REGISTRATION FORM

NAME OF UNDERTAKING: Use Air Defense Countermeasure Flares
at 5 Wing Goose Bay Military Training Area

PROPONENT:

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GLOSSARY AND LIST OF ABBREVIATIONS

AGL	Above Ground Level (flight altitude)
DND	Department of National Defence
D Air CFG	Directorate of Air Contracted Force Generation
EA	Environmental Assessment
FMTGB	Foreign Military Training – Goose Bay
IEMR	Institute for Environmental Monitoring and Research
LLTA	Low Level Training Area
MTA	Military Training Area
MCC	Military Coordination Center
MOU	Memorandum of Understanding
MTA	Military Training Area
NM	Nautical Miles
PTA	Practice Target Area
VEC	Valued Ecosystem Component

1.0 INTRODUCTION

1.1 Identification of the Proponent

The Department of National Defence (DND) is the Responsible Authority for Foreign Military Training (FMT) activities conducted at 5 Wing Goose Bay. As signatories to agreements with the Government of Canada, air forces from foreign nations are authorized to conduct flight training in Canada. An implementation arrangement, known as a Memorandum of Understanding (MOU), identifies specific requirements and other terms and conditions relating to the training of the international participants at 5 Wing Goose Bay. The original MOU took effect in 1986 and was renewed for another ten-year term in 1996.

Current and prospective participants have indicated a need to achieve cost savings and training enhancements to assure their continued involvement in Goose Bay beyond the MOU expiration in 2006. DND considers this undertaking an important element for 5 Wing to remain viable as a training venue; it is initiating this undertaking to satisfy a longstanding allied requirement.

1.2 Nature of the Undertaking

1.2.1 Background

Military training at Goose Bay has averaged 5,000 - 6,000 low-level flights in past years, during the April to October flying season. However, activity levels have declined substantially during the last few years. Until recently, most training was comprised of low-level flights involving activity below 1000 feet and as low as 100 feet above all obstacles within a designated training area over the interior of the Quebec-Labrador peninsula. Figure 1.1 illustrates the training area, the entirety of which measures 130,000 square kilometres (the size of England). Seventy "camera targets" are dispersed throughout the Low-Level Training Area (LLTA); these are mock-up structures simulating enemy installations. Crews navigate between selected targets, often flying in river valleys and below natural ridge lines (terrain-masking) to avoid radar detection. They conduct simulated attacks using onboard cameras to verify their accuracy - no weapons or stores are launched against camera targets.

Aircrew may conduct weapons training through the release of non-explosive practice weapons onto defined targets, but only within a four nautical mile radius Practice Target Area (PTA) shown at figure 1.1.

There is only one permanent community (Churchill Falls, population 800) within the training area and it is protected from disturbance by a 16 nautical mile (NM) radius exclusion zone. A dozen small communities are situated some forty kilometres or more from the training area perimeter; members of these communities practice traditional hunter/ gatherer harvesting activities within the training area during different periods of the year. The training area straddles the boundary of Labrador and the province of Quebec.

In 2003, DND successfully completed the regulatory processes, including an environmental assessment, to introduce the use of practice Precision Guided Munitions at the PTA. This entailed the transfer of administration and control of a larger parcel of land from the Province to DND to establish a Safety Template Zone around the PTA. A 16 nautical mile radius perimeter was marked on the ground by a 3-metre clear-cut vegetation slash, with signs posted in three languages.

In this instance, DND intends to further enhance allied training opportunities by authorizing practice Air Defence Countermeasures, consisting of the use of chaff and flare systems. This would be the first instance of aircrew deploying any materials from onboard the aircraft, other than within the PTA. To achieve ‘realistic’ training, aircrew must have the option to use these materials during most of their sortie. This requires the use of most, but not all, of the airspace within the LLTA. At least for the foreseeable future, DND intends to permit the activity only within the Labrador portion of the LLTA. This has the added benefit of facilitating a speedier review and approval process, and to devise research that can better discriminate comparative effects with an adjacent control area.

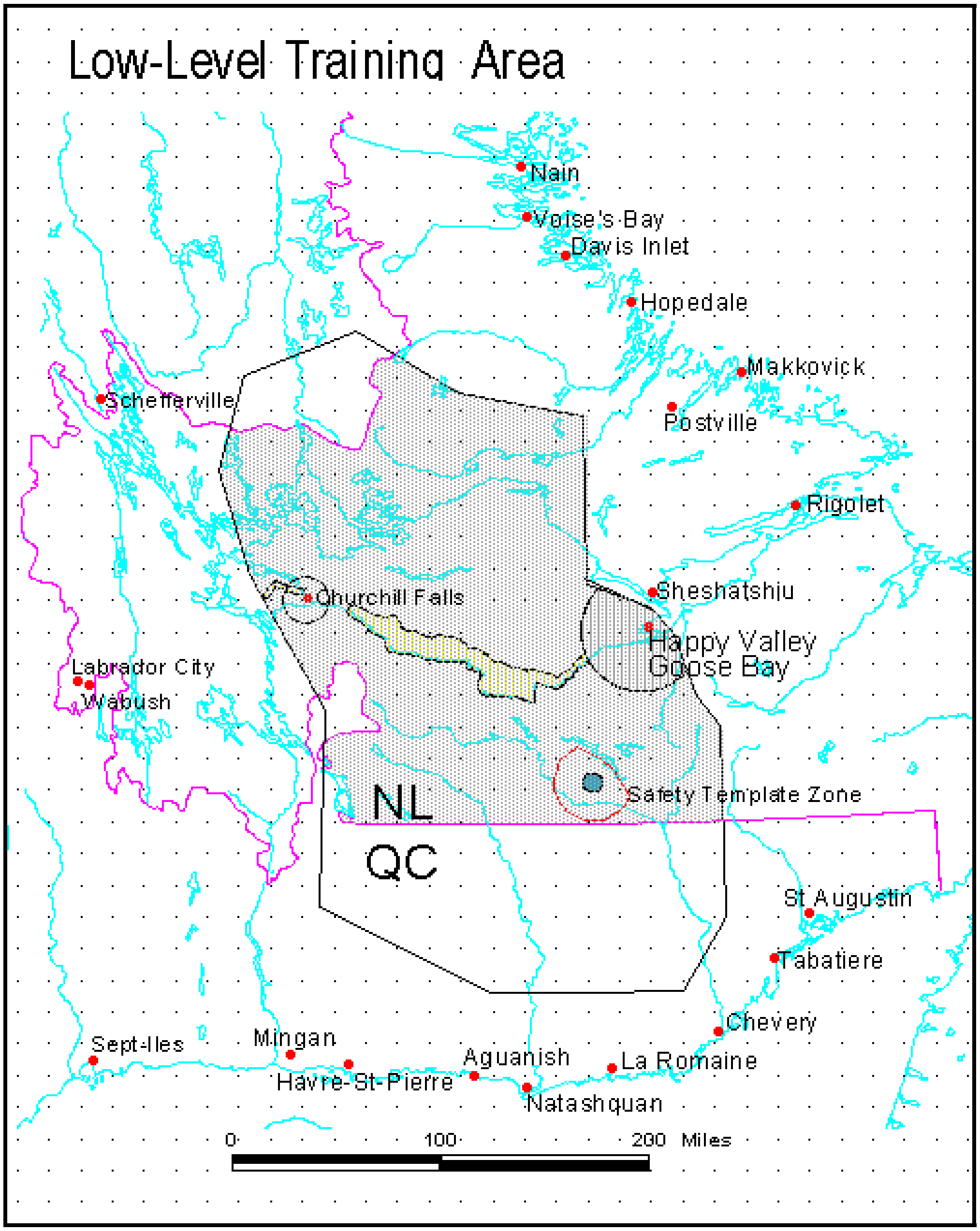

Figure 1.1 Location map; the shaded area represents the Labrador portion of the LLTA, intended to be used for air defensive countermeasure flares training. A 25nm transition zone around the Goose Bay airport and 16nm zone around Churchill Falls will be excluded.

1.2.2 Previous Environmental and Administrative Processes

The training activity described above was referred to an independent environmental assessment panel for a public review under the federal Environmental Assessment and Review Process Orders guidelines. The Department of National Defence published an **Environmental Impact Statement (EIS) on Military Training Activities in Labrador and Quebec** (DND 1994), which provided the basis for subsequent technical and public hearings throughout the affected region. In 1995, the Government of Canada accepted the principal findings and recommendations of the panel, thus authorizing the continuation and controlled expansion of the activity.

In 1995, a **Transfer of Administration and Control of Crown Land to Her Majesty the Queen in Right of Canada** (Province of Newfoundland and Labrador Document No. 106234) formalized the establishment of the PTA lands as a "tactical air weapons range" under the administration and control of DND. . This arrangement was modified in 2003 to accommodate the use of enhanced longer-range practice 'precision guided munitions', and the establishment of a Safety Template Zone. As part of the comprehensive environmental management system, the federal government established the Institute for Environmental Monitoring and Research (IEMR) in 1996 to involve the major stakeholders and all levels of government agencies in conducting independent direct research on the effects of authorized training activities. DND retains the responsibility and accountability for mitigating any potential effects and for conducting any environmental assessments prior to the introduction of new training elements within the 5 Wing program. The work conducted by the IEMR to date confirms that any environmental impact is at or below the impact levels predicted in the EIS. Increasingly, DND and the IEMR have combined resources and worked collaboratively in designing research and monitoring studies. For the introduction of new training elements, such as Air Defence Countermeasures, DND has provided the IEMR with all its documentation to facilitate a review by stakeholders and its Scientific Review Committee.

