute our livelihood and for that reason ....

I am strongly against the Spaceport coming to Canso !!

Thanks

Get [Outlook for iOS](#)



**From:** [@ac-ada.ca](mailto:@ac-ada.ca)  
**To:** [Environment Assessment Web Account](#)  
**Cc:** [catherine@ac-ada.ca](mailto:catherine@ac-ada.ca)  
**Subject:** Canso Spaceport Facility Project  
**Date:** March 21, 2019 9:50:34 AM

---

Good Morning,

I am writing in support of the Maritime Launch Service's application to construct and operate a Spaceport facility in Canso Nova Scotia.

The Aerospace and Defence industry in Nova Scotia generates over \$900 M annually in direct GDP and close to 7,000 jobs. When indirect and induced effects are included, these numbers grow to \$2B in GDP and over 16,000 jobs. These numbers will continue to grow as some of the larger shipbuilding programs such as the Canadian Surface Combatant start to ramp up, but mostly in the urban centers.

While the jobs and direct and indirect GDP that would result from the Maritime Launch Service's construction and operation increase these figures, the important aspect is that this will mostly be in **rural areas of Nova Scotia**. The facility will contribute significantly to the local economy and infrastructure in the Canso region and result in significant growth opportunities elsewhere in Nova Scotia. As an example, Dalhousie University is currently working in calibration with the Canadian Space Agency on a Cube Satellite (CubeSat) program with a focus on building and operating the satellites.

Building this expertise in Nova Scotia along with the means to launch will enable space companies to start, grow, and remain in Nova Scotia. There is also an increased probability of investment from other parts of Canada and International firms that need to be closer to the launch site. Having the launch facility as the anchor, we will have the opportunity to establish a cluster of space related firms in the region similar to other space ports around the world.

I appreciate that this speaks to the economic and not the environmental impact of the project, but it is important not to lose sight of one while evaluating the other. This project has the potential to change the way Nova Scotia is perceived both nationally and internationally from a quaint tourist destination with friendly people and great seafood; to high technology center for innovation that is also a great tourist destination with great seafood.

We have been accused of not "Thinking Big" often enough in Canada, this project is a great example of thinking big and I do not want to see this opportunity pass us by.

Kind Regards,

**Atlantic Canada Aerospace & Defence Association**  
(902) 425-0070 x8 m:  
5151 George Street, Suite 502, Halifax, NS B3J 1M5

[ac-ada.ca](http://ac-ada.ca)

[@ac-ada.ca](mailto:@ac-ada.ca)

M.E. Harnish Heating & Ventilation Inc.  
4915 Larry's River Road  
Guysborough  
Nova Scotia

March 21/2019

To Whom this may concern,

We are writing this letter in support of Maritime Launch Services proposed rocket launch site in the Canso and Little Dover area. We are a family of four from this small tight knit community that has been suffering for a number of years, due to the closure of the fishing industry. We have lost many residents and services during this time and we stand to lose so much more if this proposed project falls through. Without this project our economy will continue to decline and we face losing our schools, healthcare facilities, recreation facilities and families. We run a small business and without this project we feel we may even lose our way of life, our boys who are now 21 and 18 are searching for jobs out of province as there is nothing here for them and without families needing our services we would have to leave to find new employment as well. The community needs this project, we deserve to live where we love, in our homes that we work hard for everyday. There has to be a way to get this project moving, to make our communities thrive as they are in other areas of the world with the same kind of facilities, they have made it successful, we should be able to follow in their paths.

Thank you for taking the time to read this letter of support and concern, we hope that this project will be given the go ahead and that our little communities will thrive because of it.

Sincerely,

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Re: MLS  
**Date:** March 21, 2019 9:21:35 PM

---

To Whom It May Concern,

I am writing to endorse my support for Maritime Launch Services to commence construction of facilities and add equipment required to offer the services of launching satellites. I believe this project has a lot to offer all communities in the surrounding area. The jobs, indirect jobs and tourism attention will definitely benefit all surrounding communities. Many people will come to watch the launches providing more business for existing businesses and a potential for new business to develop in the area. I also believe it will influence the services that we take for granted. For example, our hospital in Canso. With the influx of population in the area, we may not be a hasty target for closure in future, as this project requires a hospital close by. I believe this project will be as beneficial to the area as the Stan Rogers Folk Festival is. But multiple times during the course of a year.

Thus far, MLS has provided satisfactory answers to any questions we bring them. They are generous to offer open houses to inform and answer any questions the general public may have. They show respect and dedication to our community where there is no demand for it.

I believe this could be a new beginning, if you will, for our little communities that are now, slowing fading as our seniors leave us. This could be an avenue to rebuild our once thriving communities!

Sincerely,



Virus-free. [www.avast.com](http://www.avast.com)

**From:** @live.ca  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 21, 2019 11:42:54 PM

---

Project: canso-spaceport-facility Comments: I think this would be a great advancement in technology for Canada. There would be an increase in all aspects, levels, and categories of employment further development of necessary regulatory bodies and Canada would be making progress in this field of expertise. Name: Email: @live.ca Address:

**From:** @outlook.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 11:07:49 AM

---

Project: canso-spaceport-facility Comments: Little Dover  
Nova Scotia March 22/2019 To Whom this may concern, I am writing this letter in support of the MLS proposed Rocket Launch Project in the Canso and Little Dover area. I was born and raised in this small tight knit community, and have seen first hand what this community was in it's day and what it has lost since the collapse of the fishing industry 30 years ago. There were numerous oppertunities available for employment, there were multiple grocery stores, a department store, a movie theatre, dining establishments and other facilities that were lost due to the collapse of the economy. People have been leaving the area in a steady stream along with members of my family looking for employment, this project would change out little suffering community and bring it back to what was a thriving area, without this project we stand to lose what little we have left, our school, hospital our lone grocery store etc. I hope this project gets the go ahead and once again our families and friends can continue to live in a happy thriving community. Sincerely, r. Name: . Email:  
@outlook.com Address:

**From:** [@gmail.com](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 12:08:41 PM

---

Project: canso-spaceport-facility Comments: this project should be approved as proposed.it has the potential to create much needed jobs and could be a shot in the arm to the tourist industry all concerns have been addressed.safety has been proven in many countries.get this project under way without further delay!!!! Name: Email:

**From:** [@ns.sympatico.ca](mailto:@ns.sympatico.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 12:36:34 PM

---

Project: canso-spaceport-facility Comments: I support Canso Spaceport Project.I support the starting of construction of facilities and equipment needed to offer services of launching satellites.I believe this could be an asset to Canso and surrounding areas. Yours truly...

: Email: @ns.sympatico.ca Address



**From:** @msn.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 2:33:06 PM

---

Project: canso-spaceport-facility Comments: March-22-2019 To who it may concern, In regards to MLS Spaceport Launch Canso / Dover . I often wonder if our Provincial Members know of our hard struggle to survive in a rural area, what we stake our lives and the lives of our children on. Over the past 30 years the number of lost residents , families and businesses that has had its effects on this area. We get knocked down but we get back up and try again. I see the MLS Spaceport as a glimmer of hope for the young people and an opportunity to this area to improve its tourism and our way of life for its residence . Also with great enthusiasm for new businesses to come to our area and set up shop. Without it you can expect this area to become a GHOST TOWN. Doctors will leave, Hospital will close school will do the same. We know that money has been allocated to Yarmouth /USA to up grade their tourism , but what we want is this chance to help ourselves. And all that takes is a stroke of a pen, And MLS will follow through and the rest will be history. There are no Guarantees in this world, we just have the chance to try and thrive because of it. With all information that is circulating everyone has a right to say yes or no. For almost two year I have been doing research on everything to do with rocket fuel /launches. No one can see or tell what the future holds , but don't stop us from trying . I VOTE YES for MLS !!!!! Sincerely, . Name:  
Email: @msn.com Address:

**From:** [@shaw.ca](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 2:50:58 PM

---

Project: canso-spaceport-facility Comments: The company is following international standards. Dont shut them down for something that is a very small possibility. Greener propellants will arrive some day, but opportunities like this wont suddenly return because of that. This project deserves the chance to become a going concern and be allowed to mature on par with international facilities. Canada needs to be open for business. Name:  
Email: [@shaw.ca](#) Address:

**From:** @gmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 4:42:48 PM

---

Project: canso-spaceport-facility Comments: I write in favour of the Space Port. Lets move Nova Scotia forward, provide some good jobs, put some money in circulation. Enough procrastination, lets get the thing built. Cape Canaveral would appear to have faired well, why would it be different here! Lets get with the program get on with it. Name:  
Email: @gmail.com Address:

**From:** [@chebucto.ns.ca](mailto:@chebucto.ns.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 5:36:57 PM

---

Project: canso-spaceport-facility Comments: Build it and support it as quickly as you can!  
This facility will provide skilled jobs to the region. Name: Email:  
@chebucto.ns.ca Address:

**From:** [Environment](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 22, 2019 7:19:01 PM

---

Project: canso-spaceport-facility Comments: As a resident of NS, I fully support this project  
Name: Email: Address: Municipality: Postal-Code: Phone: ### ### - ##### Fax: ### ### -  
##### email\_message: Privacy-Statement: agree x: 55 y: 29

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Canso Spaceport Facility Project  
**Date:** March 23, 2019 12:56:41 PM

---

To whom it may concern;

I am writing today, to show my support for the proposed space port in the Canso/Little Dover area.

I am      years old. I grew up at the time when the fisheries had its peak and its crash. I watched families and friends move away to find work and eventually, I did so as well; serving in the military for 13 years. After that time had passed I chose to move back to my home of Little Dover, or what's left of it. Almost all of the businesses have closed. There are a few lobster fisherman that prosper but the rest of the people just scrape by.

I know there are people opposed to this project, but most of these people are misinformed or afraid of change. Don't get me wrong, I know how dangerous the second stage fuel that they will be using is. However, it's no worse than the amounts of Uranium contaminants in the ground water, which exceed the acceptable levels, according to Canada's Guidelines for Canadian Drinking Water Quality. Not to mention elevated levels of Radionuclides, related to Uranium such as Radon, Lead<sup>210</sup> and Radium.

There are also elevated levels of Arsenic in the ground water that frequently exceed the national drinking water guidelines for Arsenic. All of this information is on the Department of Lands and Forestry web page that show maps, under the heading of Environmental Risk. So, there is no more of a risk to the environment from launching rockets, than what is in the ground already.

Like I said, I support MLS. I support bringing jobs to the area, and I support people who want to come back home but never had the opportunity to. I support the growth of ALL of the communities involved. This is a much needed project for everyone in this area, and personally I don't think the risk is high enough to stop progress.

For your consideration,



**From:** [@gmail.com](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 23, 2019 3:24:05 PM

---

Project: canso-spaceport-facility Comments: Please, I absolutely beg of you, do not approve this project. This is not progress in any way shape or form, and if anything were to go wrong during any part of the launch, the environment would be severely damaged. Whatever the report has to say about minimizing risks, I dont care, Im telling you, this could be disastrous for the environment in Nova Scotia. A maximum of 8 launches per year means 8 potential catastrophes a year. This company should not be allowed to use toxic chemicals in or near Canso. Whatever is to be gained by this, by which I mean whatever money is to be gained by this, the environmental impact is absolutely not worth the endeavor. Name:



**From:** @hotmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 23, 2019 3:25:56 PM

---

Project: canso-spaceport-facility Comments: I hope you get the green light, hopefully it will bring back some of the young people and it will create jobs which will be great for the economy. Name: Email: @hotmail.com Address:

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** support for MLS  
**Date:** March 24, 2019 1:03:44 AM

---

To Whom It May Concern,

I am writing to endorse my support for Maritime Launch Services to commence construction of facilities and add equipment required to offer the services of launching satellites. I believe this project has a lot to offer all communities in the surrounding area. The jobs, indirect jobs and tourism attention will definitely benefit all surrounding communities. Many people will come to watch the launches providing more business for existing businesses and a potential for new business to develop in the area. I also believe it will influence the services that we take for granted. For example, our hospital in Canso. With the influx of population in the area, we may not be a hasty target for closure in future, as this project requires a hospital close by.

I believe this project will be as beneficial to the area as the Stan Rogers Folk Festival is with multiple launches during the course of a year.