DND publishes, on an annual basis, an Environmental Report and Mitigation Program relating to Foreign Military Training in Goose Bay. This report indicates the results of the environmental work conducted by FMTGB over the last period, outstanding issues to be addressed, consultations and collaborations with external groups, goals and objectives and the following year's workplan (roughly $1.5 million in expenditures annually). This report can be obtained online at www.goosebay.org. In 2003, FMTGB also achieved ISO 14001 certification, attesting to DND's comprehensive approach in addressing environmental issues relating to the training activity at 5 Wing.

1.3 The Undertaking

At any time during a combat mission, aircrew may be exposed to numerous types of threats from either air-based (opposing aircraft with missiles and guns) or ground-based (various surface-to-air missiles or anti-aircraft artillery) systems. These systems usually incorporate fire control and guidance components using either radar tracking and guidance or infrared (heat) seekers. To counter these threats, aircrew must manoeuvre the aircraft rapidly while deploying defensive counter-measure systems, such as radio frequency (RF) chaff and flares. Chaff is used to counter radar-controlled systems and is treated separately in another Registration document; flares are used to counter infrared systems and are the subject of this Registration.

This undertaking seeks to initiate the use of flares at 5 Wing Goose Bay for aircrew training in Air Defence Countermeasures. It represents an individual element within an overall training activity, which has already been approved under a previous federal environmental panel review process (DND 1994).

1.4 Need for the Undertaking

Almost all combat aircraft make use of defensive countermeasure to defeat anti-aircraft weapon systems. To do so effectively, aircrew need to incorporate their use as part of their flight training activities. Ground support maintenance personnel also require regular training to maintain combat readiness and validate flare system operational reliability. Since this element was not incorporated among the activities in the EIS, the use of these countermeasures has not been permitted in the Military Training Area at Goose Bay, to date. Participating air forces have indicated that training with defensive countermeasures, including flares, is vital for aircrew proficiency; not having this capability at Goose Bay is a significant detriment to their continued training at 5 Wing.

With the growing sophistication of anti-aircraft systems, the need to regularly conduct realistic training continues to grow. Survival in air combat demands that aircrew develop and correct, instantaneous and intuitive responses to various anti-aircraft threats, including in-flight analysis of weapons; survey warning and defensive counter-measure sensors for adversaries; employ tactics and weapons for timely defensive countermeasures; assess the success of the measures and continue on with their assigned tasks.

In Canada, the use of flares is permitted in designated areas of the Cold Lake Air Weapons Range (CLAWR) in Alberta.

1.5 Alternatives to the Undertaking

The viability of the foreign military training program conducted at Goose Bay is entirely dependent on DND’s ability to offer facilities and services that continue to satisfy the evolving requirements of participating air forces in a cost-effective and comprehensive manner. The inability to train in a crucial aspect of their operation could compromise the overall training value of their program in Goose Bay, and thus lead to the selection of alternative training venues elsewhere in the world. The employment and socio-economic benefits accruing from the allied training have been well documented in the 1994 EIS, and more recently, in studies sponsored by the Institute for Environmental Monitoring and Research. Over the past several decades, and for the foreseeable future, the military activity at Goose Bay represents an economic mainstay for the region.

1.6 Schedule for the Undertaking

DND intends to authorize use of flares as soon as the environmental process is completed. The implementation of this undertaking does not require any new construction and/or modification within the Military Training Area, nor other licenses or approvals.

2.0 DESCRIPTION OF THE UNDERTAKING

2.1 Introduction

Since the 1980s, much of the training conducted at Goose Bay has focused on low-level flying. Such tactical employment of aircraft provided a degree of security to the crews, minimizing detection by flying in the valleys. This practice, known as terrain masking, is not always an operational option – crews may have to fly at higher altitudes, where they are more vulnerable to enemy fire. Advances in airborne and ground-based anti-aircraft detection and weapons systems are also posing an increasing threat to aircraft. To counter the threat posed by infrared (heat-seeking) homing devices, the pilot must take evasive action in conjunction with the deployment of flares. The flare produces temperatures of about 2,000 degrees Fahrenheit (F), higher than the jet engine exhaust, creating a second false target to confuse the firing solution and providing an opportunity to manoeuvre out of the threat area.

Flares are designed to be ejected from aircraft and to burn rapidly (3.5 to 5 seconds), equating to a drop distance of 100 metres, well before reaching the ground. The main component of flares is magnesium pellets, and the only materials that should be deposited on the earth's surface are the residual ash and incidental debris from flare canisters (typically a felt spacer and a plastic end cap.

With minor variations, the flares used by allied forces in Goose Bay are similar to the USAF M-206 and MJU-7 (see Appendix A). The flares are wrapped with aluminum-filament-reinforced tape and inserted into an aluminium case. The top of the case has a pyrotechnic impulse cartridge that is activated electrically to produce hot gases that push one 1-inch square by ¼-inch thick cap and the flare material out of the flare dispenser mounted in the aircraft. The flare ignites as it is ejected from the dispenser.

Different types of flares are available, namely: parasitic, non-parasitic, and semi-parasitic. These different types can be used by the same aircraft, [Parasitic – M-206 and MJU-7/B (MBT Lot), Non-parasitic – MJU-7/B; and Semi-parasitic ---MJU-7A/B)

Parasitic – The parasitic type of flare is ignited in the aluminium case before it leaves the aircraft by holes in the piston that permit ignitor gases to contact the first fire mixture on top of the flare pallet. This type of flare is less likely to produce duds.

Non-parasitic – This type of flare incorporates a mechanical mechanism to prevent ignition of the pallet in the case. This includes, a push button and spring, a firing pin, and primer assembly. When ignited by the firing pin, the primer assembly fires the ignition charge, which fires the output charge, which ignites the flare pallet. This type of flare is likely to produce the largest number of duds and the most debris due to the complexity of the ignition process.

Semi-parasitic – these fall some where in between the parasitic and non-parasitic flares as far as the number of duds are concerned.

The distinction between the types of flares was a key determinant in DND putting forward this undertaking with the required level of confidence that it will not pose any significant risk to the environment or public safety. As described in Section 4, the use of flares in training will be permitted only under controlled circumstances and from safe minimum altitudes.

More detailed information on the composition and operation of flares is provided at Appendix A.

2.2 Current and Future Usage

DND assumes that about half of the total sorties flown (or 2,500) would deploy self-protection flares, with an estimated maximum of about 30 flares ((each weighing about 200 grams) per sortie. Accordingly, approximately 75,000 flares, or 15,000 kilograms of flare material would be dispersed annually, nearly all of which will have been consumed before depositing on the ground.

2.3 Current Environmental Protection Procedures

As part of its extensive mitigation efforts, DND maintains a comprehensive monitoring program to identify sensitive areas in the MTA arising from human or wildlife activity on the ground. This information is gleaned from ongoing surveys, tracking of wildlife based on satellite and radio collars, and data collected through a community liaison program. Allied crews are notified by the Military Control Centre (MCC) of sensitive locations and protective buffer areas are established where flight activity is prohibited. As discussed in Section 4, this same avoidance program will be adopted to prevent the deployment of flares directly over sensitive areas.

As previously stated, the DND environmental program is conducted in cooperation with federal and provincial wildlife officials and the Institute for Environmental Monitoring and Research (IEMR), in consultation with interested aboriginal groups. This arrangement provides an effective mechanism to address issues that may arise with this undertaking at any time in the future. DND expects that the IEMR will undertake a program to monitor the actual impacts of flares on the environment.

2.4 Probability of Flare Failure

As mentioned earlier, the incidence of 'dud' flares is largely a factor of the type of flare used (parasitic or other), based on its mechanical components. The comparison is only in relative terms, as the actual rate of dud incidents is very low.

As part of its quality assurance measures, the USAF requires that flares production lots pass an ignition and ejection test. To be accepted, each 80 sample lot must have two units or fewer fail the inspection, equating to a minimum reliability standard of 97.5 percent. Allied Forces have similar quality assurance standards for the acceptance of flare systems.

In the United States Air Force, where more than one million flares are used annually, when mishaps have occurred, they were confined mainly to Air Force personnel and property. The potential safety risks posed to aircrews by deployment of flares come from the improper or incomplete flare ejection. Civilian impacts were minimal or nonexistent. Some risk is associated with non-aircraft related maintenance and handling operations. Although the rate of incidents is low, the possible consequences of any incident involving pyrotechnics can be considerable. For that reason, safety standards for the storage, handling and use of these materials are well established and enforced.

2.5 Fire Risk Assessment

Fires resulting from flare use have the potential to cause impacts on a variety of resources. Fire is part of the natural ecosystem of most plant communities and is a major force in all arid, temperate, boreal, and austral zones. Quite often, land managers use controlled burning as a way to lessen build-up of fuels to reduce potential for large fires. Nevertheless, the potential consequences of unplanned fires caused by other than natural causes are not desirable in any situation.

There are several situations, although improbable, that could result in a burning flare reaching the ground:

- the flare could be released at too low an altitude with inadequate surface clearance;
- the flare could descend unexpectedly rapidly due to vertical shear or wind burst;
- the flare could burn at an unexpectedly slow rate due to manufacture error;
- the internal ignition source could malfunction, causing the flare to ignite late in the air or fall to the ground as a dud and ignite later; or
- the flare could land on dead vegetation, such as a tree top, while still burning.

In a US Air Force study, operating parameters (such as release altitude, area, environmental conditions) were too diverse to isolate level of use as the only or primary factor affecting frequency of fires. For this reason, and because flare-caused fires are rare in any case, no statistical correlations could be made between utilization, environmental conditions, and fire occurrence. Some regulations restrict the types of self-protection flares that can be employed, but it was not possible to correlate flare-caused fires to specific flare types.

Because of the type of fire information required (fuel type, weather conditions, and terrain) for fire hazard evaluation, risk assessments must be performed on a site-specific basis. Fire hazard and behaviour prediction modeling software are in the public domain.

Mechanisms are in place for aircrew to report fire sightings to 5 Wing officials and for the notification of provincial lands and forest personnel. These and other coordinating arrangements will be reviewed by DND and Provincial authorities prior to the start of flare training.

2.6 Timeframe for Operational Activity

The international Memorandum of Understanding governing foreign training at 5 Wing provides for “a flying training season of up to 36 weeks for each Participant within a 39 week window during the period 01 March to 30 November inclusive.” In practice, while active and intense training periods are generally confined to the period April to October of every year, there is an increasing amount of short-term flying training during the winter months. DND proposes that implementation of training with flares be included for the balance of the current 2004 – 2005 training cycle, and beyond with Provincial agreement.

2.7 Communicating with Civil Aviation and Other Local Authorities

Military Control Centre (MCC) coordinates all military flights into the Military Training Area in accordance with visual and instrument flight rules and also acts as a liaison with locally-based civilian air carriers.

Operations staff at 5 Wing conducts a mass briefing for these air carriers annually in March, at which time all new activities relating to the military flying program and training areas are thoroughly described.

This undertaking will utilize the same airspace envelope currently authorized for foreign training. All of the restrictions on non-military airspace use that are currently in effect will remain, and no new airspace restrictions will be imposed.

The use of flares in the Military Training Area will not affect the command, control and communications capabilities of MCC or the civilian air carriers. Nor will it obstruct in any manner the commercial air traffic radar systems.

2.8 Amendment to Military Flight Procedure

The proposed undertaking will not require any significant changes to existing mitigation, communications or coordination procedures.

3.0 ENVIRONMENTAL ASSESSMENT

3.1 Introduction

This section examines the potential interaction between the undertaking and the environment.. Four resource categories were analysed to identify potential impacts:

- Physical resources (soils and water)
- Biological resources (vegetation and wildlife)
- Air quality issues
- Land use activity (Land management, use, and recreational resources)

Information from various sources has been utilized; these include: The Military Low Level Training Area Map MCE 820, 1:250K NTS sheets., and 1:50K NTS for selected area. The geomorphic and geological information has been derived from the topographic maps. This information has been supplemented with the Labrador Forest Inventory maps corresponding to each 1:50K NTS sheets produced by the Environment Canada. These maps were derived from the Landsat Thematic Mapper and provide information about the distribution of different types of land cover. For the sake of interpretation, some of the land cover categories have been merged. Additional information about the distribution of the different types of vegetation, as well as wildlife, has been obtained from the EIS (DND, 1994).

A great deal of the material used in the literature review is based on United States Air Force (USAF) reports, primarily because the preponderance of available data originates from that source. That documentation was helpful in identifying the issues and reviewing the various environmental impacts resulting from the use of self-protection flares.

3.2 Issues and Concerns

Safety risks to persons on the ground may result from faulty ignition, leading to duds that could be immediately hazardous if they hit someone on descent, or that could remain a potential hazard if picked up later and handled improperly. Burning flares generate air emissions with potential air quality impacts. If a flare is still burning when it hits the ground, it may cause a fire and result in a variety of secondary impacts on soil, water, biological resources, cultural resources, land use, and human safety.

Dud flares and flares that have not been fully consumed are potentially explosive when mixed with water. This raises questions of potential hazards and chemical effects from flares falling into water bodies, as well as resulting impacts on biota. If a dud flare lands on the ground, it may react with latent moisture or it may remain intact, raising issues of chemical effects on soil and potential indirect impacts on groundwater and vegetation. Wildlife issues include whether light from flares might affect the vision of nocturnal animals. Dud flares and flare debris may accumulate in areas underlying training airspace and result in land use and visual impacts.

Given that the primary environmental concerns, and the potential impacts with the most serious consequences, involve instances of 'dud' flares, DND is proposing to authorize training only with **parasitic** flares, which would essentially preclude the possibility of duds (the flare material could not eject from the aircraft unless it was already ignited). The balance of the assessment does not exclude the 'dud' factor, but readers should be mindful of the improbability of such an occurrence.

3.3 PHYSICAL RESOURCES

3.3.1 Geomorphology

The topography of the Military Training Area ranges from undulating to hilly with relatively large flat areas covered with various types of bogs. The area is punctuated by a number of small lakes and streams flowing to and from these lakes. In general, geomorphic features are oriented in NW-SE direction, and. most of these streams also flow to the southeast. A large water body, known as Churchill Reservoir is located in the northwestern part of the training area. There are quite a few broad U-shaped river valleys with more or less flat valley floors. The valley floor is covered with barren soil and/ or recent burns with few exceptions where trees of different types are present. Most of the region is covered with thin layer of glacial soils, with few outcrops (barren rocks). Small water bodies tend to occupy relatively flat areas, and are generally surrounded with bogs of various types (these have been classified in the Labrador Forest Inventory maps as -- open bog, string bog, tree bog, and wet sites). Some of the areas of recent burns have been re-vegetated.

3.3.2 Impacts on Soils and Water

The findings of the literature review on the potential impacts on soils and water resources are contained at Appendix B. Those effects are assessed as negligible, since the residual flare debris would not accumulate to any significant extent on the surface of these resources. The residual constituents of the flares are chemically inert, and any accumulation of materials on soil surfaces would be quickly dissolved due to the humid conditions and acidity of the soils. The number of flares to be deployed in the area would not significantly alter the chemistry of the water bodies.

Due to the particle size of flare ash and the exposed surface area, it is more susceptible to weathering than flare duds. Elements of concern for flares generally include magnesium, boron, barium, and chromium. The laboratory test results indicate that the potential for release of these elements is strongly related to pH, the highly acidic media producing higher concentrations (with the exception of barium in the flare pellet samples, which did not vary appreciably with pH). The magnesium in flare material is clearly least stable in acidic environments. The dissolution of either flare material or flare ash will be greatest where water content is high. Impacts from dud flares are not considered of significant concern because the incidence of duds is rare

Based on the dilution factor for the ash components due to dispersal, they are not likely to bioaccumulate in the flora and fauna. Further, the limited amount of the exposure to these chemicals is not likely to have any impact on the wildlife present in the area.

The main issue with flares is their potential to start fires that can cause a wide variety of significant secondary effects on soil, water resources, biological resources and land use. The potential for ground fires, with the mitigation measures that will be in place (see Section 4), is considered negligible. .

3.4 BIOLOGICAL RESOURCES

3.4.1 Vegetation

The Labrador Forest inventory maps provide information about the vegetation cover types. The land cover has been classified into 25 different categories, however in this report, the original land cover classes have been merged to produce composite and more descriptive land cover types. Further, some of the information about the nature and distribution has been corroborated from the study conducted for the EIS (DND, 1994). The land cover types used in this report are as follows (the original Environment Canada land cover types are given in parentheses):

- Spruce: (Heavily Stocked Spruce/ Fir Commercial Forest; Moderately Stocked Spruce/ Fir Commercial Forest; Sparsely Stocked Spruce (Sphagnum Cover) Non-Commercial; Sparsely Stocked Spruce (Lichen Cover) Non-Commercial; Immature Spruce/ Fir; Spruce/ Fir Regeneration)
- Hardwood: (Mixed wood Mature; Hardwood mature; Hardwood Successional; Hardwood Scrub)
- Barren Soil: (Lichen/ Barren Soil)
- Barren Rock: (Rock Barren)
- Recent Burn: (Lichen/ Recent Burn; Recent Burn)
- Bog: (Lichen Scrub/ Open Bog; Open Bog; String Bog; Tree Bog; Wet Sites)
- Cleared Land: (Cleared Land)
- Water: (Water Bodies)

The predominant land cover type is spruce forest, with varying degrees of density. In general, there is a greater diversity of land cover types particularly in the river valleys, where the valley floors is covered with thick soil, and this includes, patches of mixed-wood and deciduous forest, along with large areas of recent burn and barren soil. Moreover, depending upon the amount of precipitation received in the area, various parts of the streambed are likely to be exposed and/ or covered with sand. Based on the amount of precipitation, these sand bodies (including sand bars) contain varying degree of moisture and are likely to be shifting, and thus providing a variety of land cover types. Around the small water bodies, there are a few bogs present as well.

Based on the total anticipated use of the flares in the military training area, and the spatial extent over which it will be used, there is no impact on the vegetation due to the proposed activity.