Thus far, MLS has provided satisfactory answers to any questions we bring them. They are generous to offer open houses to inform and answer any questions the general public may have. They show respect and dedication to our community where there is no demand for it. I believe this could be a new beginning, if you will, for our little communities that are now, slowly fading as our seniors leave us. This could be an avenue to rebuild our once thriving communities! I am proud of where I come from and it has been sad to see the community decline.

hope this project  
gives us a new chapter for our children and grandchildren to remember and bring back this  
amazing community.

Best Regards

**From:** @gmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 24, 2019 9:22:35 AM

---

Project: canso-spaceport-facility Comments: I believe that the Spaceport is an excellent idea. I consider myself an environmentalist, yet the risks of damage from a launch seem minimal in the grand scheme of things. Other similar launch sites operate on a regular basis with little harm done to surrounding areas. This is an opportunity that will generate some touristic and employment opportunities. Even in the almost impossible event that 8 launches failed in a year, I dont see this causing a detrimental impact that even comes close to our other provincial pollutants, such as pulp mills, mines, and coal powered generating stations. Rocket launches are part of our necessary telecommunications today, and we would be foolish to miss our chance to be a part of a growing and important industry. Name:           Email:  
@gmail.com Address:

**From:** @icloud.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 24, 2019 10:17:09 AM

---

Project: canso-spaceport-facility Comments: Nova Scotia is awesome, space is awesome and the fact that we will be bridging the gap between the two will be out-of-this world amazing. I've always dreamed of seeing a rocket launch into space and I can't wait to see it happen from my motherland! See you at the launch site! Name: Email:  
@icloud.com Address:

**From:** [@ns.sympatico.ca](mailto:@ns.sympatico.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** MLS Rocket Launch Canso Nova Scotia  
**Date:** March 24, 2019 8:06:51 PM

---

Please be advised that  
Rockets Canso NS

fully support MLS re

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Canso Rocket Launch  
**Date:** March 24, 2019 8:20:15 PM

---

I am writing this email in regards to the proposed Rocket Launch Project off of Canso, Nova Scotia. There are mixed feelings between people in Canso and the surrounding areas and everyone's opinion needs to be respected. Many people lost their lives so that we could all have freedom of speech.

In the mid 70's there was a strike at the Canso Fish Plant and people fought not only with words but with acts of violence. Friends, families and neighbors fought amongst each other-many being seriously injured or arrested and still carry those consequences with them today. Those who have passed from that time often did so, holding grudges. It has taken the next two generations to settle the dust and repair some of the damage from that strike. I can picture the town and communities going down that path again. The rockets are not here nor are even approved, and there are already many heated arguments amongst the residents.

Several residents have expressed their intentions to move should the rocket project move forward. We are a small community of retired and working fisherman and our industry is what we know. This leaves us vulnerable to whatever information is given to us about the rockets. It would be easy to lie to us and give us false assurances.

Mankind has made many mistakes, we are human. Faulty automobiles, ships not built strong enough, aircrafts, rockets falling from the sky or exploding. We need experts and the Government of Canada, specifically Environment Canada, needs to disclose completely and truthfully the risk to the residents and our environment especially considering our fishing industry.

The smallest rocket (some are two times bigger) produces 17,500 gallons of emissions, which is 437 barrels per blast. 1% of those emissions falling back down to our environment is 4.37 barrels per blast.

No one doesn't want to see Canso thrive or grow but not at the risk of the lives of the current residents or future generations. This is a manmade project with many unanswered questions, specifically around the safety of the fuel being used in these rockets. The decision cannot be based on emotion or excitement of headlines.

The Canso Rockets Project needs to be investigated with a fine tooth comb. You cannot un-press that big red button.

Sincerely,

Sent from [Mail](#) for Windows 10

**From:** @stfx.ca  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 24, 2019 10:47:41 PM

---

Project: canso-spaceport-facility Comments: I fully support this program. This is a very important initiative and not only it will have commercial benefits, but it will also have huge academic benefits to students interested in science. Also, this has a huge potential for tourism and overall growth of the region. I wish this project all the best! Name:  
Email: @stfx.ca Address:

**From:** @hotmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** March 25, 2019 7:42:19 AM

---

Project: canso-spaceport-facility Comments: Good day. A not so distant time ago I would have said cool, rockets launching into space from Nova Scotia, now I am on the other side of that thought. The very few amount of jobs created and the economic return on the Region for this launch site are not worth risks to the environment, including failed launches falling into the ocean even if the risk is minimal, nor successful launches with the toxic emissions and the quantity of water used to cool down the launch site. On top of that, the company does not even have a plan for spills and other mishaps, as long as they are not serious, they should not be allowed to operate in our Province, nor Country. Name: Email:

@hotmail.com Address:





REACTION  
DYNAMICS

CEO & CTO

---

*Reaction Dynamics Lab Inc.  
5640 Chemin du Bois-Franc  
Saint-Laurent, QC, Canada, H4S 1A9  
Email: bachar.elzein@reactiondynamics.space  
Phone: +1 (514) 652-8028  
URL: reactiondynamics.space*

March 25, 2019

To: The Honourable Margaret Miller, Minister of Environment  
Nova Scotia Environment  
PO Box 442  
Halifax, NS B3J 2P8  
Tel.: 902-424-3736  
Fax: (902) 424-1599

*The following letter of support is issued in response to the public consultation initiated by Nova Scotia Environment concerning the submission of the focus report by Maritime Launch Services Ltd. regarding their Canso Spaceport Facility Project.*

Dear Minister,

After having reviewed the environmental assessment and focus report submitted by Maritime Launch Services Ltd. (MLS), we wish to express our support for the Canso Spaceport Facility Project and strongly recommend that they be given approval to go forward with the construction of their spaceport and subsequent operations.

Reaction Dynamics is a Quebec-based rocket propulsion and space launch company that has been in operation for over a year. We have gathered significant financial support from the Canadian Space Agency and obtained more than 100 million dollars in letters of interest. We have also had the opportunity to work with MLS, as we consider their Canso Spaceport to be an excellent option for our launch operations which we hope to begin in 2023.

The establishment of a spaceport in Nova Scotia represents something new for the province: an opportunity for Nova Scotia to become a national and global leader in the space industry. The greatest example of what a launch infrastructure can do to a region is Florida's space coast. The launch site at Cape Canaveral Air Force station has been in operation even before the space race began and has seen extraordinary historical events, including the first American manned spaceflight, the Apollo missions to the moon, and the operation of the space shuttle. The region now plays host to over 17,000 aerospace-related companies which have employed more than 130,000 people and provide over 19 billion dollars in revenue to Florida's economy.

Locating a launch site in Nova Scotia would force other companies, including launch companies like ourselves, spacecraft companies, original equipment manufacturers, and others, to co-locate with MLS in Nova Scotia to get easier access to the launch site, launch services, and potential customers. While MLS predicts that their Spaceport can create 335 jobs by 2025, the simple fact that a Spaceport is in operation will attract significantly more business from a variety of other companies, and has the potential to create a Canadian version of Florida's Space Coast.

At the same time, Reaction Dynamics is not ignorant to the concerns that have been raised about the Canso Spaceport project, namely the use of toxic propellants in the upper stage of the Cyclone 4M launch vehicle. We would like to emphasize that the use of such propellants is not uncommon in modern launch vehicles. In Europe, both the Ariane 5 and the Vega use these propellants in their upper stages. As well, many satellites, including those launched from American soil, also carry these propellants on a regular basis. In all these cases, the risk posed by these propellants has been mitigated through modern safety practices and operations.

We are confident that MLS will be able to mitigate these risks as well. Our confidence is bolstered by the experience we have witnessed on the MLS team. A prime example of this is the President and CEO, \_\_\_\_\_, who, in 1994, was issued a prestigious "Silver Snoopy" award \_\_\_\_\_ for outstanding achievements related to human spaceflight safety. \_\_\_\_\_ already has decades of experience with rocket propellants and keeping the people around them safe.

As we hope to continue working with MLS, there is a possibility that our rockets, which use a new proprietary non-toxic propellant, could be operated from their site as well. Companies like ours launching from MLS would significantly increase the returns for MLS and the Nova Scotia economy while negating environmental concerns.

With the recent release of the Canada's first National Space Strategy in over 20 years which declared space to be a national strategic asset for Canada, the time has never been better for Nova Scotia to move forward with legislation opening the province to space companies. Reaction Dynamics strongly urges that the Nova Scotia government go forward with the approval of this venture. Doing so would open up a world of economic possibilities to Nova Scotia, and the heavens to the nation of Canada.

Respectfully,

To Whom this may concern,

I am writing this letter in support of the MLS proposed Rocket Launch Project in the Canso and

Little Dover area. I was born and raised in this small tight knit community, and have seen first hand

what this community was in it's day and what it has lost since the collapse of the fishing industry 30

years ago. There were numerous oppertunities available for employment, there were multiple grocery

stores, a department store, a movie theatre, dining establishments and other facilities that were lost due

to the collapse of the economy. People have been leaving the area in a steady stream along with

members of my family looking for employment, this project would change out little suffering

community and bring it back to what was a thriving area, without this project we stand to lose what

little we have left, our school, hospital our lone grocery store etc. I hope this project gets the go

ahead and once again our families and friends can continue to live in a happy thriving community.

Sincerely,

March 25<sup>th</sup> ,2019

The Environmental Assessment Branch  
Nova Scotia Environment  
P.O. Box 442  
Halifax, N.S.  
B3J 2P8

Dear N.S.E.A.B.

Re: MARITIME SPACE LAUNCH

**WE MUST LOOK TO THE FUTURE** , private space launch is a growing and developing business for now and the future.

We must seize the opportunity and actively work to participate in it.

I'm all in favor of Maritime Space Launch Services forthcoming project at Little Dover Guysborough County.

Your's Truly



March 30, 2019

Environmental Assessment Branch  
Nova Scotia Environment  
P.O. Box 442  
Halifax, NS, B3J 2P8

To whom it may concern,

I am writing in relation to Maritime Launch Services' (MLS) focus report recently submitted for public consultation in relation to the proposed Canso spaceport facility.

While I am not a scientist and cannot comment on the natural or technical nature of the report, I am experienced as both a management consultant and an academic in strategic management, design, implementation, risk management and business contingency planning.

From both my reading of the report, and my discussions with company president Steve Matier, it is my understanding that MLS proposes to assemble and launch a Ukrainian-designed rocket, with assembly in Canada, at a facility in Canso, Nova Scotia. While the proposed Canso spaceport would be new, the rocket itself is derived from a rocket family with a well-established and successful launch history.

I am aware that some concerns have been raised in relation to the use of hydrazine as a propellant. It is important to note that hydrazine is employed at all launch facilities, because, as noted on page 1-7, engines involving the use of hydrazine "are usually simple and reliable because they need no ignition system." Thus, from a risk management perspective, the issue is not so much whether the use of hydrazine itself should be permitted – it goes part and parcel with the approval of *many* space vehicles including the former space shuttle and the current SpaceX Dragon capsule, as well as *any* spaceport facility. The question to be considered is whether the launch facility itself in terms of location and operations is appropriately situated and operated for activities involving the use of hydrazine.

Following my reading of the report, I am reassured that the handling, storage, transportation and use of hydrazine onsite can be achieved in a safe and reliable manner. Further, in the event of an adverse launch outcome, the proximity to habitable structures is such that no impact upon persons or property would be expected. Further, that under worst case scenarios of an upper stage landing in the ocean, that the rate of propellant dispersal would be rapid and isolated, resulting in a *de minimus* impact.

Accordingly, I am very comfortable in lending my support for Maritime Launch Services' proposed Canso spaceport. In addition, I wish to highlight the economic, social, educational and technological benefits that such a facility would provide to the region of eastern Nova Scotia. As a faculty member at St. Francis Xavier University, there would be invaluable opportunities for students in business, engineering and science, among others, to benefit from the close proximity that the Canso spaceport would offer. Therefore, I strongly encourage the approval of MLS' environmental assessment for the Canso spaceport facility.

Thank you for your consideration. If you have any questions, please feel free to contact me directly.

Sincerely,

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Canso Spaceport Focus Report correction  
**Date:** March 31, 2019 2:58:11 PM

---

The Honourable Margaret Miller, Minister of Environment  
Environmental Assessment Branch  
Nova Scotia Environment  
P.O. Box 442  
Halifax, NS, B3J 2P8

Maritime Launch Services wishes to correct a typographical error in the Focus Report we submitted. We apologize for the confusion.

Section 1.1 of the Terms of Reference requests MLS clarify the number of launches annually. We did clarify that value as described below, which is correct. The total launches projected through the period of 2021 through 2030 is shown as 159 which is not correct. That value is 59 over the 10 year period.

"The Cyclone-4M will ramp up to a maximum of eight (8) launches per year over the first five (5) of operation. It is anticipated there would be one launch in the first year (2021) and an increasing number of launches each year up to a maximum of eight (8) by approximately 2026. The total number of launches under this project (2021-2030) is estimated to be 159." 159 should be 59.

Thank you,

President and CEO  
Maritime Launch Services Ltd

**From:** [@hotmail.com](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 1, 2019 8:40:06 PM

---

Project: canso-spaceport-facility Comments: I think it would be great for the communities and all people involved Name: Email: @hotmail.com Address:



**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Maritime Launch - windmill risk question  
**Date:** April 2, 2019 6:04:08 AM

---

Hi all,

I am writing to inquire about the risk of operating windmills adjacent to the storage of large quantities of rocket fuel.

A recent windmill fire in Pictou county showed the intensity, flying pieces and flames from a failed windmill. It certainly seems believable that this could lead to a fairly major explosion or fire should flaming pieces reach the nearby rocket fuel storage.

I understand the new EA focus report is a more complete assessment and would therefore include an assessment of this risk.

Philips Harbour, NS

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** UDMH concern  
**Date:** April 2, 2019 6:24:18 AM

---

Hi all,

I am writing to express my concerns about the UDMH being used in the MLS Cyclone 4M rockets. While MLS insists everything is fine, we would only expect that from a foreign company wanting to use our neighborhood to grow their profits.

More concerning is seeing the use of UDMH associated with former eastern bloc or developing nations. That is sort of a big red flag to me around environmental impact. Do our American neighbors use something safer?

Even if the material works properly in the rockets, how much do we understand the risks of delivery, storage and handling.

Kind regards,

Philips Harbour, NS

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** MLS - failure modes analysis question  
**Date:** April 2, 2019 6:38:00 AM

---

Hi all,

I have read that the new MLS focus report is much more comprehensive. The very skinny nature of their first EA filing was a red flag to me that MLS was unconcerned about being thorough on a highly visible document. By extension, what degree of diligence can be expected from MLS when no one is watching? This is not out in the New Mexico desert with nothing but rattlesnakes to hurt. This is a magical marine paradise and vibrant fishing industry that deserves every effort to preserve.

My question is around the depth of failure modes analysis. Have they systematically gone through all their operations and identified failure modes and all the effects these could have on human safety and the environment? If they took a short cut with their first EA, I see the risk of short cuts being taken with this aspect as well.

I trust you agree with the importance of this part of the report being done to a very high standard.

Kind regards,

Philips Harbour, NS

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Let's get some great job opportunities available for future Nova Scotians. Sometimes wish I could work on the first launch.  
**Date:** April 2, 2019 3:32:25 PM

---

Sent from my Samsung Galaxy smartphone.

**From:** [@yahoo.ca](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 3, 2019 12:28:33 PM

---

Project: canso-spaceport-facility Comments: This will be great for our area Name:  
Email: @yahoo.ca Address:

**From:** @gmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 3, 2019 12:39:43 PM

---

Project: canso-spaceport-facility Comments: With a very low environmental impact, this would be a great investment in our province. Construction and ongoing jobs is something we desperately need here. Name: Email: @gmail.com Address:

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Support for the Canso Spaceport Facility Project  
**Date:** April 5, 2019 3:26:05 PM

---

To the Minister of Environment,

Please find the following correspondence to be in full support of bringing a Spaceport to the Canso area.

The proposal of bringing a Spaceport to Nova Scotia, let alone Canada, is welcomed news. The local buzz about the potential tourism this facility will create should be thrilling for those in Guysborough County! The prospect of bringing the launch facility to Canso will not only bring obvious economic benefits to a region that is in need of a boost, but will likely spur a renewed interest in STEM careers and in science. As a science instructor at St. Francis Xavier University, the possibility of visiting and even potential working with those associated with the Spaceport is exciting for the opportunities it will bring.

The environmental concerns of having this facility have been addressed in the Focus Report for this project. In reviewing the report it appears that all major concerns have been addressed. As long as Maritime Launch Service follows all regulations and works in conjunction with the Dept. of Environment to monitor the surrounding environment, if an issue arises I am confident that it will be addressed and dealt with in a timely and proper manner. The only concern I wish to address is the transport of hydrazine. I believe that consideration of having this chemical produced near the facility should be explored. I fear that the transport of the propellant from the U.S. would potentially lead to a greater environment issue than if it were made nearby. The latter option would also help in creating more local jobs.

Nova Scotia is in desperate need of bringing high tech, grey-matter industries to the province to help the economy grow. A Spaceport would definitely allow for this to happen and I would assume there would be partnerships with our universities to encourage research and the promotion of local STEM careers.

The creation of the first Spaceport in Canada seems to a “no-brainer” for the economic, research and tourism benefits it will bring to Nova Scotia and the community of Canso. I support the establishment of this Spaceport and I encourage you to as well.

Sincerely,

---

Environmental Science Lab Instructor  
Dept. of Earth Sciences

St. Francis Xavier University  
P.O. Box 5000  
Antigonish, NS, Canada B2G2W5

P: 902-867-5184

W: [people.stfx.ca/mschumac](http://people.stfx.ca/mschumac)



**From:** @aol.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 6, 2019 11:49:18 AM

---

Project: canso-spaceport-facility Comments: I own R2 zoned private property directly under the flight path PID35046283 in what would be an evacuation zone for launches. The waterfront property is 115 acres, 1.5 miles of oceanfront, two freshwater lakes, and zoned R2. I have submitted a proposal to the Crown to trade for land outside of the security zone but am still waiting on a response. Another option would be for MLS to purchase my land, but they have shown no interest. Approving this project negatively impacts the property and in all fairness one of the two previously mentioned options should take place if you are going to lease the land. Name: Email: @aol.com Address:

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Rockets to be launched in Canso  
**Date:** April 6, 2019 1:41:00 PM

---

It is my firm belief that this will bring more harm than good to our area. Please don't approve this venture.

**From:** [gaboardoftrade@gmail.com](mailto:gaboardoftrade@gmail.com)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 7, 2019 6:26:26 PM

---

Project: canso-spaceport-facility Comments: We are writing today to express our support for the Canso Spaceport Facility Project proposed by Maritime Launch Services Limited. Our support is subject to the satisfactory completion of your environmental review. We believe that this project will have a very positive economic impact for Canso and the surrounding area in which we operate. We expect there to be substantial benefit coming from direct employment, increased business to supporting services as well as a substantial impact on the flow of tourism to our area. The economic stimulus that this project will create is sorely needed in our area. The Guysborough and Area Board of Trade is a volunteer run, non-profit association of 35 local businesses and organizations. Through its members, we are a respected voice on matters affecting our businesses, a valued resource for our members and a strong supporter of our community. Membership in the Board is open to anyone with an interest in the trade, commerce or economic and social welfare of Guysborough and Area. Name:

Guysborough and Area Board of Trade Email:

[gaboardoftrade@gmail.com](mailto:gaboardoftrade@gmail.com) Address:

**From:** [innkeepers@seawindlanding.ca](mailto:innkeepers@seawindlanding.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 7, 2019 6:28:37 PM

---

Project: canso-spaceport-facility Comments: We are writing today to express our support for the Canso Spaceport Facility Project proposed by Maritime Launch Services Limited. Our support is subject to the satisfactory completion of your environmental review. We believe that this project will have a very positive economic impact for Canso and the surrounding area in which we operate. The expected impact on tourism cannot be underestimated. We believe that the spaceport facility will contribute to reach the goal set out in the Ivany Report to reach \$4 billion in annual tourism revenues by 2024. Seawind Landing Country Inn is a 13 room inn featuring oceanfront dining and accommodations. It is located in Charlos Cove on the Eastern Shore, approximately 40 minutes from the proposed launch site. Name:  
Email: [innkeepers@seawindlanding.ca](mailto:innkeepers@seawindlanding.ca) Address:

**From:** @gamil.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 8, 2019 11:56:03 AM

---

Project: canso-spaceport-facility Comments: April 8, 2019 Nova Scotia Environment PO Box 442 Halifax, Nova Scotia B3J 2P8 Phone: 902 424-3736 E-mail: minister.environment@novascotia.ca Attention: The Honourable Margaret Miller, Minister of Environment Reference: Letter of Support: Maritime Launch Services MLS Canso Spaceport Facility Project Dear Ms. Miller: I support the Maritime Launch Services Project MLS. Not only will this project provide many needed construction jobs in a hard-hit area of the Province, it will also mean ongoing operational jobs. These operational jobs will range across the skill spectrum of trades people, researchers, development positions, and tourist operators. The Spaceport project would establish Nova Scotia as the Space Super Cluster Hub in Canada. Why not be a first in Canada? The Spaceport will be new and exciting for Nova Scotia but is an already well-established industry around the world. Experts are already providing answers to the pending questions. Case in point includes fuel handling. Atlantic Canada has a proven record of safely running fuel handling operations including 20 years of Sable offshore Oil and Gas, refineries, LNG facilities, oil tankers and ships, airports etc. This project fits perfectly within our province's competencies and capabilities. The MLS is nothing more than an airport for rockets and we have well managed airports in NS with great volumes of aviation fuel and higher frequency of aircraft take offs. Maritime Launch Services will bring international attention and jobs to Nova Scotia. From the start the Spaceport will develop international skills transfer from the USA and the Ukraine for both rockets and support services. This supports the initiatives and immigration growth of both the Federal and Provincial Governments. The MLS proposal is privately funded and should be supported and embraced by the Nova Scotia Government. Ranging between \$50 to \$100 million in value, the establishment of the Space Port is a significant investment and once constructed this is not transferable. The project shall be considered a strategic investment in Rural, NS and supported by the Provincial Government at every level in a measured and systematic approach. Yours truly,

Name: paul currie Email: @gamil.com Address:

**From:** @gmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 9, 2019 12:05:56 PM

---

Project: canso-spaceport-facility Comments: I have lived in Little Dover, a small, rural, fishing community all my life. They say that salt water is in your veins and I believe this to be true. The thought of rockets being launched over the water that has sustained our way of life for generations is devastating! Our community and surrounding areas need jobs to ensure a future for generations to come, but at what cost? I feel that the lure of prosperity has created a false sense of economic security and has blinded people to the dangers that rocket launches will bring. I have listened to stakeholders and nothing but positivity was thrown my way. When something sounds too good to be true, it usually is. There is definitely big money to be made here, but Not for us! When I graduated from university with a teaching degree, I returned home. I wanted to live and work in my beautiful, fishing community, a place where I felt safe. The thought of rockets being launched over our ocean, rivers, and lakes leaves me scared as to the impact this will have on the environment. I have concerns about the use of hydrazine fuel. What will this mean for our waters? What effect will this have on our wildlife? How will the use of UDMH effect our health? There are too many unanswered questions! Giving approval to this project will forever change the sense of security and the natural, historic beauty that Dover and Canso possesses. Maritime Launch Services Limited is leading people to believe that they are saving our community. Please, Honourable Miller, save our community from them! Name: Email: @gmail.com Address:

**From:** @bdo.ca  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 9, 2019 6:32:05 PM

---

Project: canso-spaceport-facility Comments: What a great economic opportunity for Nova Scotia. The job creation, tourism, and opportunities for our children to get some amazing jobs. Please ensure this gets approval! Name: Email: @bdo.ca Address:

**From:** [bdo.ca](mailto:info@bdo.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 9, 2019 6:36:49 PM

---

Project: canso-spaceport-facility Comments: This would be a great addition to the Nova Scotia economy. Name:                      Email:                      @bdo.ca Address:  
Municipality: Halifax Postal-Code:



**From:** [@gmail.com](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 9, 2019 9:58:45 PM

---

Project: canso-spaceport-facility Comments: This a great opportunity to create jobs in the Province outside the core city centre. This would also boost awareness of the area for tourism  
Name: Email:



April 10, 2019

Director  
Environmental Assessment Branch  
Nova Scotia Environment  
P.O. Box 442  
Halifax, Nova Scotia  
B3J 2P8  
(via attachment to email [EA@novascotia.ca](mailto:EA@novascotia.ca))

Re: Environmental Assessment Proposed Canso Spaceport Project

Dear Director,

Thank you for the opportunity to comment on the March 2019 response by Maritime Launch Services Ltd to the August 23, 2018 direction by the Minister of Environment to provide more details in support of the environmental assessment of the proposed Canso Spaceport Facility.