3.4.2 Wildlife

A number of wildlife species are present within the boundaries of the proposed undertaking. The known wildlife species in the MTA (EIS, 1994) that are of concern include the following:

a. Ungulates
    - Caribou
        - -Migratory Caribou Herd-- George River Caribou Herd
        - -Woodland Caribou – Red Wine Mountain Caribou Herd, Lac Joseph Caribou Herd, Other woodland caribou herd (Dominion Lake herd)
    - Moose

b. Fur-bearers

c. Birds
    - Raptorial Birds
    - Waterfowl

3.4.2.1 Species At Risk Considerations

The Species at Risk Act (Bill C-5) passed into law in 2002 "to prevent Canadian indigenous species subspecies and distinct populations of wildlife from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, to encourage the management of other species to prevent them from becoming at risk." The Province of Newfoundland and Labrador also announced the provincial Endangered Species Act, identifying species at risk. The LLTA is known to contain some of these species and DND has put in place focused mitigation programs in consultation with the resource manager, where appropriate. These programs have served to gather significant wildlife population information in the region. DND will continue to work with the resource management agencies to prevent unacceptable impacts on particular species.

3.4.2.2 Wildlife Monitoring Activities

The Department of National Defence maintains an active wildlife monitoring program, designed to mitigate disturbance from aircraft noise over sensitive locations in the training area. This program is conducted in collaboration with the Institute for Environmental Monitoring and Research (IEMR), federal (Canadian Wildlife Services) /provincial (Quebec, and Newfoundland and Labrador) wildlife management agencies, as well as environmental consultants. Temporal and spatial data are collected through a series of real-time, or near real-time data-gathering programs specific to individual species. Extensive use is made of remote monitoring technology such as radio and satellite telemetry and aerial surveys for most of the monitoring programs.

The concept for wildlife mitigation is based on temporal and spatial separation between the flying activity and sensitive areas to ensure that the acoustic effects threshold (where significant effects may be expected to occur) is not exceeded. Each sensitive species is protected using pre-established criteria for avoidance; these are updated as additional information becomes available, through consultation with the resource management agencies and the IEMR.

3.4.3 Potential Impacts on Wildlife

Toxicity is not a concern with flares, since the primary material, magnesium, is not highly toxic, and it is highly unlikely that wildlife would ingest flare material. Flares have the potential to affect biological resources directly through visual responses. The significance of flare impacts on biological resources vary in relation to the sensitivity of the environment affected including the presence of threatened or endangered species.

Little information is available regarding the potential startle effects of flares on wildlife. However, it is expected to be negligible during daylight hours, which encompass most of the training. It would also be secondary only to the noise startle created by the aircraft.

3.5 AIR QUALITY ISSUES

Air quality impacts could occur from both the flare materials and the explosive charges used to eject and ignite the flares. These impacts may be due to the presence of certain types of gaseous materials, volatile compounds, and/ or the particulate materials.

Typically, flares contain a mixture of magnesium with Teflon and Fluorel binder (polytetrafluoroethylene-a) wrapped in aluminium- reinforced tape. The combustion products of the flare material may contain the following compounds: magnesium oxide, magnesium chloride, magnesium fluoride, carbon, and trace amounts of carbon monoxide, carbon dioxide, and oxygen difluorine (Appendix A).

Several different types of impulse cartridges are used for flares. Typical flare impulse cartridges contain all or some of the following compounds: boron, potassium perchlorate, titanium with potassium dichromate, calcium chromate, and potassium nitrate.

A review of available literature provided limited data with regard to typical compositions of combustion products from flares. Although one study claimed that no residue or ash was produced from flare burning, there is a suggestion that, upon cooling, the magnesium would condense from its vapour state into solid particulates. Consequently, it is believed that the flare mass when burned is released as particulate material into the atmosphere. Since information related to the condensation phenomena and/or the particulate size generated during condensation was not available, it would be hard to speculate whether respirable particles are produced. However, emissions from flare usages occurs over large areas and over long periods of time, and are therefore not expected to result in non-compliance with the National Air Quality Objectives (NAQO). Several types of impulse cartridges are used with flares by the U.S. Air Force. Some of these impulse cartridges release hazardous air pollutants such as chromium and lead. The amount of these materials is measured in terms of milligrams, and that would be spread over a very large area. A screening health risk assessment performed to assess the potential health impacts from these emissions concluded that it is highly unlikely flare use could result in short-term or long-term health impacts.

The residual material from this undertaking is not likely to cause any significant health risk to humans and the wildlife present in the area.

3.6 Assessment of Valued Ecosystem Components (VEC) Vulnerability

Based on the non-toxicity of flares and the potentially manageable risk of fire, the effects on vegetation, wildlife, and special-status species would be negligible. Sensitive species closures that are currently applied will remain in effect for this undertaking. Thus, impacts to wildlife from startle effect would be minimized. Wetlands are not expected to be impacted by residual components of flares due to the size of the training area and the extremely low potential for accumulation of components. No impacts to these resources are expected under the proposed action.

The main source of disturbance to wildlife within the training area consists of noise and visual stimuli associated with the low-level aircraft. The new undertaking would not increase the noise levels. Moreover, along with this new training element, DND expects that there will be a growing shift away from low-level training to altitudes greater than 1000 ft AGL.
In summary, the new undertaking will result in:

- no negative effects on the health of biota including plants, animals, and fish;
- no threat to rare or endangered species;
- no Reductions in species diversity or disruption of food webs;
- no loss of or damage to habitats, including habitat fragmentation;
- no significant discharges or release of persistent and/or toxic chemicals, microbiological agents, nutrients (e.g., nitrogen, phosphorus), radiation, or thermal energy (e.g., cooling wastewater);
- no population declines;
- no loss of or damage to commercial species;
- no removal of resource materials (e.g., or resources; peat, coal) from the environment;
- no appreciable transformation of natural landscapes;
- no obstruction of migration or passage of wildlife;
- no significant negative effects on the quality and/or quantity of the biophysical environment (e.g., surface water, groundwater, soil, land, and air).

3.7 Land Use and Visual Resources

The principal resource users in the area are the Innu, Inuit, Métis, Settlers and other Labrador residents, visitors/tourists and clients to outfitting operations. Much of the activity is for subsistence or recreational purposes, with some commercial/business interests (e.g., caribou harvest, trappers and adventure and nature tourism operators). Industrial operations include hydro power generation/ transmission and development, some forest harvesting and the construction of the Trans-Labrador Highway.

The literature summarizes the issues regarding the effects of flares on land use and visual resources as:

- debris from flare cartridges creates litter on the ground. This might affect users' attitudes and uses of outdoor recreation areas;
- dud flares lying on the ground could create a hazard and/or interfere with certain land uses;
- large numbers of burning flares may affect sensitive visual resources;
- fires caused by flares could displace existing land uses; and
- fires caused by flares could affect the visual quality of an area.

The potential sensitivity of particular land uses resulting from the use of - flares and accumulation of flare debris is highly variable and quite subjective. Moreover, if a dud flare were found and improperly handled by an untrained person, it could ignite and cause injury or damage to property. Also, it is assumed that fire could have a significant adverse effect on any land use. Therefore the sensitivity to land use and visual resources is primarily related to potential hazard to people or ecological damage.

At the same time, the degree to which a fire affects land uses and visual resources depends on the damage caused by the fire, land use objectives, aesthetic value, and the number of people exposed to a hazard. Smoke from fires may obscure views and reduce scenic quality, but those impacts would be temporary and not result in permanent changes to visual resources. Smoke damage to structures (other than cultural resources) may have an economic consequence, but is not expected to affect enduring land use or visual attributes.

The relatively low number of flares to be used over the large expanse of the training area, the very limited residual products of the type of flare to be authorized, and its inherent 'zero-dud' characteristics should virtually preclude the likelihood of the first two issues listed above, concerning duds and debris. Similarly, the choice of parasitic flares, in conjunction with specific operating procedures regarding their use (Section 4), should minimize any potential for fires resulting from this undertaking (last two issues on the list). As regards the third issue, the effects on sensitive visual resources, the visual impact of illuminated flares would be short term and temporary and not expected to have a significant impact on the overall scenic quality of outdoor experiences. The remoteness and relative inaccessibility of the interior of Labrador also limits the potential for this issue to be a factor for most of the region's population.

3.8 Protection of Human Occupancy Areas

DND maintains an active mitigation program in the LLTA. It remains aware of the human occupancy areas through its community liaison program and consultations with interested groups. The human occupancy areas are protected from aircraft overflights by environmental closures that are based on the noise threshold values, as well as on special considerations and direct consultations with regard to traditional land use. As an additional precaution in the context of flare use, DND intends to expand the current lateral separation specified in the environmental closure criteria (generally 2.5 nm, unless special provisions are arranged), while increasing the vertical separation up to 2000 feet AGL.

3.9 Aboriginal Land Issues

The Department of National Defence has publicly committed to respect aboriginal land title as regards the use of land associated with the allied training activity in Goose Bay. Most of the land over which the proposed activity will take place is the subject of comprehensive land claims negotiations affecting two aboriginal groups. DND is engaging in technical discussions with the Innu Nation on flares and other future training requirements and, once land claims are resolved, will conclude mutually agreeable arrangements as regards this activity over their land.

4.0. ENVIRONMENTAL MANAGEMENT

4.1 General

The Department of National Defence maintains a high standard of environmental management associated with the training activities in Goose Bay. A fully functioning and certified (ISO 14001) Environmental Management System (EMS) governs the conduct of the activity to safeguard the environment. The FMTGB mitigation program benefits from its association with the provincial wildlife agencies of both provinces, the Institute for Environmental Monitoring and Research and other partnerships it has developed over the last ten years.

National Defence will continue its monitoring program of the entire training area for as long as the allied forces train in Goose Bay. The public can access copies of the annual Environmental Report and Mitigation Program, the EMS, Mitigation Orders, study reports and other material directly from the FMTGB website (www.goosebay.org).

4.2 Avoidance Criteria

Avoidance criteria are the standard applied to establish protection areas for sensitive locations, and to exclude jet training activity. The criteria were initially developed in the early phase of the mitigation program, during the preparation of the EIS. At the time, the potential for impacts that might result from jet overflights at low-level was poorly understood. Avoidance criteria were based largely on perception and the adaptation of existing aeronautical restrictions. However, the scientific knowledge base has improved considerably, resulting in some changes to the criteria over the years. Some of these were based on work by the IEMR, which has conducted research focused specifically on the effects of military flight activity. To date, results of these studies clearly indicate that actual impacts of the training activity on the environment are minimal. Avoidance criteria are outlined in the FMTGB Mitigation Orders, available online.

4.3 Environmental Monitoring, Mitigation and Follow-up

Environmental monitoring and follow-up is an important part of the environmental assessment process, providing a means for verifying environmental effects predictions and examining the effectiveness of mitigation measures. It also provides assurances that environmental legislation standards and commitments are being followed. Any environmental problems identified through a monitoring or follow-up program can be addressed in an effective and timely manner.

Based on this environmental assessment and various considerations arising from the use of flares in the 5 Wing training activity, DND proposes to implement the following measures within the mitigation program:

- only parasitic flares will be authorized for use in allied training (this will prevent any dud flare cartridges from being deposited on the ground);

- flares will only be deployed within the Labrador portion of the Military Training Area;

- to preclude any public concern, flares will not be used within two areas of human concentration - a 25 nautical mile radius around the Goose Bay airport and a 16 nm radius around Churchill Falls;

- Wing Flying Orders will impose minimum height restrictions for flare release, similar to those in effect at CFB Cold Lake, to preclude the risk of initiating fires in the training area - minimum of 700 feet above all obstacles in low risk fire hazard conditions (wet and cold); 2,000 feet in moderate fire conditions, and 10,000 feet in all other conditions;

- the existing FMTGB monitoring program and the associated environmental closures (within which aircraft are not authorized to fly) will also safeguard those sensitive areas form any flare use activity;

- for daylight operations, the avoidance criteria currently in effect to safeguard sensitive wildlife locations will be sufficient to mitigate any risk of adverse impacts, as the predicted effects of visual startle, as well as the physical and biological effects of accumulation of flare residue on fauna are negligible;

- for night training, lateral separation may be selectively extended to 5 nm for species considered to be particularly vulnerable to flare visual impacts (in conjunction with effects research program to be conducted by IEMR;

- the closures for human activity, as currently defined for noise disturbance, but with an increased vertical separation to 2000 feet AGL, are deemed sufficient to preclude any risk to public safety, which has already been categorized as minimal;

- DND will implement a periodic sampling program at selected locations to verify the validity of the predictions in this EA and will inform the IEMR of its findings; and

- Allies will maintain and submit records regularly to FMTGB via MCC on utilization (quantity/area), and incidents involving flares – these records will be used to support research studies and to determine if other corrective measures are warranted in the future. DND will include information about the quantity of flares used and any resulting incidents in the annual report to the Province and the IEMR on FMTGB flare use;

- DND will coordinate activity mitigation measures with appropriate provincial officials, while reviewing relevant weather information and aircrew reports to mitigate the potential for fires; and

- DND will expand its communications activity to include information on the use of flares, the possible sighting of material on the ground and the fact that there is no risk to the environment or to public health and safety.

4.4 Site remediation

Based upon the annul usage of flares and the area over which it will be distributed, flares residual components are not expected to accumulate on soil or water surfaces or change the chemistry of soil or water properties. Therefore, management and use of the lands would not change from existing conditions and no site remediation would be required.

4.5 Cumulative Environmental Effects

Individual effects can combine and interact, resulting in cumulative environmental effects that may be different in nature or extent from the effects of individual activities. Cumulative environmental effects may result in combination with other projects or activities that have been or will be carried out. Cumulative environmental effects were considered for each of the VECs within the FMTGB monitoring program, according to

- spatial and temporal boundaries;
- interactions among the project's environmental effects;
- interactions between the project's environmental effects and those of both existing and planned projects and activities;
- mitigation measures used towards achieving a no-net-loss or a net-gain outcome.

First, in the context of the existing activity, the addition of flares will produce a net-gain environmentally. Generally, the introduction of defensive countermeasures, including chaff and flares, will tend to raise the altitude level at which training is conducted, thereby reducing the intensity of the aircraft noise dosage, which remains the primary concern associated with military training. Additional altitude restrictions are also being imposed to control the specific use of both chaff and flares. While flare material will be deployed from the aircraft, its combustion and dispersal of residuals will result in 'negligible' adverse environmental and health impact. There is no habitat modification or construction involved in this undertaking.

In addressing cumulative effects, the foremost consideration is that the existing mitigation program operates on a dynamic spatial and temporal basis, which precludes the risk of environmental impact by separating the activity from the seasonally-changing sensitive locations on the ground. Most of the other projects are based along the Churchill Falls corridor, or other road access, which are areas of relatively minor jet traffic. While the training area may encompass sites where other project activities exist or are planned, those sites will be avoided when occupied. The potential therefore, for physical or environmental interaction, given the nature of this undertaking, is minimal.

In the event that an environmental impact, direct or cumulative, were to arise, it would logically be detected through the ongoing IEMR monitoring programs, and appropriate measures taken to correct the situation, including the possibility of limiting or discontinuing the use of flares.

Appendix C provides the existing (baseline) environment description for the principal VECs identified within the FMTGB Environmental Management System (EMS); it reflects the effects of past and ongoing human activities, including military flying, on the region's natural environment. Where appropriate, the current status of the VEC due to natural and/or anthropogenic factors is indicated (e.g., a statement is made as to whether a VEC population is declining, stable or increasing).

4.6 Consultations and Communications

Generally, most of the communications relating to this undertaking have occurred within the context of the DND's participation in the work of the IEMR, which has representation from all of the major stakeholders and aboriginal communities in the region. This interaction has occurred at the Board of Directors level, as well as within the Institute's Scientific Review Committee (SRC) forum, in which FMTGB has ex officio status. An initial presentation on the use of chaff and flares, as well as other possible future training requirements, was made at a full-day symposium dedicated to this topic, in conjunction with a Board meeting in Happy Valley-Goose Bay in September 2001. In November 2003, DND made another more detailed presentation in St. John's to update invited representatives from interested federal/ provincial departments and Innu Nation on future training requirements, including chaff and flares.

Early in 2004, DND provided CD copies of the reference material to the IEMR and the Province. In March 2004, the draft screening document on chaff use was made available for review by the SRC

In May 2004, DND concluded an MOU with the Innu Nation which, among other provisions, outlines the mechanism and DND support for consultations in these matters. Arrangements are in place for a meeting of a Technical Committee coincident with the provincial registration of this document.

4.7 Applicable Regulations and Processes

A review of CEAA legislation indicates that use of air defense countermeasure flares for training activity does not constitute a project under any of the various provisions of the Act. As well, it does not constitute a "designated undertaking or exception" under Part III of the Province's Environmental Assessment Regulations 2000.

The Department of National Defence is committed to environmental stewardship and, as such, has a policy of conducting "due diligence" screenings to identify and mitigate any potential adverse impacts before a new activity is approved. Foreign Military Training Goose Bay also received ISO 14001 certification in 2003, which commits that activity to rigid environmental standards and external audit of its practices.

4.8 Project Related Options

Should it be determined that the undertaking cannot proceed, individual air forces will make their own determination on the value of the training offered at Goose Bay. This proponent will not pursue the undertaking, or some form of it, elsewhere.

4.9 Project Related Documents

Over the last year, FMTGB has conducted an extensive literature search on the subject of chaff and flares and in the process, has compiled a considerable library of reference material, which it has made available in CD format to provincial officials, the IEMR and interested aboriginal groups. Documents from the following list may be obtained from the DND contact officer:

Mobley, J.; and others, 2000; Pyrotechnics health risk assessment no. 39-EJ-1485-99: Residential exposures from inhalation of air emissions from the surface trip flare: U.S. Army Center for Health Promotion and Preventive Medicine, June 2000.

USAF, 1978; Environmental Effects of Chaff; USAF Occupational and Environmental Health Laboratory, Aerospace Medical Division (AFSC), Brooks Air Force Base, Texas, December 1978.

USAF, 1993; Technical Reports on Chaff and Flares: Technical Report No. 1 – Review of Available Data, Prepared for U.S. Air Force, Headquarters Air Combat Command, Langley Ai Force Base, Virginia, March 1993.

USAF, 1994; Technical Reports on Chaff and Flares: Technical Report No. 5 – Laboratory Analysis pf Chaff and Flare Materials, Prepared for U.S. Air Force, Headquarters Air Combat Command, Langley Ai Force Base, Virginia, November 1994.