My comments are limited to:

- a. Canso Spaceport corporate structure: authority and responsibility;
- b. environmental hazards associated with the rocket payloads;
- c. provision of water to the facility;
- d. sources and methods of delivery of hazardous materials to the Spaceport facility;
- e. removal and disposal of hazardous waste; and
- f. public safety.

#### Canso Spaceport Corporate Structure

After reviewing the "Canso Spaceport Facility Environmental Assessment Registration June 2018" and "Responses to Terms of Reference for the Preparation of a Focus Report Regarding the Canso Spaceport Facility", further explanation and clarification are required of the authorities and responsibilities of the various entities which will be involved the Canso Spaceport.

It is important and relevant to understand that Yuzhnoye SDO, PA Yuzhmash and UPC are not registered companies in either Nova Scotia or federally in Canada. As indicated in Appendix A of the "Canso Spaceport Environmental Assessment Registration June 2018" Maritime Launch Services (MLS) Ltd is a registered company in Nova Scotia (confirmed by search of the Nova Scotia Registry of Joint Stocks database). The authority, responsibility and liability of Yuzhnoye SDO, PA Yuzhmash and UPC as corporate entities in this project are therefore questionable. Unless these companies register in Canada or Nova Scotia and all

four companies create a formal partnership that details individual roles and responsibilities, authority and liability should reside solely with Maritime Launch Services Ltd for any and all activities associated with the development, operation and decommissioning of the Canso Spaceport. In this regard, it would also seem reasonable for the Minister to require that Maritime Launch Services Ltd provide proof of adequate ability to undertake remediation in the event of an environmental incident and any other associated liabilities, e.g. insurance or bond.

Figure 1.1 in the “Responses to Terms of Reference for the Preparation of a Focus Report Regarding the Canso Spaceport Facility” shows an organization chart for the "Launch Team" of the Canso Spaceport. What are the intended roles and responsibilities of NavCanada, Transport Canada and Canada Coast Guard? Have these federal organizations committed to supporting activities at Canso Spaceport?

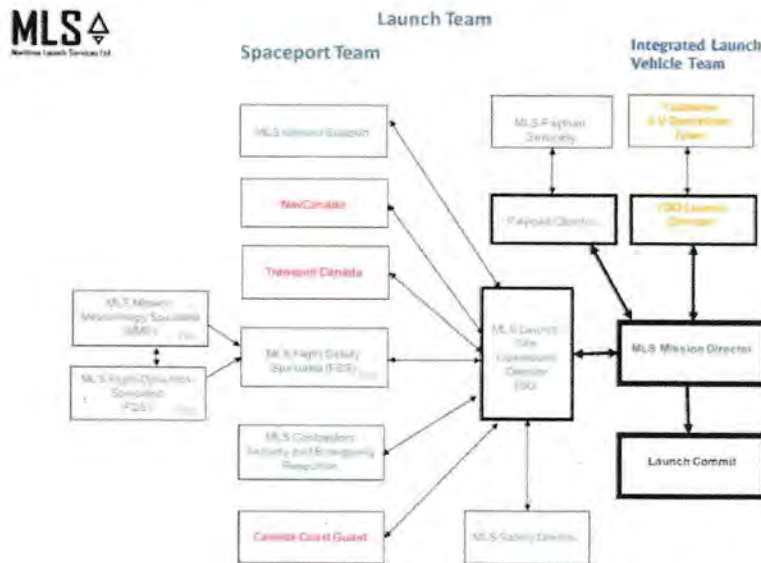


Figure 1.1 Cyclone-4M Launch Team Organizational Chart

### Environmental Assessment of Payloads

I am not aware of any discussion concerning the environmental hazards of potential payloads to be launched from the Canso Spaceport, with the exception of brief mentions of spacecraft manoeuvring propellants in the documents from Maritime Launch Services Ltd. Given that some satellites use nuclear reactions to provide power, the omission of payloads from this environmental assessment is viewed with extreme concern.

It is recommended that a separate environmental assessment be undertaken of the potential payloads to be launched from the Canso Spaceport. This would allow the current environmental assessment of the launch facility and launch systems to proceed.



## Provision of Water

Significant amounts of water will be used by the Canso Spaceport Facility, particularly in the use of the deluge system to support launch operations. Section 5.3 of "Terms of Reference for the Preparation of a Focus Report Regarding the Canso Spaceport Facility Proposed by Maritime Launch Service Ltd. September 17, 2018" specifically directed the proponent to "Assess potential Project impacts on the sustainability of water supply (e.g., water quantity) in the general Project area."

Section 2.1.4 of the "Canso Spaceport Facility Environmental Assessment Registration June 2018" states "Potable water would either be delivered by truck to the water tower at the VLA or pumped from a well."

"Responses to Terms of Reference for the Preparation of a Focus Report Regarding the Canso Spaceport Facility" states:

"The required amounts of water will be refined during the design process. The water would most likely be obtained from wells. The Canso water supply system could be an alternative source subject to agreement. The city water supply system is a gravity water supply with an accumulator tank located on a hill. The system pressure is within 1.2 – 1.4 kgf/cm<sup>2</sup>. The diameter of pipe at the potential connection point is 12 inches (304.8 millimetres [mm]). Launch site water supply would be obtained by means of pipes with 6 inches (152.4 mm) in diameter. Should city water be utilized for the project, new infrastructure such as a pump station would likely be required. The project would assist with this infrastructure if it is needed.

If new water supply sources are needed, they would be developed in accordance with the Nova Scotia Guide to Surface Water Withdrawal Approvals (NSE 2016) or the Guide to Groundwater Withdrawal Approvals (NSE 2010).

Overall, impacts to water supply sustainability would not be anticipated."

These responses by Maritime Launch Services Ltd are considered inadequate.

With respect to acquiring water from wells on the Canso Spaceport site, the records of wells located in the area of the Canso Spaceport (Section 5.3.2 "Canso Spaceport Facility Environmental Assessment Registration June 2018") appears to indicate a low probability of obtaining adequate supplies to support Spaceport operations using groundwater sources alone.

There is no indication that Maritime Launch Services Ltd has held discussions with Canso-Hazel Hill Water Facility concerning their ability or willingness to provide water to the Canso Spaceport. This should be undertaken to confirm whether or not this is a potential source of water for the Spaceport. If the Canso-Hazel Hill Water Facility should become the source of water for the Spaceport, then any associated infrastructure costs should be borne by Maritime Launch Services Ltd.

With respect to surface water as a potential source for the Canso Spaceport, Section 5.4.1 “Canso Spaceport Facility Environmental Assessment Registration June 2018” indicates that the three lakes closest to the Spaceport are Hazel Hill Lake, Publicover Lake and Seven Island Lake; with Publicover Lake being nearest to the actual launch pad. It is understood that these are small and shallow lakes with relatively low recharge rates (particularly in the late spring to early autumn timeframe). The potential of these surface water sources to provide water to the Spaceport Facility should be confirmed, including the probability of obtaining provincial approval to do so.

On page 14 of the “Canso Spaceport Facility Environmental Assessment Registration June 2018” Maritime Launch Services Ltd states that the “site deluge water would also be used for fire protection.” In the event of a catastrophic failure at the time of launch, it appears probable that the deluge tank, which is immediately adjacent to the launch pad, would also be damaged or destroyed. Consideration should be given to having an alternate source of water at the launch site for fighting fires, mitigating contamination, etc.

#### Sources and Methods of Delivery of Hazardous Materials

The types, quantities, storage and handling arrangements for hazardous materials to be used at the Canso Spaceport have been presented in the documentation. No indication is given, however, of the source for these materials (suppliers and their locations), how it is intended that they be transported to the site, the environmental implications associated with their transportation, and identification of responsibility and liability in the event of accident during transportation.

It is recommended that Maritime Launch Services Ltd identify the potential suppliers of hazardous materials to support operations at the Canso Spaceport and provide details associated with their transportation.

#### Removal and Disposal of Hazardous Waste

The documentation provided by Maritime Launch Services Ltd makes general statements to the effect that waste will be accumulated, stored, transported and disposed by approved facilities. This lack of specificity should not be accepted.

Maritime Launch Services Ltd should identify potential disposal organizations for each and every type of waste from the Spaceport and obtain confirmation that the organizations are approved, capable and willing to take the types and quantities of waste that will be generated. The methods of transportation of the hazardous waste to the disposal sites need to be identified, along with the responsibility for clean-up and remediation in the event of accident.

#### Public Safety

There is extensive discussion in the documentation provided by Maritime Launch Services Ltd about the effects of noise and the hazardous materials associated with the Spaceport; however, there is only very limited information concerning measures that will be taken to



ensure the physical safety of the public. There is some mention of fencing and patrols, but these seem to be oriented toward the security of the facility rather than the protection of the public.

It is reasonable to assume that there will be significant public interest in viewing launches at the Canso Spaceport; however, I saw nothing that indicated what would be the safe distance or distances from the launch site for the public. It is noteworthy that the Launch Control Centre is located approximately two kilometres from the launch site.

It is recommended that Maritime Launch Services Ltd be required to identify the safe distances for the public and provide details of measures that will be taken to ensure that no member of the public could reasonably get within or remain within those distances.

### Summary

Overall, it appears that Maritime Launch Services Ltd has made good efforts in identifying environmental hazards associated with the proposed Canso Spaceport and in detailing how these hazards will be managed. Additional amplifying effort is required in the following areas to provide a more complete assessment:

- a. corporate structure;
- b. provision of water;
- c. delivery of hazardous materials;
- d. disposal of hazardous waste; and
- e. public safety.

As stated in this letter, a separate environmental assessment should be conducted for the payloads to be launched at the Canso Spaceport.

Sincerely,

[brian.palmer@ns.sympatico.ca](mailto:brian.palmer@ns.sympatico.ca)

Independent Researcher

<https://www.linkedin.com/in/brian-palmer-2329386a/>

C.c. Maritime Launch Services Ltd (via email attachment

[@maritimelaunch.com](mailto:info@maritimelaunch.com))

**From:** [Environment](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 10, 2019 10:47:32 AM

---

Project: canso-spaceport-facility Comments: I grew up in Little Dover and my parents, younger brother and several family members still live in the Little Dover/Canso area. The area has seen some hard times over the last several years. However, the fishing industry has enabled several members of the community to stay as opposed to leaving in search of work. My concern is that we are taking a risk with allowing this project to move forward that could impact the fishing industry and take away the only source of income in the area. I dont believe the benefits out-way the risk for the community. Therefore, I am not in support of this project. Name: Email: Address: Municipality: Postal-Code: Phone: ### ### - ##### Fax: ### ### - ##### email\_message: Privacy-Statement: agree x: 66 y: 32



**From:** [\\_aol.com](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Canso Space Rocket  
**Date:** April 11, 2019 1:50:08 PM

---

<http://acuriousguy.blogspot.com/2017/11/more-rocket-shenanigans-parts-problems.html?m=1>

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Maritime Launch Services  
**Date:** April 11, 2019 6:43:01 PM

---

Hello,

My name is . I was a Project Developer in Nova Scotia for years, and am currently working as a Project Assessment Officer at the BC Environmental Assessment Office (though I am not writing this in my professional capacity).

My email is related to the Public Comment Period for the Maritime Launch Service (MLS) facility. In my opinion, the benefits of the MLS initiative cannot be overstated. Access to space is in the strategic interest of Canada and Nova Scotia. Following the release of Canada's new space strategy and recent successes in the private space sector, the importance of a launch facility is paramount.

Nova Scotians are renown for their awareness of and interest in environmental protection. This is commendable. Every precaution should be taken to ensure that launches are safe and reliable. However fantastic it might seem, launching vehicles into space has become routine in many parts of the world, and can be in NS too.