USAF, 1997; Environmental Effects of Self-Protection Chaff and Flares, Final Report, Prepared for: U.S. Air Force, Headquarters Air Combat Command, Langley Air Force Base, Virginia, August 1997.

USAF, 2001; Final Environmental Assessment for the Defensive Training Initiative, Cannon Air Force Base, New Mexico: Prepared for: Air Combat Command, Langley Air Force Base, Virginia, September 2001.

USAF, 2001; Characteristics of chaff – appendix from the Defensive Training Initiative, Cannon Air Force Base, New Mexico: Prepared for: Air Combat Command, Langley Air Force Base, Virginia, September 2001.

USAF, 2001; Elmendorf Air Force Base – Initial F-22 Operational Wing Beddown, Draft Environmental Impact Statement, April 2001.

USAF, 2003; Draft: Shaw AFB Chaff and Flare environmental assessment: United States Air Force, Air Combat Command, Shaw Air Force Base, October 2003

The following documents provide project information relevant to the training activity, National Defence Regulations, Orders and Procedures and previous associated environmental assessments:

- An Environmental Impact Statement on Military Flying Activities in Labrador and Eastern Quebec (DND, 1994)
- Transfer Administration and Control of Crown Land To Her Majesty The Queen in Right of Canada, 01 June 1995 (Lease Agreement) between DND and the Province of Newfoundland
- Wing Flying Orders – 5 Wing
- Mitigation Orders for Foreign Military Training in Goose Bay

5.0 CONCLUSION

The foreign military training presence at Goose Bay has long been a "way of life" and a primary source of economic activity for the region. With time and advancing technology, the training requirements keep evolving to meet changing operational demands The use of defensive countermeasures is a standard training requirement for operational air forces.

This undertaking presents no significant adverse environmental impacts. On the other hand, its rejection could have major socio-economic consequences for the region.

6.0 APPROVAL OF THE UNDERTAKING

The following permits and approvals may be required to commence training with the Air Defense Countermeasure Flares at 5 Wing Goose Bay Military Training Area, Labrador.

Table 6.1 Permits, Approvals and Authorizations

Provincial, Permit, Approval or Authorization	Agency
Release from Newfoundland Environmental Assessment Act	Department of Environment

7.0 FUNDING

There are no incremental funding commitments anticipated for this undertaking. Any costs which may arise would be assumed by the Department of National Defence, consistent with arrangements established in a Memorandum of Understanding with participating air forces.

7.1 Signature

Brigadier - General J. Hincke
Director Air Contracted Force Generation
National Defence Headquarters

Appendix A

COMPOSITION AND OPERATION OF SELF- DEFENCE FLARES

A1.1 Flare Composition

Self-protection flares are primarily mixtures of magnesium and Teflon (polytetrafluorethylene) moulded into cylindrical or rectangular shapes). Longitudinal grooves provide space for materials that aid in ignition such as:

- First fire materials: potassium perchlorate, boron powder, magnesium powder, barium chromate, Viton A, or Fluorel binder.
- Immediate fire materials: magnesium powder, Teflon, Viton A, or Fluorel
- Dip coat: Magnesium powder, Teflon, Viton A or Fluorel

Typically, flares are wrapped with an aluminum-filament-reinforced tape and inserted into an aluminum (0.03 inches thick) case that is closed with a felt spacer and a small plastic end cap (Air Force 1997). The top of the case has a pyrotechnic impulse cartridge that is activated electrically to produce hot gases that push a piston, the flare material, and the end cap out of the aircraft into the air stream. The M-206 flare is 8 inches long and 1 square inch in cross-section. Figure 1 is an illustration of an M-206 flare. Table 1 provides a description of M-206 flare components. Typical flare composition and debris are summarized in Table 2.

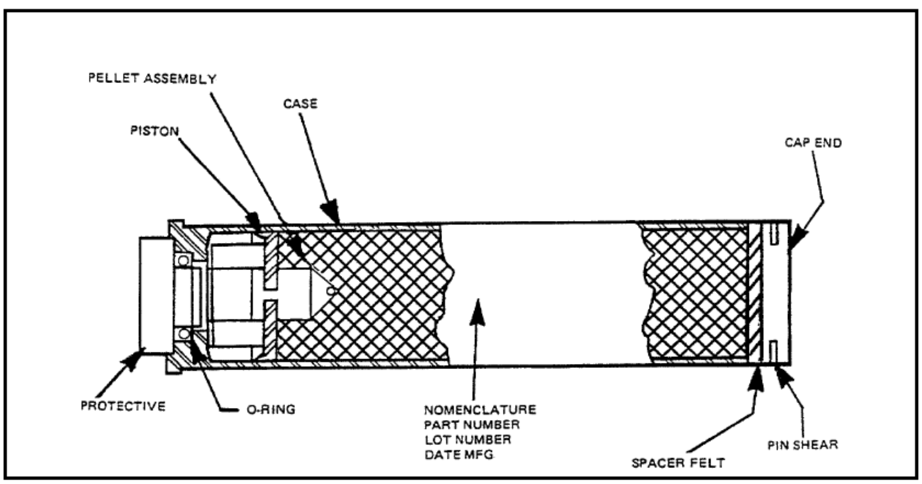

Figure 1. M-206 Flare (*Source: Air Force 1997*)

Table 1. Description of M-206 Flares

Attribute	M-206
Aircraft	A-10, AC-130, C-17, F-16
Mode	Parasitic
Configuration	Rectangle
Size	1 x 1 x 8 inches (8 cubic inches)
Impulse Cartridge	M-796
Safety and Initiation Device	None
Weight (nominal)	6.8 oz
Comments	Simulator version (T-1) uses potassium chlorate, powdered sugar, and yellow dye smoke charge
Source: Air Force 1997	

Table 2. Typical Composition of M-206 Self-Protection Flares[1]

Part	Components
Combustible	
Flare Pellet	Polytetrafluoroethylene (Teflon) (-$[C_2F_4]_n$ – n=20,000 units Magnesium (Mg) Fluoroelastomer (Viton, Fluorel, Hytemp)
First Fire Mixture	Boron (B) Magnesium (Mg) Potassium perchlorate ($KClO_4$) Barium chromate ($BaCrO_4$) Fluoroelastomer
Immediate Fire/Dip Coat	Polytetrafluoroethylene (Teflon) (-$[C_2F_4]_n$ – n=20,000 units Magnesium (Mg) Fluoroelastomer
Assemblage (Residual Components)	
Aluminum Wrap	Mylar or filament tape bonded to aluminum tape
End Cap	Plastic (nylon)
Felt Spacers	Felt pads (0.25 inches by cross section of flare)
Piston	Plastic (nylon, tefzel, zytel)
Source: Air Force 1997	

A1.2 Flare Ejection

M-206 is a parasitic-type flare that uses an M-796 impulse cartridge (Air Force 1997). It is ignited in the aluminum case before it leaves the aircraft. Holes in the piston permit ignitor gases to contact the first fire mixture on top of the flare pellet. The parasitic type flare is less likely to produce duds. The plastic end cap falls to the ground following flare ejection. Flares are tested to ensure they meet performance requirements in terms of ejection, ignition, and effective radiant intensity. If the number of failures exceeds the upper control quality assurance acceptance level (approximately 99 percent must be judged reliable), the flares are returned to the manufacturer. Table 3 describes the components of M-796 Impulse charges.

Table 3. Components of M-796 Impulse Charges

Component	M-796
Overall Size Overall Volume Total Explosive Volume	0.449 x 0.530 inches 0.104 cubic inches 0.033 cubic inches
Bridgewire	Trophet A 0.0025 inches (diameter)
Closure Disk	scribed disc, washer
Initiation Charge	
Volume	0.011 cubic inches
Weight	100 mg
Compaction	5,500 psi
Composition	20% boron 80% calcium chromate
Booster Charge	
Volume	0.011 cubic inches
Weight	70 mg
Compaction	5,500 psi
Composition	18% boron 82% potassium nitrate
Main Charge	
Volume	0.011 cubic inches
Weight	185 mg
Compaction	Loose fill
Composition	Hercules HPC-1 (~40% nitrocellulose)
Source: Air Force 1997	

Typical Composition and Debris of Self-Protection Flares

Part	Components
Combustible	
Flare Pellet	Polytetrafluoroethylene (Teflon) (-$[C_2F_4]_n$- n=20,000 units) Magnesium (Mg) Fluoroelastomer (Viton, Fluorel, Hytemp)
First Fire Mixture[1]	Boron (B) Magnesium (Mg) Potassium perchlorate ($KClO_4$) Barium chromate ($BaCrO_4$) Fluoroelastomer
Immediate Fire/Dip Coat	Polytetrafluoroethylene (Teflon) (-$[C_2F_4]_n$- n=20,000 units) Magnesium (Mg) Fluoroelastomer
Primer Assembly (in Safety and Initiation Device)[2]	Initiation Charge (15 mg) Lead styphnate Lead azide (N_6Pb) Barium nitrate (N_2O_6Ba) Antimony trisulfide (Sb_2S_3) Tetracene ($C_{18}H_{12}$) Output Charge (40 mg) Zirconium (Zr) Molybdenum trioxide (MoO_3) Potassium perchlorate ($KClO_4$)
Assemblage (Debris)	
Aluminum Wrap	Mylar or filament tape bonded to aluminum tape
End Cap	Plastic (nylon) or aluminum[3]
Felt Spacers	Felt pads (0.25 inches by cross section of flare)
Piston	Plastic (nylon, tefzel, zytel) or aluminum[6]
Slider Assembly[4]	2 plastic pieces, 0.5 ′ 0.825 ′ 2 inches, (delrin) 2 springs, 0.625 ′ 0.125 inches, (steel) 1 roll pin (steel)
Safety and Initiation Device[5]	G-weight (steel) Locking bar and fork (steel) Push button and spring (steel) Firing pin (steel) Primer assembly

There are two versions of the MJU-7/B: a “parasitic” and a “non-parasitic” type. The parasitic type is ignited in the aluminum case before it leaves the aircraft by holes in the piston that permit ignitor gases to contact the first fire mixture on top of the flare pellet. The non-parasitic type flare incorporates a mechanical mechanism (a safety and initiation device) to prevent ignition of the pellet in the case. This mechanism includes a G-weight, a locking bar and fork, a push button and spring, a firing pin, and primer assembly. When ignited by the firing pin, the primer assembly fires the ignition charge (15 mg of basic lead styphnate, lead azide, barium nitrate, antimony trisulfide, and tetracene) which fires the output charge (40 mg of zirconium, molybdenum trioxide, and potassium perchlorate), which ignites the flare pellet.