The potential for this facility to fuel interest in STEM trades, tourism, economic diversification, employment, future space development, and a host of other possible benefits is enormous. Current US Law (ITAR, the International Traffic in Arms Regulations) prohibits aspiring Canadian engineers and managers from fully accessing many private avenues to work in the space industry. A Canadian option would build potential career paths for a new generation of Canadian talent.

I hope you will consider this as a project very much in the national and provincial interest. The focus document bears out that the project can and will be operated safely, and in my experience stacks up with the best in class of environmental management planning rigor.

Sincerely,

Master of Resource and Environmental Management, CAPM

**From:** @hotmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 11, 2019 9:57:18 PM

---

Project: canso-spaceport-facility Comments: Dear Honourable Miller I am writing to you with grave concern regarding the potential Maritime Launch Services Ltd. rocket project in Canso, Nova Scotia. As a health professional I am very concerned regarding the detrimental health and environmental risks/impact that will be imposed upon our community. I am a Registered Nurse and have worked at Eastern Memorial Hospital in Canso for most of my career. Over the years I had many opportunities to leave for employment but I knew I wanted to stay in my community and work as a rural nurse. There is a something about the sea that always draws you home. I raised my children here and have always felt safe. However I can honestly say that ever since the mention of potential rockets launching over our community I have felt a sense of unease. My family and many others rely on the fishing industry as our main source of income. One can only begin to imagine the impact upon our lobster, fish, shrimp, crab, mussels, sea urchins as well as other forms of wildlife ecosystem and habitats from the hydrazine fuel. There is a sense of employment and a sense of increased tourism and hence this is the reason that some people are for this project. Many of the community members that I have personally spoken to made comments such as, "if this rocket launch was good it wouldn't be coming to Canso!" It's also been said "we are so small in populated numbers so what if we are wiped out!" All of the Quad counties should be concerned. We are so close in proximity to Antigonish and Cape Breton. This is not an isolated event that will affect Canso alone therefore I hope other counties are paying close attention. This rocket launch is NOT our saviour but our destruction! It is my understanding that other countries have denied access to this company so why ask us Honourable Minister? We need to say NO too! How could the Department of Natural Resources allow this to happen with so many unanswered uncertainties and risks as other countries have not. Your Honourable Minister, I beg you to please please keep the citizens and natural resources of Canso, and all of Nova Scotia, Canada safe. Respectfully,

Name





**From:** @live.ca  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 12, 2019 8:52:53 AM

---

Project: canso-spaceport-facility Comments: This is a much needed project in an economically depressed area of N.S. The project alone would be a huge economical boost to the area, also it would create many many benefits to a number of different industries. It is the small business? Ts like tourism, construction, hotels, restaurants, all badly needed in this area, plus we cannot forget about the tax revenue which is much needed in this province. Name: Email:  
@live.ca Address:

**From:** [Ray White](#)  
**To:** [Environment Assessment Web Account](#)  
**Cc:** [lloyd Hines](#)  
**Subject:** Maritime Launch Canso NS  
**Date:** April 12, 2019 9:10:04 AM

---

Hon. Margaret Miller Minister of Environment  
Hon. Lloyd Hines Minister of Transportation and Infrastructure Renewal

Hon. Ministers

I have had the opportunity to participate in the numerous open houses and as member of the Community Liaison Committee for the proposed Maritime Launch Project for Canso NS.

During these meeting I have observed strong community support for this project.

This is also demonstrated in the petition tabled in the House by the Hon. Lloyd Hines.

I am pleased that you required a focused report from Maritime Launch stressing environmental protection.

I have reviewed the focused report submitted by Maritime Launch. It appears that established industry protocols address the issues with additional information.

I support the Maritime Launch proposed project for Canso.

I hope if you require additional information or that if additions safeguards are needed to protect the environment this can be done in a timely manner which will not delay the project.

Hon. Raymond White E.C.N.S.  
Former member Guysborough Port Hawkesbury  
Former Mayor Town of Canso





## **Comments on the Avian Component of the Focus Report on the Canso Spaceport Ph.D.**

As an environmental anthropologist who has specialized in recent years on the impact of economic developments on bird migration, I provided comments about the potential impact of the Canso Spaceport on birds in response to the call for public input to the registration document. These comments were further informed by three years of field research I conducted in the proposed project area of the spaceport and in surrounding areas. Many of my comments were consistent with the questions needing to be addressed as outlined subsequently in the terms of reference for the focus report.

The only significant question relating to birds that was addressed in the focus report concerns the impact of noise on their breeding and migratory activity (Section 8.2). The section on this subject concludes with the statement:

“In summary, noise impacts on birds and other wildlife is expected to be short-term and temporary and are likely to respond similar to that seen during thunderstorms.”

This conclusion is oversimplified and potentially masks serious consequences for birds.

Studies have documented that birds can hear infrasound (Hagstrum 2000, Yodlowski et al. 1977) and can detect intensity changes and Doppler shifts in infrasound. This indicates an ability to discern movements and directions of weather systems at a considerable distance (Quine et al 1981). Thus, birds can use infrasound to predict, prepare for, or flee thunderstorms. Most recently, a study demonstrated the ability of Golden-winged Warblers to detect severe weather 24 hours before its arrival, fly 1500 km away, and return 5 days later (Streby et al. 2015).

It is unexpected sound that may pose a greater threat to birds. This kind of disturbance to birds is summarized by Shamoun-Baranes et al. (2011). They have documented through radar studies and a review of the literature how fireworks can

negatively impact birds. Single events such as fireworks can cause thousands of birds to take off and stay in flight for a minimum of 45 minutes at peak altitudes of 500 meters. Thousands of Red-winged Blackbirds fell from the sky on New Years Eve in Beebe Arkansas in 2010. In this case it was believed that a combination of factors consisting of fireworks, inclement weather, disorientation, collisions, and stress led to the high mortality (Shamoun-Barnes et al. 2011). As summarized by Shamoun-Barnes et al. (2011), unexpected loud noises may result in birds entering an “emergency life-history phase” with short-term consequences which may include:

1. Energetic cost of flight
2. Disruption of resting or foraging
3. Disorientation
4. Negative effect on immunocompetence

Since the Canso Spaceport is located in a concentration area for migratory birds (Kearney, 2017), the number of birds affected could be in the thousands if a launch occurred during the migration season. The four consequences listed above, when occurring in migratory flight or migration stop-over, could have critically negative costs for birds.

## References

- Hagstrum J.T. 2000. Infrasonic and the avian navigational map. *Journal of Experimental Biology*. 203: 1103-1111
- Kearney, John F. 2017. Sable Wind, Breeding and Migrating Birds Post-Construction Monitoring, 2015-2016”. John F. Kearney & Associates for the Municipality of the District of Guysborough and Nova Scotia Power Inc., March.
- Quine D.B., Kreithen, M.L. Frequency shift discrimination: can homing pigeons locate infrasounds by Doppler shifts?. 1981. *Journal of Comparative Physiology*, 141: 153-155.

- Shamoun-Baranes, Judy, Dokter, Adriaan M., van Gasteren, Hans , van Loon, E. Emiel, Leijnse, Hidde, Bouten, Willem. 2011. Birds flee en mass from New Year's Eve fireworks. *Behavioral Ecology*, 22 (6):1173-1177.
- Streby, Henry M., Kramer, Gunnar R., Peterson, Sean M., Lehman, Justin A., Buehler, David A., and Andersen, David E. 2015. Tornadic Storm Avoidance Behavior in Breeding Songbirds. *Current Biology* 25(1): 98-102.
- Yodlowski, M.L., Kreithen, M.L., Keeton, W.T. 1977. Detection of atmospheric infrasound by homing pigeons. *Nature* 265: 725-726.

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Cc:** [steve.matier@maritimelaunch.com](mailto:steve.matier@maritimelaunch.com)  
**Subject:** Submissions for the Canso Spaceport Facility Focus Report public review process  
**Date:** April 15, 2019 1:56:39 PM  
**Attachments:** [1751\\_001.pdf](#)

---

To: the EA Administrator:

Please find attached for submission in support of the above referenced project and Focus Report an article published in the April 15, 2019 edition of the Guysborough Journal.

As a related item, the Hon. Lloyd Hines, MLA Guysborough - Eastern Shore - Tracadie made the following statement in the Legislative Chamber at the Nova Scotia House of Assembly on April 11, 2019 according to the official transcript:

“Mr. Speaker I beg leave to table a petition with the operative clause as being, we the undersigned request the government of the province of Nova Scotia, to give permission for Maritime Launch Services, to be given written approval for the development of the Canso Spaceport project—a medium range satellite launch facility, in Canso Nova Scotia, creating both part time and permanent employment opportunities. Mr. Speaker, the petition includes 753 names by signature according to the rules of the house.”

The Focus Report has been submitted by Maritime Launch Service (MLS) Ltd.. MLS respectfully requests the Minister to consider these submissions favorably in the decision-making process.

Sincerely,

{on behalf of MLS}

Principal, Environmental Management

Fax: 902 468-9009

[@stantec.com](mailto:)

Stantec  
102-40 Highfield Park Drive  
Dartmouth NS B3A 0A3



The content of this email is the confidential property of Stantec and should not be copied, modified, retransmitted, or used for any purpose except with Stantec's written authorization. If you are not the intended recipient, please delete all copies and notify us immediately.

# Petition aims to show community support for Canso Spaceport

By Helen Murphy

CANSO – The Canso Area Development Assoc. (CADA) has started a petition to show the provincial government the high level of local support for Maritime Launch Services' planned Canso Spaceport.

On Monday, March 25, 1000 flyers promoting the petition were distributed to the BOH postal code areas, stretching from Canso to Guysborough. The petition is available for signatures at a number of local retails and organizations noted on the flyer.

“It’s another way the community can rally to show they support the project,” CADA President Harold Roberts told *The Journal*. Other opportunities include attending open houses MLS has hosted and submitting comments to the review process currently underway with the Dept. of Environment.

The petition documents will be gathered and presented to Minister of Transportation and local MLA Lloyd Hines. Roberts said Hines plans to table the petition in the House of Assembly early in the spring session.

“We have a lot of support (for the spaceport),” said Roberts. “There are certainly those out there who would have questions and perhaps misgivings and we’ve encouraged them to approach the Community Liaison Committee members to bring their questions and get answers. We’ve also encouraged people to go to the MLS open houses and to visit their website for more information.”

Roberts said residents with questions can also bring them to the CADA “and we’ll try to get answers for them.” He said issues around the safe handling of rocket fuel, noise levels and potential water contamination have all been addressed in the company’s Focus Report, which was recently submitted to the Dept. of Environment.

In terms of concerns around rocket fuel, Roberts said, “There are spaceports all over the world using the same first- and second-stage rocket fuel. And there are no documented cases of anyone being harmed by the rocket fuel at these sites.

“So it’s all about doing due diligence around this to make sure environmental standards are satisfied.”

As part of the environmental review process, comments on the company’s Focus Report (available on Dept. of Environment’s website) can be submitted until April 19 via the department’s website form or by emailing EA@NS.ca.

“Our group has formally submitted a letter of support,” said Roberts. “There are many letters pouring in to support the project and there are some letters of opposition, that’s part of it.”

“With input they (the department) will be able to make an informed decision.”

Roberts said the majority of people he has spoken with about it are in favour of the project. “They see it as a win for the community, the county, the province and the country to have our first spaceport here. It would bolster our population and provide short-term and long-term jobs that are certainly needed in the community. These are both low-skilled jobs and high-skilled jobs.”

The petition flyer lists some of the types of jobs expected to be created by the project, including catering, cleaning, security, metalwork and engineering.

MLS plans to have eight rocket launches per year at the Canso Spaceport, to put commercial satellites into space. Roberts said each of these launches would be advertised well in advance and undergo three levels of approval: from staff, Transport Canada and the Canadian Space Agency. There would be a specialized fire team on site and the area would be secure, he said.

“If you look at all of that, there is so much there to ensure that the launch is safe.”

Roberts said in addition to new jobs, the tourism potential from launches is significant.

“I’ve been to Kennedy Space Centre to watch a shuttle launch and thousands of people come to watch a launch. The same kind of thing will happen here. There are great venues here for watching a launch.”