The MJU-7A/B (a semi-parasitic type flare), was designed to reduce the complexity of the non-parasitic type flare, improve its reliability, and reduce debris. In this flare, the mechanical mechanism is replaced with a slider assembly that incorporates an initiation pellet (640 mg of magnesium, Teflon, and Viton A or Fluorel binder). This pellet is ignited by the impulse cartridge, but its hot gases do not reach the flare until the slider exits the case, exposing a fire passage from the initiation pellet to the first fire mixture on top of the flare pellet.

The parasitic type flare is less likely to produce duds, and the only debris is the plastic end cap and the remains of the piston. However, there is an increased risk of fire damage to the aircraft, compared with the non-parasitic flare. The non-parasitic flare can be expected to produce the largest number of duds and the most debris, due to the complexity of the ignition process. The MJU-7A/B provides a middle ground by igniting a small pellet inside the case, rather than the flare itself, thereby reducing both the safety risk and the quantity of debris. Since the complexity of the flare ignition process of the MJU-7A/B falls between the parasitic and non-parasitic versions of the MJU-7/B, the dud rate can also be expected to fall between them.

APPENDIX B

PHYSICAL RESOURCES AND RELATED ISSUES

B1.1 PHYSICAL RESOURCES

This section addresses the potential effects of flares on soil and water resources. The principal issues include:

- Effects of flare materials and by-products, including dud flares and flare ash, on soil and water chemistry.
- Potential for flare duds and flare ash to accumulate in areas where they could affect soil and water.

Factors that influence the potential for flares and flare ash to affect soils and water chemistry include the chemical composition of flare material and ash, the chemical reactions that those materials may have with moisture, the density of dud flares, the quantities of flare ash produced by burning flares and its distribution on the ground, and the background environmental conditions in areas where flares and flare ash are deposited. Chemical changes, particularly in water bodies, affect habitat conditions and aquatic organisms. Chemical changes in soils can affect vegetative cover and result in increased erosion and sedimentation. Ignition cartridges for the MJU-7/B contain lead compounds, barium nitrate, antimony trisulfide, tetracene, zirconium, molybdenum trioxide, and potassium perchlorate.

In the US, the Clean Water Act prohibits the discharge of pollutants from any point source into the waters. In addition to solid waste, the definition of pollutant includes munitions. Self-protection flares may qualify as munitions, since they are used in combat and serve no civilian or peacetime purpose, other than for training. Dropping ordnance from aircraft into waters of the United States was found in at least one case (Weinberger v. Romero-Barcelo) to require a permit. However, burning flares are not intended to reach the surface, and dud flares are not intentionally discharged into water bodies. Flare ash, on the other hand, may be considered solid waste.

B1.2 Literature Review

There have been a number of environmental assessments and other documents addressing the effects of flare use in certain airspace areas. Most, but no all, of those documents have concluded that the flares are fully consumed after ignition, and there would be no residual debris.

There have been few laboratory or field studies that address the potential impacts of flares on soil or water resources. Most potential impacts discussed in the available literature revolve around associated fire hazards. Some documents addressed flare debris as a solid waste issue, commonly concluding that the debris is dropped over such a large area that it does not affect the environment. Impacts to water resources were addressed in only one environmental assessment. Most of the documents reviewed came to the conclusion that no impacts would occur but did not support their findings with empirical data.

B1.2.1 Discussion

The effects of dud flares and flare ash on the environment depend on the quantity of material deposited in a particular environment, the characteristics of the receiving environment (e.g., pH), and the sensitivity of the environment to contaminants of concern. Dud flares are rare and incidental events, so it is extremely unlikely that any given location would experience long-term cumulative effects from a build-up of flare material. Flare ash is widely dispersed by wind, and the likelihood that a sufficient quantity would accumulate in a particular pond, stream, or estuary to measurable affect its chemical make-up is also remote.

Flare ash is more susceptible to weathering than flare duds, just based on particle size and exposed area. The magnesium in flare material is clearly least stable in acidic environments. The dissolution of either flare material or flare ash will be greatest where water content is high. The following paragraphs summarize conclusions relative to soil chemistry and water resources.

B1.3 Soil Chemistry

Elements of concern for flares include magnesium, boron, barium, and chromium. The laboratory test results indicate that the potential for release of these elements is strongly related to pH, the highly acidic media producing higher concentrations (with the exception of barium in the flare pellet samples, which did not vary appreciably with pH). Impacts from dud flares are not considered of significant concern because the incidence of duds is rare, and the number that would have to land in a single location to have an effect is on the order of tens of thousands.

The principal element in flares and in flare ash is magnesium. Magnesium occurs naturally in soil at a mean concentration of 9,000 mg/kg. The highest concentrations produced by the surrogate environment laboratory tests were 3,050 mg/l for a dud flare and 861 mg for flare ash at pH 4. At higher pH, the concentrations dropped off dramatically; to an average of 186 mg/l at pH 7 and 202 mg/l at pH 10 for flare ash (the reductions were even more dramatic with flare pellet samples).

Flare ash samples also produced detectable quantities of boron, barium, and, in some samples, chromium. Barium was detected in the pH 4, 7, and 10 treatments, with the highest levels found in the most acidic solution. The unexpectedly high quantities of barium detected in the flare ash samples raise questions about potential contamination of the ash used, which was not produced in a controlled environment.

Barium mobility and uptake by plants have not been well studied, since barium generally occurs sparingly in solutable forms and at low concentrations in most soils. Test results indicate it will become more mobile in low pH environments. Barium can be toxic to animals when ingested in forms other than the insoluble barium sulfate. The elevated barium concentration in the pH 4 extracts of the flare ash suggest that barium may present a localized hazard for sensitive organisms. This level was exceeded in only one of the laboratory findings, in the pH 4 extract of flare ash (the next highest finding was 3 mg/l).

Boron toxicity can occur in alkaline environments, and the laboratory tests of flare ash produced the highest concentrations in the alkaline (pH 10) solution. Based on a mean background soil content of 33 mg/kg, the amount of flare ash that would be required to raise the boron concentration to triple the background level in the upper inch of soil was estimated at over 1,500 kg/acre. This represents about 4,000 flares.

Chromium was detected in low concentrations in the pH 10 treatment of flare ash. The low quantities detected indicate that chromium is not a significant issue. In contrast, the highest detected concentration in the laboratory test of flare ash was 0.03 mg/l.

Three replicate samples of flare pellet material were analyzed to measure production of hydrogen gas. An average sample of 1.1 grams of flare produced an average of 580 millilitres of hydrogen gas. Assuming an average flare weight of 370 grams, a complete flare falling into water could produce 195 liters of hydrogen gas. Hydrogen gas is highly explosive if in a confined area, although it would dissipate rapidly in an open environment. Hydrogen gas production from dud flares would not pose an environmental threat, but it could be a safety hazard if a wet flare were placed in an enclosed container.

B1.4 Water Resources

Of the five metals measured in the flare pellet material, only magnesium showed sufficiently high levels to warrant consideration. Aluminum, boron, barium, and chromium did not extract in sufficient quantities to be of concern to aquatic organisms. Magnesium was measured at almost 3,000 ppm at pH 4, dropping to 4.4 ppm at pH 7, which more closely approximates typical aquatic environments. There are no aquatic criteria for magnesium, and the occurrence of dud flares is so rare as to be highly unlikely to have an impact.

The elements of concern in the flare ash extracts are magnesium, barium, and boron. Aluminum and chromium were either undetected or in insufficient quantities to threaten aquatic life. There are no established water quality criteria for barium. No data are available concerning toxicity of barium for aquatic life that live in lower pH environments. Also, there are no water quality criteria established for boron.

Incidental flare duds falling into marine environments would not be expected to generate adverse effects due to the small amount of chemicals released. The only chemicals detected in the flare ash samples were magnesium, boron, and chromium. Unlike the freshwater extracts, no barium was detected. Magnesium levels were as high as 86 ppm, after correction for the high background level of magnesium in seawater (about 867 ppm). No magnesium toxicity data are available for seawater.