He said the increase in visitors would also be good for Parks Canada's site at Grassy Island.





APR 09 2019

54517

NOVA SCOTIA ENVIRONMENT

Hon. Margaret Miller:  
Dept. of Environment  
Barrington Towers  
1894 Barrington St. Suite 1800  
P.O. Box 442  
Halifax NS  
B3J 2P8

Dear Minister: This is a letter of concern Re: Development of the Rocket Launch Pad in Canso/N. Pulp effluent pipe:

My partner has severe chemical sensitivities (environmental illness) and has struggled and deteriorated because of our existing environments. She became sick in Halifax over 30+ years ago... We bought property in Rural Pictou Co (Gas Pipeline and more air quality problems)... have retired in Carichat (now struggling with Port H. Biomass affecting air... and now a Rocket Pad... We are less than 5 mile miles (as the crow flies) from Canso/Fox Hill - and are very concerned especially with the unsymmetrical diamethyl hydrazine toxicity (Russia - China & other countries are backing off from these pads)...

I was born in New Glasgow, NS. when the Northumberland Strait was pristine... then the Pulp Mill... and the effects to environment and living things have exacerbated to this day... a great concern. I have lived in Weymouth North (now has a toxic board plant on beautiful St. Mary's bay); the Annapolis Valley (major pesticides); Halifax (Tuft's cove) among other issues etc. Over the past 69 years our province has not been protected by our politicians - or ourselves for that matter... in fact, quite the opposite.

I would ask you to seriously take a stand as a government and do the right thing for our children and grandchildren - do not allow this Rocket Launch Pad at Northern Pulp effluent pipe - we can make better choices for our province and our residents,

Thank you for your consideration,

April 11, 2019

To whom it may concern,

My name is [redacted]. I have been a resident of Canso, NS for most of my 52 years. When I first [redacted] the proposed Space Port coming to our area, I was sceptical. Why would it be coming here? Later I was excited for what this could mean for our community. We have seen much better times. This could be just what we needed.

We started talking about the rockets in and around our community. Some people thought it would be great, bringing much needed economic development. Others were worried about the impacts to us and our environment. After reading everything I could find out about the proposed Space Port, it was quickly becoming evident that the risks far outweighed the benefits.

Since this is actually rocket science, I'm not really sure of the questions I should be asking and the concerns I should have. I attended a Maritime Launch Services open house. I asked some questions concerning the types of fuel being used. I was assured they were safe when handled properly and commonly used. This topic is well beyond my understanding and I believe that is true for most of the people in our community. It would be great if we had somebody come and explain what this project would mean for our community, good and bad. What are the real risks? Right now we are only hearing what Maritime Launch Services is telling us and unfortunately what people are posting on social media.

My concerns stem from the rocket being used. The 1st and 2nd stage engines are newly developed. I read there wasn't much testing done on the second stage due to the price of the UDHM fuel and this is when things can go seriously wrong. They plan to eject the engines off our coast. These usually have fuel left in them. Another concern is the UDHM fuel used in the second stage engine. This cancer causing toxic fuel is no longer being used by many countries and being phased out by others. And the third concern is the location of the Space Port. It's proximity to our communities and source of our drinking water.

Here are my questions from my concerns:

1. What effect will this have on our water shed? From possible spills and the many launches over many years. There are numerous lakes and streams in the area. Southwest Lake is not that far from the Space Port sites and is where we get our drinking water.
2. Air pollution from the launches? What effect will the prevailing winds have on the exhaust created from burning the rocket fuels. What byproducts are created? Will these be carried back over our communities?
3. Is this project far enough away from our communities? What would happen with a launch pad or near launch pad explosion? Could the rocket crash in our community?
4. What about our local fisheries and coastal environment. The lobster fishery is by far the major employer in our communities. Who would buy our seafood products being harvested so close to where the rockets are being launched. Or even worse what would happen to our fisheries if there was an explosion or fuel spill? There are many other fisheries off our coast. What effect would the ejected engines have on these fisheries and the ocean environment?
5. Transportation of the rocket fuels. They will have to be transported through our communities to get to the site. What if a spill happens during this process?
6. The company plans on leasing the land. Who will clean the site when they are through with it? It is foreign owned and I'm not sure they could be made to clean the site. St. Mary's,

Newfoundland is seeing this first hand with a 30 year old environmental hazard of a storage building containing rotting fish that nobody wants to clean up.

7. How much government money will be spent on this project. My limited research has indicated that this is not a commercially viable business.

When I first heard about this project I wondered why they would build it here? From what I have read they are not allowed to put it near any populated areas. This is due to the large amounts of rocket fuels being used. If it is not safe for populated areas, how can it be safely located so close to us? It seems with the promise of jobs, we would overlook all the risks. If we can't drink our water, breath the air, or live in our communities, what good are any jobs?

**From:** @hotmail.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 15, 2019 2:56:18 PM

---

Project: canso-spaceport-facility Comments: It would be a amazing job to come to a struggling community which it would also bring tourism to the location too Name: Email:  
@hotmail.com Address:

**From:** [Environment](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 15, 2019 2:59:10 PM

---

Project: canso-spaceport-facility Comments: It would be nice to see some major projects come to the area  
Name:                      Email:                      Address:                      Municipality: Antigonish  
Postal-Code:                      Phone: ### ### - ##### Fax: ### ### - ##### email\_message: Privacy-  
Statement: agree x: 80 y: 20

**From:** [@hotmail.ca](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 15, 2019 6:46:46 PM

---

Project: canso-spaceport-facility Comments: I support this project as it will bring desperately  
need jobs to the area Name: Email: @hotmail.ca Address:

**From:** @yahoo.com  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 16, 2019 11:56:53 PM

---

Project: canso-spaceport-facility Comments: This project well managed will bring prosperity for all Canadians, especially to future generations. All developed nations are embarking in a space race. Our wealth and therefore our capacity to protect the environment depends on projects like this. Lagging behind other nations in this global competitive world can be impacting the development of Canada. I have seen first hand what lack of sustainable income and jobs produce to the environment. That is among other reasons I hope that this project go ahead. And with it a well settled environmental plan. Name: Email:  
@yahoo.com Address:



## UNITED ASSOCIATION

of Journeymen and Apprentices of the  
Plumbing and Pipe Fitting Industry of  
the United States and Canada

Founded 1889

Letters should  
be confined to  
one subject

UA Local Union:

Subject:

**244, P.O. Box 40, St. Andrews  
Antigonish County, Nova Scotia, B0H-1X0  
Phone 902-386-2551/Fax 902-386-2006  
Email: ualocal244@ns.sympatico.ca**

Mark McManus  
*General President*

Patrick H. Kellett  
*General Secretary-Treasurer*

Michael A. Pleasant  
*Assistant General President*

April 17/2019

Environmental Assessment Branch

Nova Scotia Environment

P.O. Box 442

Halifax, NS, B3J 2P8

Fax: (902) 424-6925

**EA@novascotia.ca**

### Canso Spaceport Facility

Environment Assessment for Canso Spaceport Facility proposed by Maritime Launch Service Ltd.

The following comments are submitted on behalf of the Membership of UA Local 244 - Antigonish Plumbers, Pipefitters, Welders, Instrument Technicians and Apprentices

#### **Our comments are in SUPPORT of the Project**

Most of our comments will be directed towards the potential for vastly improved socio economic conditions for Guysborough and surrounding Communities in the Strait of Canso Area.

The Terms of Reference for the required Focus Report places emphasis on the use of hydrazine as a propellant.



Quoting an article posted by the Chronicle Herald "propellant proposed for Canso Spaceport widely used" 3-21-19

Hydrazine is used as a Rocket Fuel around the World and there is currently no replacement option for this fuel. 87% of the hydrazine used in Canada is used to prevent corrosion in boilers of Power Plants and other Industries. NASA and the European Space Agency are doing research on a green replacement but none are available at the present time.

Cape Canaveral is probably the most commercialized rocket launch facility in the World with thousands of tourists coming out to watch every launch. Many pictures are available online showing large numbers of people on the surrounding land and beaches watching the launches.

We will leave technology and scientific comments to the professionals in those areas.

That being said Canso is a pretty remote area compared to the population density of the Cape Canaveral.

On the socio-economic side of the equation the proposed Canso Spaceport can and will be Canada's Cape Canaveral. This will mean hundreds of jobs for the whole area as well as being the catalyst for future development. Many International Construction Companies are based in Florida doing Business with the Space Industry.

Actually the United Association of Plumbers and Pipefitters has had many Articles published in Industry Journals about work we do in the Space Industry.

The Tourist Industry would be one of the major beneficiaries of the Spaceport.

For instance Cruise Ship Lines could schedule stops in the Strait of Canso to watch the Launches

It would take very little infrastructure spending to make this happen. Other areas would have to spend hundreds of millions of dollars to come up with a tourist attraction like this.

Canso and Nova Scotia in general are in bad need of a stimulus like this to create Employment so we can bring our young people back to a decent job in the very exciting Space Industry.

No Government make work program compares to this and taxes don't have to be increased to make it happen.

In closing the Local Construction Industry is well prepared and experienced for Projects like this.

We wish the proponents a positive outcome from the Environmental Assessment Board and a minimum of red tape that is killing Industry in this Province.

Sincerely,

Business Manager  
UA Local 244

**From:** [@ns.sympatico.ca](mailto:@ns.sympatico.ca)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 17, 2019 9:18:00 PM

---

Project: canso-spaceport-facility Comments: I realize many residents have valid trepidation with this new and unique space project. The questions about the chemicals, fuels and what ifs are truly understandable. However, the opportunities this project has to make a positive change for our area is undeniable. Not only will it bring in new businesses, it will help support existing businesses. Who knows what type of spinoff will come. In my opinion - one of the biggest benefits that will come with this is the security of our hospital. We have been lucky to keep it this long. Many who dont want change will see a major changenot for the betterif we lose this vital service. The people involved in the Maritime Launch Services seem genuinely concerned with both the community and environment. With the strict safety standards of Nova Scotia and the many contingency plans put in place, I feel that this project will be a safe and beneficial project for our area. Name: Email: @ns.sympatico.ca  
Address:



RECEIVED  
MINISTER'S OFFICE

APR 16 2019

54555  
NOVA SCOTIA ENVIRONMENT

RECEIVED  
MINISTER'S OFFICE

APR 15 2019

NOVA SCOTIA ENVIRONMENT

April 10, 2019

The Honourable Margaret Miller  
Minister of the Environment  
N.S. Legislature

Dear Madam:

Please excuse the unusual form of this letter. I am eighty-three and awaiting cataract surgery, so have resorted to this means of communication in order to be able to see what I am doing!

I have lived on Cape Canso all my life, and love it dearly. Someone called it (in my hearing) "The last outpost of peace, cleanliness and sanity." I did not disagree.

You are certain to have made yourself familiar with this cape during recent months, so I will not attempt an unnecessary description of its terrain, flora, fauna, & waterways. I will however comment on the latter because of my grave concerns about them.

Miller



Waterways:- There at least a dozen lakes within hiking distance of the proposed MLS launch site. They are connected by a wide variety of streams and wetlands. (note: N.S. government promised YEARS AGO to protect our wetlands, but did not fulfill this promise.) All of these treasured resources are in danger of contamination if MLS is established here.

Drinking Water:- One of these lakes is Wilkin's Lake - about three miles "as the crow flies" from the proposed site. Even if all goes well with any launch this lake, as well as all others in proximity, will inevitably be contaminated sooner or later. What are we to do if our reservoir is useless? This is the only "Clear water" lake within miles. All others have water which is golden due to tannin in our soil.

\* Due to "fallout" from the thrust.

\*→ "Insignificant Streams":- So called by a would be developer not many years ago, whose project would have ruined them as well as the tiny wetlands (with which they interact) which are home to the few survivors of the amphibians (e.g.) leopard frogs, Boatman beetles, skippers, etc etc. - and insect-eating plants like sundew (on the endangered list) and pitcher plant. All of which have been almost eliminated by our use of salt on highways.

\*→ THERE IS NO SUCH THING!!!