In conclusion, impacts from flares on water resources would only be of potential concern in small water bodies subject to substantial, repeated flare use, and which support organisms sensitive to these chemicals. Deposition of flare ash in the concentrations used for the laboratory analysis could be toxic to aquatic organisms. However, these concentrations (material to solution ratio of 1:20) were far higher than could occur as a result of military training. Site-specific analysis should be considered if any area that could be affected is known to provide habitat for a threatened or endangered species. Two approaches could be taken:

- The quantity of flare ash deposition could be projected, based on anticipated number of flares to be used, and resulting chemical effects could be estimated and compared to acute or chronic values or to toxicological data for the organisms of concern.

- The sensitive water body of concern could be subjected to a sampling program to determine whether flare use is affecting its chemical composition.

APPENDIX C

C1.1 BIOLOGICAL RESOURCES

The biological resources, or Valued Ecosystem Components (VECs), currently monitored within the FMTGB Environmental Management System, include:

C1.2 Caribou

C1.2.1 George River Caribou Herd

The George River caribou herd routinely migrates across the northern portion of the Quebec- Labrador peninsula with calving occurring to the north of the LLTA. The period from pre-calving through to post-calving are most sensitive to potential noise disturbance from military activity. That portion of the LLTA that has had historical migration routes has the lightest aircraft activity (generally less than two flights per week). Given the low aircraft activity and the brief period that the herd may be exposed (usually April/ May and August/September), the potential risk of population level impact is considered to be very low.

At present, the mitigation activities are based on “core area closures” a protective (no fly) area around collared animals, which will vary in radius from 10-19 nm, depending on the seasonal sensitivity. While this approach is generally effective, it assumes that the collared animals are centered in each group, that they represent large groups and that the closed area is sufficient to accommodate movements of the group between reporting cycles. With the approval of the new undertaking, the current mitigation approach would continue; and as an additional level of mitigation, a core area closure will be applied whenever practical, effectively removing the north-western portion of the LLTA from active flying during the herd migration through the area.

C1.2.2 Red Wine Mountain Caribou Herd

The Red Wine Mountain caribou herd (RMCH) is a small woodland (sedentary or non-migratory) herd. With reconfiguration in 1996, the entire range of the herd became included within the new training area. Given the proximity to the airfield, the RMCH occupy a potentially high-use area for flying activity, which, without mitigation, could result in significant disturbance. A 2001 survey by DND showed that he RMCH herd has been in continuous decline and currently has about 97 animals. This decline was also noted in a parallel census of the Mealy Mountain Caribou herd, which is outside the training area, and is consistent with a continental decline that has resulted in woodland caribou being assigned a “threatened” status by COSEWIC. This status is consistent with the status assigned under the Provincial Endangered Species Act.

Unlike the George River herd, the Red Wine animals do not embark on extensive migrations or form large aggregations. Mitigation is presently designed around a radio-telemetry monitoring program with an enhanced sample of 15 transmitters deployed on the herd, and establishing a "core-use" area based on these collars. Considering the limited movement of woodland caribou and the large core area closure normally applied, the application of the core concept resulted in a closure for the herd of about 7-8000 km^2 throughout most of the flying training season. The current level of mitigation activities including the "core area closures" will continue with this undertaking.

DND is a member of the Recovery Team established by the provincial government as a result of the COSEWIC "threatened" designation of this and other woodland caribou herds. DND will support the team's efforts to assist in the recovery of these species.

C1.2.3 Lac Joseph Caribou Herd

The Lac Joseph Caribou herd (LJCH) is another woodland herd, and like the Red Wine Caribou herd, its status was also changed to 'threatened'. Given the location of the herd and the small numbers of animals inside the LLTA, as well as the relative lack of military activity (less than 2 flights per week) in that portion of the training area, little monitoring had been conducted in that general area. Instead, DND relied largely on block closures of the western portion of the LLTA.

In 2002, DND in partnership with the IEMR and the Wildlife Division, conducted a census of this herd, resulting in an estimate of 1,200 animals. Mitigation is based on these satellite telemetry units, with an 8 nm radius closure established around the collared animal. This is the same standard applied to define the core for the Red Wine Caribou herd, and provides a protected area of 700 km^2 for each collared animal/group. Considering the light activity and the exclusion of the core of the herd's range, the risk of significant (population level) impact, even without mitigation, is unlikely.

The Province of Newfoundland and Labrador is proposing to establish a nature preserve for the Lac Joseph Caribou herd. While the area designated is west of the LLTA, a small portion overlaps the LLTA. As the plans for this preserve evolve, DND will work with the Province to ensure mitigation measures are appropriate.

C1.2.4 Other Woodland Caribou

Other woodland caribou were also located in the southern portion of the LLTA, and one animal in a group of four was equipped with a satellite collar. It is still uncertain whether these animals are the remnants of the Dominion lake herd or dispersed Lac Joseph caribou. Regardless of the herd affiliation, as woodland caribou, they are designated as threatened. DND will maintain the monitoring program using satellite telemetry to monitor additional groups applying the same mitigation standard applied to Lac Joseph collar groups.

C1.3 Birds

C1.3.1 Raptorial Birds

The Raptorial Bird monitoring component includes cliff-nesting (Golden Eagles, Peregrine Falcons and Gyrfalcons), and woodland (Bald Eagles, Osprey) raptors. DND has conducted an annual raptor monitoring program since 1990 and has gathered a substantial database, including detailed distribution, habitat use and recruitment data.

In the LLTA, cliff areas with suitable nesting or perching habitat are limited, these areas will continue to be monitored for cliff-nesting raptors. It is not anticipated that Gyrfalcons or Peregrine falcons will be found, as there is no historical use within the reconfigured training area. Likewise, based on historical data, 1-2 active Golden Eagle nests may be active. Active nest sites will be confirmed, and a 2.5 NM radius protection area assigned to each active nest for the nesting period.

Bald Eagles comprise a small stable population, consisting of 6-8 active nests dispersed along the western boundary of the LLTA. DND will establish protection areas of 2.5 NM around all known active nest sites at the beginning of the nest initiation period and maintain these closures until the sites are confirmed to be inactive.

Since reconfiguration, Osprey have been the main focus of the program, due to their large population and dispersion across the training area. Based on the results of recent population, recruitment and behavioural studies, the Osprey population appears healthy, and expanding. Military activity does not appear to cause any negative effect. In a workshop sponsored by the IEMR to examine the DND's monitoring program that included the resource managers and species experts; it was agreed that the commitment to protection of individual nests could be terminated, and the level of effort dedicated to Osprey monitoring was significantly reduced. To ensure that longer-term effects do not go unrecognized, DND continued a monitoring program, using a sample of about 30 disturbed nests in the highest aircraft activity area and 30 non-disturbed nests on the adjacent Eagle Plateau, using the same monitoring protocol as in previous seasons.

C1.3.2 Waterfowl

Waterfowl are distributed in very low densities throughout the training area. They have previously been considered sensitive to disturbance, in varying degrees, during their moulting, staging and nesting periods. However, recent monitoring and disturbance research by DND, in cooperation with the Canadian Wildlife Services (CWS) and other studies, suggests sensitivity during the nesting period is less significant than initially perceived in the EIS. However, CWS has identified all high-use areas, which will be protected for the sensitivity period.

C1.3.3 Eastern Harlequin Ducks

Harlequin ducks have received special consideration in light of their status as an endangered species. With reconfiguration, most of the known prime habitat for the Harlequin duck is now outside the LLTA. Over the past few seasons, and with the cooperation of CWS, IEMR, the Voisey's Bay Nickel Company, the Lower Churchill Hydro Projects and the Department of Work Services and Transportation, DND has compiled an inventory describing the areas of use and occupancy periods for these ducks within the LLTA.

Harlequin Ducks have recently been downgraded from endangered to vulnerable in the recently released Provincial Endangered Species Act. This change is, to a large extent, due to the work done by DND, Voisey's Bay Nickel, CWS and others, resulting in a clearer picture of the population, distribution, nesting and migration patterns. The changed status of the Harlequin triggers a review of the mitigation requirement. DND will consult with the IEMR and the resource manager regarding the appropriate level of mitigation. Until then, DND will protect all known high-use nest areas.

C1.4 Moose Wintering Yards

The EIS, predicted that military flying training would result in a minor impact on Moose during the late winter period. The EIS further identified high, moderate and low habitat capability for this period, which was verified by DND. However, the distribution and population was less than expected in the EIS. Mitigation measures for moose are based on the avoidance criteria of 5 moose per square kilometre over a 10 square kilometre area.

During winter of 2000, IEMR in participation with the resource managers and DND conducted an aerial transect survey of the entire southern portion of the LLTA collecting distribution data on moose and caribou. However, the transects have not indicated that there were any high-density areas not already in our inventory for protection. Areas previously identified as high capability late winter habitat will be protected.

C1.5 Nocturnal Species

Nocturnal species received little attention during the preparation of the EIS, as there was little night flying activity and little literature available. As a result, there are no avoidance measures focused on nocturnal species. While the current night flying activity level is well below the approved level, there may be an increasing requirement. Accordingly, DND is reviewing the literature for this group to assess the current understanding of potential aircraft impacts, with a view to establishing new criteria, if necessary. DND hopes to collaborate on this project with the two Provinces and the Institute for Environmental Monitoring and Research.