### Variable Winds

Cape Canso runs about thirty miles out into the Atlantic. Sea breezes and land breezes respond to changes in temperature - sometimes even small ones. When this happens, the wind can change direction several times in one day, as the thermal currents rise and ~~move~~ air of a different temperature moves in. These wind changes would affect the plans, and results of launchings in various ways. Thermal currents would disperse any contaminated air for many, many miles.

### Peat Bogs

Very close to the proposed site there are two large peat bogs. Their origin, not to mention their function and value in our environment, is still not well known. These two peat bogs contain so-called lily-ponds whose properties are not well understood. They are also temporary havens for migrating waterfowl.

### Migrant Birds

Cape Canso is a natural landfall for thousands of migratory birds, coming across the ocean - or up the Atlantic Seaboard.

Some of these are on the endangered species list.



Miller

4.

Finally, I wish to mention the attached sheet, printed from Google, and pertaining to the Cobeguid - Chedabuto fault.

I remember, as a child, looking up at the old cracks in the older plaster on my bedroom ceiling, and hearing how an earth tremor had cracked it, before I was born - Several of my older siblings remembered the experience well.

I will not belabor this subject. The obvious risks posed to a delicate project\* by such a geological situation, needs no embellishment. Also the risks are small, but non-the-less real. The people of Nfld. were not expecting the devastating earthquake that destroyed & killed in \*1929 - nor were the people on this coast expecting broken dishes & cracked plaster - nor the mild tsunami which did no damage here as far as I know.

My sincere thanks for your attention to this unorthodox mission. You hold a very difficult office, & I am proud of you and all my "sisters" who enter such careers.

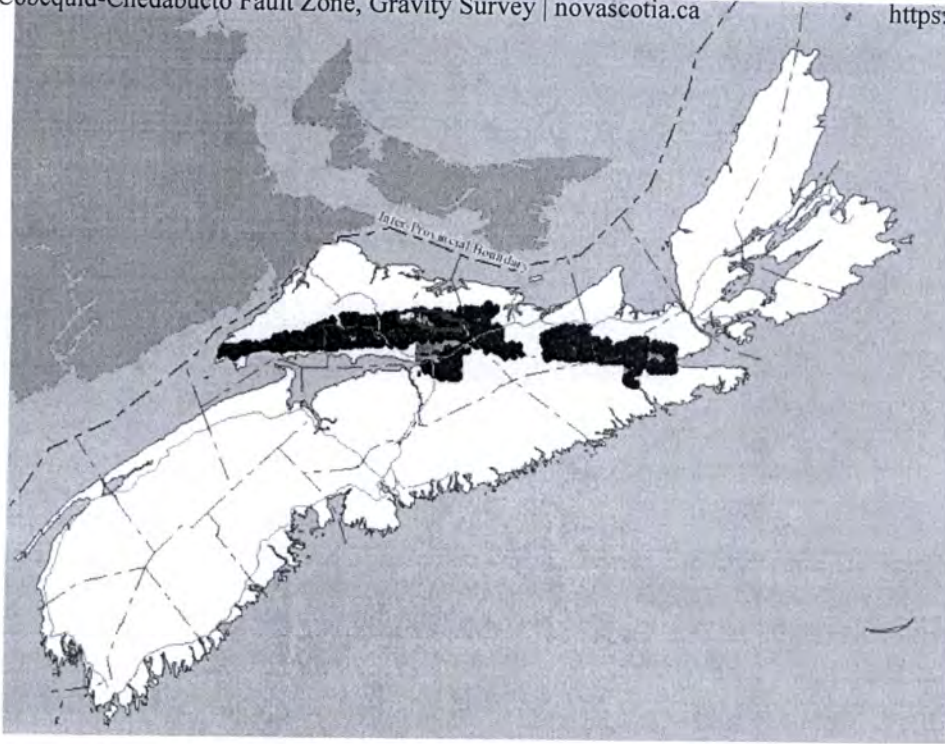
Best wishes

\* MLB  
SITE

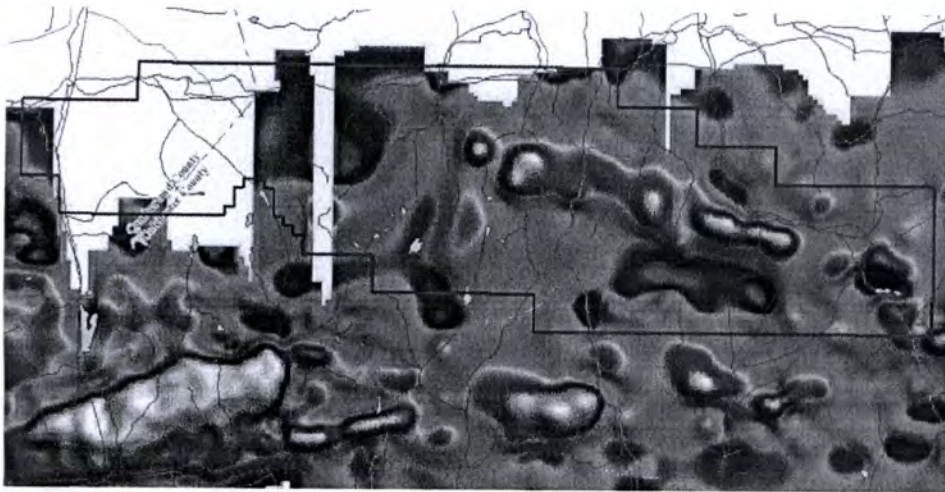
\* SEE  
Google  
printout  
& attached

Miller

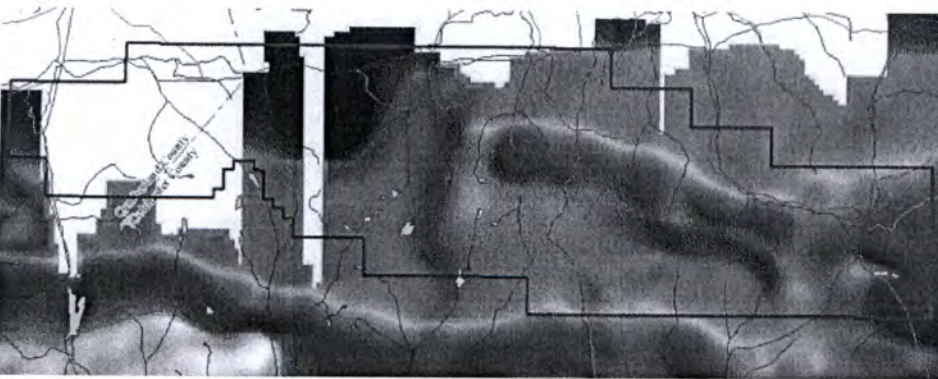




Detailed Sample 1st Vertical Derivative Bouguer Gravity



Detailed Sample Residual Gravity



### Format and Projection

- Format** ESRI shape files (SHP) and Joint Photographic Experts Group (JPEG) images for the processed data compressed into a ZIP file (more information on data formats) ([dpformat.asp](#))
- Size** SHP/JPG Files - 9.5 MB (compressed), 145 MB (uncompressed)





DNR (/natr/) > Geoscience & Mines Branch (/na... > Cobequid-Chedabucto Fault Zone, Gravity Survey

Lands and Forestry (/natr)

## Cobequid-Chedabucto Fault Zone, Gravity Survey

DP ME 509, Version 1, 2018, Ground Gravity Survey, Cobequid-Chedabucto Fault Zone, Northern mainland, Nova Scotia

[Disclaimer \(dp509.asp#disclaimer\)](#)

[Location Map \(dp509.asp#location\)](#)

[Sample \(dp509.asp#sample\)](#)

[Format and Projection \(dp509.asp#format\)](#)

[Metadata \(dp509md.asp\)](#)

[Download Instructions \(dp509.asp#instructions\)](#)

[Download Digital Data Sets \(dp509dll.asp\)](#)

### Abstract

This dataset consists of a SHP file of 11,662 ground gravity stations and JPG images for 1st vertical derivative bouguer gravity and residual gravity over the full length of the **Cobequid-Chedabucto Fault Zone** in the northern mainland of Nova Scotia. This work was done in 2008 and 2009 by Minotaur Atlantic Exploration Limited and used from 2008 to 2012 as part of mineral exploration work in the area. There were several assessment reports submitted over this period that describe this survey and the results (e.g. AR\_ME\_2008-18 and AR\_ME\_2009-010).

The purpose of this data was to find gravity anomalies to assist with mineral exploration work.

### Disclaimer

The information on the PDF map comes from a variety of government and non-government sources. NSDNR accepts no liability for any errors or deficiencies on this map. This map should not be used for legal purposes.

The PDF map is intended for use at the published scale of 1:50 000.

The DATA is provided to the USER on an "as is" basis, without warranties of any kind, express or implied.

The entire risk as to the quality and accuracy of the DATA is with the USER and the USER shall use his/her own judgment in making use of the DATA or drawing conclusions based upon it.

DNR shall not be liable to the USER, his/her clients, servants, agents, contractors, assigns, or to any other person for any loss or damage of any kind including personal injury or death arising from the use of the DATA or accompanying written materials, or from errors, deficiencies or faults therein, whether such damage is caused by negligence or otherwise. If errors or omissions are found in the DATA, the USER will notify DNR.

The terms and conditions of the license accompany the downloaded digital product.

### Location Map

**From:**  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Maritime Launch Services EA  
**Date:** April 19, 2019 7:27:13 AM

---

Hi all,

I have a special attachment to the natural beauty of this corner of the world. I wonder what impact both the rocket launch and sudden stream of visitors will have on the local environment.

How will gems like this be protected from trampling by swarms of visitors?

Kind regards,

Philips Harbour, NS

From: l@hotmail.com  
Sent: April 19, 2019 2:38 PM  
To: Environment Assessment Web Account <EA@novascotia.ca>  
Subject: Proposed Project Comments

Project: canso-spaceport-facility Comments: April 19, 2019 Dear Honourable Margaret Miller Minister of Natural Resources, I write this letter to express our grave concerns, as well as voice to you the many still unanswered questions we have related to the spaceport launch proposed for the Canso area of Nova Scotia. I wish to state that I, as well as my children and my parents, do not support this project as currently proposed. We do not believe it is safe for our community and that the risks far outweigh any benefits. There are still too many unanswered questions and Maritime Launch Services are not providing appropriate answers. I have been a resident of this beautiful community for most of my life. I grew up here and I have chosen to raise my children here. I own a home which is extremely close to the proposed site, my children attend school, and I work at the local hospital. My parents, now retired, also own their home. Should this spaceport become a reality as it is currently proposed, my children and I, as well as my parents and many others I have spoken to, feel we will be forced to leave our homes. Below are the many questions we have and the reasons why we feel it necessary to make the disappointing decision to leave our life long home, should this proposal be accepted. 1. The toxic fuels that are slated to be used, unsymmetrical dimethylhydrazine UDMH and Kerosine. Both of these fuels are known to be highly toxic with long lasting effects to all living organisms. These fuels, whether burned or the leftovers spilled on land or into the ocean, will not dissipate into the air or water never to be seen again. They do not break down and will actually build up, leading to concentrations far exceeding the allowable level of safe exposure. I am certain you will agree that there is no way the people in our community, or our land and marine wildlife, including the water, soil and vegetation deserve to be exposed to these highly toxic agents. Both of these chemicals are known to cause everything from skin and eye irritation to lung damage, cancer and central nervous system damage. There is always leftover fuel that spills into the air, water and land. And what if an accidental spill occurs where tonnes of this is leaked into our environment? Will I living in an environment in which we, as a population, are exposed to a known, highly toxic combination of chemicals lead to increases in medical insurance rates, or no access to medical insurance? 2. The proposed rocket, the Cyclone-4M, is a Ukrainian rocket that has been developed/modified for commercial satellite launches and has never actually been launched before. I am very apprehensive about my home, as well as many other homes, being so close to an experimental first launch. Maritime Launch Services MLS say the blast can cause windows to break and plaster to fall. I do not wish to have to repair my home every time a blast occurs. What will this mean for our home insurance rates? Will we even be able to insure our homes? How close are homes allowed to be to an actual rocket launch site? Will we be forced to move because we are too close? And what if the rocket doesn't launch properly are we just then the poor victims of an unfortunate accident? 3. The failure of the 10 year long partnership between Brazil and the Ukrainian partners to actually launch a rocket. There were many financially related questions about misappropriation of funds and other continuing scandals in the media. Do they have any of their own money to start this venture or are they looking to our government and taxpayers to foot this? Are these key players to be trusted to look out for our community's best interests, or are they yet another group trying to take advantage of a vulnerable population of people? 4. We do not believe that the possibility of employment and economic development for this community will be significant enough to justify the health hazards that will be experienced should this be accepted as proposed. I know there are still many questions that we have not yet thought of related to this spaceport proposal, and I trust that there are many other people asking the same relevant questions, as well as many others. I sincerely hope and believe that before rendering a decision regarding the acceptance or denial of this project, that you will consider all aspects of what this proposal may mean for our community. We thank you for taking the time to read and consider this letter. Sincerely,

Attached are links to documents such as the SDS sheets for kerosine and UDMH, as well as news articles where I found plenty of disturbing information, related to both the proposed chemicals as well as the type of rocket being used and the key players MLS and the Ukraine representatives behind this proposal. UDMH SDS sheet: <http://cdn.chemservice.com/product/msdsnew/External/English/N-1012820English20SDS20US.pdf> Kerosine SDS sheet: <http://www.globalp.com/documents/files/SDS20Kerosene20Final1.pdf> Disturbing news articles related to the choice of chemicals, the type of rockets chosen for this project and the integrity of the key players involved:

[https://www.researchgate.net/publication/320172035\\_Toxic\\_splash\\_Russian\\_rocket\\_stages\\_dropped\\_in\\_Arctic\\_waters\\_raise\\_health\\_environmental\\_and\\_legal\\_concerns/fulltext/5a1f422caca272cbfbc2e153/320172035\\_Toxic\\_splash\\_Russian\\_rocket\\_stages\\_dropped\\_in\\_Arctic\\_waters\\_raise\\_health\\_environmental\\_and\\_legal\\_concerns.pdf?origin=publication\\_detail](https://www.researchgate.net/publication/320172035_Toxic_splash_Russian_rocket_stages_dropped_in_Arctic_waters_raise_health_environmental_and_legal_concerns/fulltext/5a1f422caca272cbfbc2e153/320172035_Toxic_splash_Russian_rocket_stages_dropped_in_Arctic_waters_raise_health_environmental_and_legal_concerns.pdf?origin=publication_detail) <https://www.cbc.ca/news/canada/north/15th-european-satellite-launch-rocket-debris-high-arctic-1.4633752> <http://acuriousguy.blogspot.com/2018/04/ukrainian-rockets-like-cyclone-4m-are.html> <https://en.wikipedia.org/wiki/Cyclone-4M> <https://spacenews.com/brazil-pulling-out-of-ukrainian-launcher-project/> Name: Email: @hotmail.com



Environmental Assessment Branch  
Nova Scotia Environment  
P.O. Box 442 Halifax, NS  
B3J 2P8  
[EA@novascotia.ca](mailto:EA@novascotia.ca)

April 19, 2019

St. Francis Xavier University (StFX) has prepared this letter in response to the Minister of Environment's invitation to provide public comment on the revised environmental assessment (EA) prepared by Maritime Launch Services (MLS) concerning their proposal to construct and operate a commercial space launch facility in Canso, Nova Scotia.

Representatives of Maritime Launch Services have visited StFX on several occasions over the past two years. We have discussed at length the significant implications that the establishment of the proposed commercial space launch facility could have for our students' educational experience and career opportunities, for research, and for economic development in northeastern Nova Scotia. Given that StFX is the closest university to the proposed launch site, we feel that there has been a special effort made by the proponents to proactively engage in constructive dialogue with a variety of individuals from the StFX academic community.

StFX is supportive of the MLS proposal. Moreover, we see ongoing opportunities for researchers from StFX to engage with MLS on a wide range of topics that will be associated with this project over time, including those that might relate to ongoing questions that relate to social, economic or environmental questions. Our students will be actively involved in this research, contributing to their education and development as researchers in their own right. StFX anticipates creating new academic programming (courses, programs of study, student project opportunities) that will relate to the close geographic proximity of the launch site. Finally, the project will create new opportunities for the local employment of our graduates, including opportunities for entrepreneurs to start new enterprises in the region.

Numerous new opportunities will be created from the willingness of MLS to have local research participation in issues related to the preparation and launch of space vehicles, as well as research that can be carried out as a result of the launch of commercial space vehicles from the proposed site. We foresee active participation from researchers and students in our Faculty of Science (departments of chemistry, physics, biology, earth sciences, climate and environment, engineering, computer science, mathematics, and human nutrition) in these efforts. Examples of some of our current areas of research interest include: coastal community resiliency and adaptation in response to changing sea levels and climate change; community coastal and marine emergency response preparedness in the Arctic; Indigenous fisheries management; marine security surveillance; chemical catalysis and green chemistry;

data mining, machine learning, and computational power optimization; marine coastal zone ecology, species habitat assessment and monitoring; modern geomorphic processes, changes in sedimentation rates and shorelines; atmospheric and near surface greenhouse gas (hydrocarbons, carbon dioxide) detection and monitoring; climate modelling and dynamics and use of climate models to predict impacts from climate change and adaptation strategies.

StFX has also established connections with the Dalhousie Space Systems Laboratory, which is assembling collaboration of researchers to pursue a satellite constellation project that would advance research and understanding of North Atlantic waters and the Arctic. This project would see CubeSats built specifically to obtain remote sensing data from MLS launches that would assist and advance research at StFX, Dalhousie, and other academic partners, as well as private sector and industry / business interests, for greater understanding of our ocean resources.

In summary, StFX University sees positive benefits from the development of the MLS proposal to develop a commercial space launch facility in our region, as well as ongoing opportunities to contribute to this effort through academic research and educational efforts aligned with our university mission and strategic plan.

Yours sincerely,

Associate Vice President, Research and Graduate Studies

**From:** [Environment](#)  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 19, 2019 6:26:08 PM

---

Project: canso-spaceport-facility Comments: Throughout the Environmental Assessment process, Maritime Launch Services MLS has shown at best a begrudging commitment to completing the required bureaucratic paperwork, and at worst, a sinister predation on an otherwise overlooked corner of the world. There are substantial problems with their application which I'll attempt to represent below. The Cyclone 4M rockets proposed to be launched from the Canso Spaceport are still in development and consequently all projections regarding the craft's operation itself are exactly that: projections, which is to say, speculative and unproven. MLS's focus report does not give any indication of the frequency of launch failures - how could it, if there have never been any flights? The report places the purely mathematical probability of rocket landing in a nearby body of surface water after failure at about a 1 in 400000 chance. But one need only look at Yuzhnoye's Cyclone 3 Yuzhnoye's last production rocket launch history to know that launch failures are far more common - about 4 of launches failed. <https://www.yuzhnoye.com/en/company/history/cyclone-3.html>. That's 1 in 25. If we were to take that as an indication of the new Cyclone model's reliability again purely speculative, because the 4M has not flown, once the spaceport reaches its optimal launch frequency of eight per year, that makes it statistically likely to have a launch failure once every three years. The focus report highlights the biodiversity of the region, and especially of birds, but its consideration of the effects of hazardous chemical spills primarily hydrazine, the fuel to be used in the second stage of the rocket and of noise emitted from the launch site on the said wildlife leaves much to be desired. While hydrazine apparently is not bioaccumulative, it is acutely toxic, which is not fully addressed - for example, what about transporting tanker trucks full of highly toxic substances like hydrazine on poorly maintained rural highways? What happens if a spill occurs in a populated area before it reaches the project site? Where consideration is given to noise, the assessment relies upon A-weighted decibel dB levels  $L_{Amax}$  relative to human hearing as the primary metric for evaluating the effect on both humans and animals. This is problematic for a number of reasons.  $L_{Amax}$  dB calculations attenuate low- and mid-range frequencies significantly, in line with the frequency response of human hearing, and are averaged over the length of the event. Rocket launch noise is concentrated in exactly that area of the frequency spectrum, and extends over a significant period. Where an unweighted dB level is ostensibly used, it is contradictorily indicated in A-weighted dB, and only discussed in relation to risk of property damage - all of Canso and Little Dover falls within this range - not discomfort or injury. The noise measurements given themselves cast a certain amount of doubt, since a rocket launch can produce instantaneous peaks of ~180 dBs, at which point hearing damage is inescapable even at a distance and the concern realistically should not be perceived loudness as in A-weighted dB but actual physical injury. Finally, the low frequencies attenuated in A-weighted measurements to reflect perceived loudness, not actual amplitude across frequency spectrum that rocket launches produce in abundance travel farther than high frequencies, which is barely accounted for in the noise study. Overall, it is shot through with inconsistencies. Since it's outside the scope of the environmental assessment, the report makes no mention of Yuzhnoye's abandoned Cyclone 4 project at Alacranza in Brazil, from which the 4Ms are derived, that nixed in 2015 over concerns regarding costs and future market success. A director at Alacranza said: Do you really believe launchers make money in any part of the world? I don't believe so. If the government doesn't buy launches and fund the development of technology, it does not work. [...] Everybody talks about SpaceX like it's magic, somehow different. It's no

different. Their connections with NASA have been important. If NASA had stopped the funding, where would they be? I really appreciate what they are doing, but I doubt whether launch bases can make money and survive on their own without government support <https://spacenews.com/brazil-pulling-out-of-ukrainian-launcher-project/>. Similarly disconcerting are the recent allegations of misappropriated funds through existing Canada-Ukraine contracts <https://nabu.gov.ua/novyny/eks-kerivnyku-dp-ukrkosmos-povidomleno-pro-pidozru>, or the significantly more menacing thought of embroiling ourselves in a simmering geopolitical conflict between Russia, the Ukraine, North Korea, and the United States, of which Yuzhnoye/Yuzhmash's rocket producing facilities are a central aspect <https://www.nytimes.com/2017/08/14/world/asia/north-korea-missiles-ukraine-factory.html>. It's also worth mentioning that MLS's emergency response and mitigation plans are completely underdeveloped, only hinting at preparedness with plenty of "shoulds" and "woulds" while remaining dangerously optimistic about the community's capacity to respond to such a crisis. Neither do they have firm plans for decommission or remediation. But let's focus on what's at hand, one last deficiency in the focus report: its purported consultation with indigenous stakeholders. MLS contracted Membertou Geoinformatics Solutions, who produced a wonderfully informative Mi'kmaq Ecological Knowledge Study MEKS that is meritorious in many respects. MLS's engagement remains perfunctory, however. There is no indication that the MEKS was presented at the meeting with Kwilma'k Maw-klusuaqn Negotiation Office/Mi'kmaq Rights Initiative Benefits Committee, and no indication that the full Assembly of Nova Scotia Mi'kmaq Chiefs has provided a definitive endorsement of the project. Further, \_\_\_\_\_, CEO/President of MLS, was not even present at this meeting, highlighting MLS's lack of any real presence in Nova Scotia aside from a mailbox. To top all that off, Harvey Doane of Nova Scotia Business Inc. presented the information on MLS behalf. The jury is definitely still out on whether this qualifies as sufficient consultation, and Mr. Doane's actions representing both MLS and the Crown clearly interfere with the Crown's fiduciary duty in these negotiations. And still so many questions remain beyond the environmental assessment - how will MLS secure its funding? What negotiations have already taken place at the municipality level? Is there actually a sufficient market for commercial space launches free of government support, and to what degree is the lack of competitors an indication of its viability? Where do they plan to source the skilled labour required for this facility, both in construction and operation? It would be wholly irresponsible for the NS Department of Environment to give MLS the green light to move forward with the information they've provided. At the very least, the Department should again seek further clarification. Name: Email: Address: Municipality: Postal-Code: Phone: ###-###-#### Fax: ###-###-#### email\_message: Privacy-Statement: agree x: 64 y: 36

**From:** @snet.net  
**To:** [Environment Assessment Web Account](#)  
**Subject:** Proposed Project Comments  
**Date:** April 20, 2019 8:15:16 PM

---

Project: canso-spaceport-facility Comments: The risks of a malfunction are too potentially catastrophic for this project to be worth it. Tourism is a major economic component, which could be adversely affected by the fall-out from any kind of malfunction, as well as the disturbance from a routine launch. Too much downside Name: Email:  
@snet.net Address: