STATEMENT OF OPERATIONAL REQUIREMENT

WBS #00000877

AIRCRAFT ARRESTOR SYSTEMS MODERNIZATION PROJECT

INFRASTRUCTURE COMPONENT

Prepared By: Nasreen Masood, Deputy Project Manager-Infra

Effective Date: July 2009

WBS No. 00000877

STATEMENT OF OPERATIONAL REQUIREMENT

WBS NO. 00000877 – AIRCRAFT ARRESTOR SYSTEMS MODRENIZATION PROJECT

1 CANADIAN AIR DIVISION	SIGNATURE	DATE	DESIGNATION
Mr PM Reynolds		5 August 2009	A4 CE Infra 5
LCol GJJ Gergely		6 Aug 09	A4 CE Infra
Approved			
Col RC Baker		7 Aug '09	A4 CE

RECORD OF AMENDMENTS

Amendment No.	Amendment Date	Entered By	Date
Original			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

TABLE of CONTENT

A. Covering Page (*as displayed*)

B. Signature Page

C. TABLE OF CONTENTS

1. Introduction

The project WBS 00000877 will procure new and upgrade existing aircraft arrestor systems (AAS) for the Air Force. Locations that currently do not have AAS pits or a retractable cable systems (CRS) will require new pits and associated infrastructure to support the new equipment. In addition, locations with insufficiently sized pits will require new pits. A study will be conducted to determine the optimum plan to upgrade the infrastructure at Wings where facilities are inadequate or do not exist. This document will define the minimum requirements for each Wing.

1.1 Aim

To state the infrastructure requirements associated with the new aircraft arrestor systems installation

1.2 Background – Origin

The AAS consist of cross-runway engaging devices with energy absorbers designed to safely arrest tail hook equipped aircraft during emergencies and tactical operations. The CF188 is the primary combat capability of the Canadian Air Force and Canada's only means of exercising active surveillance and control over unwanted activities in domestic and international airspace.

The requirement to maintain Aircraft Arresting Systems on the bases is specified in the Aircraft Operating Instructions C-12-188-NFM/MC-001: "the compulsory use of AAS is required for certain aircraft emergencies such as loss of directional control, planning link failures, brake problems and blown tires on take off and landing." AAS are also required during training by Canadian and foreign Air Forces towards North Atlantic Treaty Organization (NATO)/North American Aerospace Defense (NORAD) combat ready status. Without the availability of this equipment, safe air operations could be compromised and could potentially result in the loss of life and aircraft. Canada is a signatory to the Air and Space Interoperability Council (ASIC) for Air Standards and Standardization Agreement (STANAGS) outlining provisions of AAS services. As a signatory, Canada is committed to meeting these standards.

In the Aircraft Accident Summary, issued 20 December 2004, for an incident that happened at 3 ERE, Bagotville, on 31 July 2001, Directorate of Flight Safety (DFS) has recommended that efforts be made to enhance the capture of data from AAS to improve flight safety. Replacement and modernization of existing AAS will provide DFS with the required data from the AAS.

1.3 Deficiency

A review of current AAS has revealed inadequate levels of safety performance, cost-effectiveness and availability. Thirteen (13) of the AAS are no longer suited to meet today’s aircraft operating characteristics. While the current limitations of the AAS were known when these AAS were first procured, these deficiencies did not represented an issue for the flying characteristics of aircraft built in the 1970s. However, as the CF188 underwent significant weight-adding modifications since its inception, the end result has been an All-Up Weight (AUW) increase of more than 15 % (from 20,400kgs to 23,600 kg) over the original AUW. The availability of the existing AAS is seriously affected by extreme weather conditions and the O&M cost have been increasing steadily over the years.

The Mean Time Between Overhaul (MTBO) for the old water twister systems is five (5) years whereas the new systems will have a MTBO of ten (10) years. Thus, modernization of the AAS would decrease maintenance costs, ensure commonality and provide higher margins of safety and reduce training times increasing operational effectiveness.

1.4 Project Assumptions and Constraints

It is assumed that the Department will proceed with the procurement of the new AAS in the very near future. Pits and associated civil works must be ready to accept these new AAS when they are delivered or shortly thereafter.

It is assumed that the cost of replacing any infrastructure that is directly attributable to the procurement of new AAS will be borne by the equipment project WBS 00000877.

The AAS modernization must meet NATO and STANAGS standards.

1.5 Related Projects

There are no related projects within the Air Force.

2. Concept of Operation

The AAS shall be used at Wings and Forward Operating Locations (FOL) in support to Air Force operational scenarios and in regional areas and training.

The AAS modernization project will streamline configuration management for mobile and fixed systems. A single type of energy absorber systems will be used, thus reducing the overall spares and training requirements.

2.1 Missions, Mandates and Tasks

The role of Canada's Air Force is to generate and maintain a combat-capable air force, perform Search and Rescue operations, maintain surveillance and control of Canadian territory by means of monitoring, control and protection of Canadian approaches and territories to meet Canada's defence policy objectives. The Canadian Air Force also assists government departments and agencies and other levels of government in support of efforts such as ground searches, drug-interdiction operations, disaster relief, law-enforcement operations, fisheries and environmental protection, and official events. In support of these operations the following AAS have been identified:

1. Fixed pit installed, computerized cable arresting systems;

2. Mobile aircraft arrestor systems; and

3. Cable Retraction System (CRS)

2.2 Role and Responsibilities

It is the responsibility of the MOS 00149 Firefighter to operate the AAS on a regular basis. It is the responsibility of the MOS 00301 RM Tech to maintain these AAS to a readiness and safe state; Refrigeration Mechanical (RM) Techs may operate the AAS when required.

These responsibilities are carried out on the active airfield in cramped conditions inside underground pits. All 1st and 2nd line maintenance is performed inside the pits. 3rd line maintenance is carried out at the designated repair and overhaul facility.

There is no anticipated increase in established positions to maintain these systems.

2.3 Organization

The aircraft arresting systems at each Wing have different establishments but are generally organized along the same lines. The organizations for each Wing are summarized in Table 1 below:

TABLE 1- AAS organizations in different Wings

Wing	Sgt Firefighter	MCpl Firefighter	Cpl/Pte Firefighter	RM Shop Sup	2 IC RM Shop	Civ / Cpl MAM 10	Total
3 Wing	1	1	4	1	1	2	**9**
4 Wing	1	1	4	1	1	2	**9**
8 Wing	1	1	4	1	0	2	**8**
14 Wing	1	1	4	1	1	0	**8**
19 Wing	1	1	4	1	0	2	**9**
5 Wing	1 civ crew chief	1 (2 I/C)	4 FFTr	1 Sup	0	2	**9**

2.4 Concept of Operations

The AAS shall be used at Wings and FOLs in support to Air Force operational scenarios and in regional areas and training

Mobile aircraft arresting system shall be air transportable by CC130 Hercules and CC177 Globemaster III aircraft, and sea, rail and road transport. The Mobile aircraft arresting system could be deployed anywhere in the world in support of CF or allied missions.

The AAS modernization project will streamline configuration management for mobile and fixed systems. A single type of energy absorber systems should be used, thus reducing the overall spares and training requirements.

The Wing Air Traffic Control (WATC) Section is responsible for directing the activation / de-activation of the AAS as required by aircraft commanders and / or as dictated by daily flying programmes.

Operation and maintenance of the AAS is the responsibility of Wing Construction Engineering Officer. This responsibility is split between the Refrigeration Shop for all operation, maintenance and training and, the Fire Hall for operation of the AAS. This responsibility is detailed in the Realty Assets Management Manual (RAMM) and 1 Cdn Air Div orders Vol 1, 1-110.

2.4.1 Fixed Aircraft Arrestor Systems.

Fire hall operation of the AAS consists of the raising or lowering of the cable when required by Wing Air Traffic Control (WATC) for the arrival or departure of fighter aircraft. The raising or lowering of the cable may take up to 30 minutes when performed this way. The fire hall is also responsible for removing the aircraft after engaging the arrestor gear and resetting the system.

RM shop personnel are responsible for the 1st and 2nd line maintenance of the Fixed AAS including daily inspections and all fire hall training on Fixed AAS. The RM Shop also performs all after arrestment inspections to ensure that the systems are safe for the next use. Trained RM Shop personnel may operate the AAS when required.

2.4.2 (CRS)

Operation of the CRS is by WATC. The arrestor cable is raised and lowered by WATC staff by remote control from the Air Traffic Control Tower. No other personnel are required; cables may be raised or lower within 15 seconds.

After arrestment the fire hall will reset the cables into the support blocks and reset the Fixed AAS, so that they system is ready to engage another aircraft.

RM Shop personnel perform all 1st and 2nd line maintenance on the CRS including daily inspections and all fire hall training on AAS. The RM Shop also performs all after arrestment inspections to ensure that the systems are safe for the next use.

2.4.3 Mobile Aircraft Arrestor Systems

Operation of the Mobile AAS is by a team consisting of MOS 00301 RM Techs, 303 Electrical Generating Systems (EGS) Techs and 00149 Firefighters. Mobile Aircraft Arrestor System deployment criteria are detailed in 1 Canadian Air Division (1 Cdn Air Div) Order Vol 1 1-110 Annex C.

3. Design and Concept Guidance

The aircraft arresting pits are located directly on the airfield, in close proximity to each side of the runway. Arrestor systems are typically located 1500 feet (457 m) from the departure

end of each runway. Due to the close proximity to the runway, 100 – 150 feet (30 – 45 m), these systems are located in large concrete pits capable of holding all the mechanical equipment for the arrestor gear and to meet the requirements of Mil 312 for obstacle limitation requirements on and around airfields. The concrete pits are designed so that they can sustain an aircraft roll over without collapse.

At the runway edge there are runway edge sheaves, which allow the tape from the energy absorber to be located within 3 – 10 feet (1-3 m) of the edge of the runway and allow approach or departure end (bi-directional) engagements of the energy absorber. The tape is carried inside a fairlead tube, which protects the tape as it transitions from the pit to the runway edge sheave. Theses tubes have concrete supports at specified intervals along their length to support the tube and prevent heaving from frost.

At select locations CRS will be installed, these system work by remote control from the Control Tower and can raise and lower the cable from a trench located in the runway.

Routine cable up/down evolution for the AAS is performed by firefighters 24/7. This involves firefighters operating the AAS in the pits as well as ensuring that the cable is correctly located, properly tensioned and the pendant support disks properly spaced on the runway.

All maintenance of the AAS is supervised or performed by RM Techs, EGS Techs for internal combustion engines, and Electrical Distribution(ED) Techs for the electric motor and controls. As directed in 1 Cdn Air Div Order Vol 1 1-110, systems must be inspected prior to daily flying activities or once every 24 hours depending on fighter Aircraft activities on the wing.

3.1. Performance Criteria.

3.1.1. Performance requirements. In specifying the different performance requirements, two levels of measurement shall be used. These levels of measurement apply to all sections of this Statement of Operational Requirements (SOR). They are defined as follows:

a. Essential. An essential requirement is a criterion of such considerable importance that it shall be met if a potential AAS is to be considered for selection. Performance criteria so designated is deemed to be of such impact that even if a potential AAS candidate meets all other essential criteria and all desirable criteria, but fails to meet one essential criterion, that AAS shall be deemed unsuitable. The words "must", “shall” or “will” are to be considered synonymous with essential.

b. Desirable. A desirable criterion is used to describe a performance requirement where the level by which it exceeds the stated essential level is deemed to have significant operational value, hence value added. This value added concept shall be used to promote a more flexible evaluation of contending items that meet all essential requirements. The word "should" is to be considered synonymous

with value added. Desirable criteria that exceed the mandatory requirements are to be quoted as options in the contractual documents.

3.2. Operability and Performance Capabilities

3.2.1. Concrete Pit Type Installation. The design of the Fixed Barrier Arresting Systems shall be adaptable to install in an underground concrete pit with a top that is substantially flush with the surrounding terrain. The reinforced concrete pit and cover shall be capable of withstanding a rollover by aircraft without collapse. All electrical and mechanical equipment shall be located inside the pits. Sufficient room must be allowed in the pits to operate the AAS and perform 1st and 2nd line maintenance. Pits shall have a sump pit with 2 sump pumps to drain any water that has entered the pit; water will be directed to a suitable runway drain. Pits shall have a fan for fume extraction to provide habitable are for personnel operating or maintaining the AAS. Fans can be both remote and automatic operation. The pits will be provided with electric heaters to maintain the pits temperatures above freezing. Electricity will be provided for operation of the AAS, lighting, and auxiliary power.

3.2.2. 3 Roller Runway Sheave. The design of the 3-roller runway sheave shall be incorporated in such ways as to allow the sheave to be installed in a sloping reinforced concrete deflection and run over surface so as to minimize damage to aircraft. The slope of the concrete is determined at the 30:1 ratio for objects installed near runway surfaces as specified in Mil 312. The height of the 3-roller sheave will not exceed 12 inches (0.30 m).

3.2.3. Fairlead tube. The design of the fairlead tube is for a tube to extend from the reinforced concrete pit to the 3-roller edge sheave underground so that the AAS purchase tape is protected at all times. The tube must be supported at regular intervals to prevent frost heave damage to the tube. All joints will be watertight and all interior surfaces must be free from sharp surfaces.

3.2.4. CRS. The design of the CRS is to allow the pendant to be raised or lowered from a remote location. The operation mechanisms are located inside a reinforced concrete trench flush with the runway surface. There is a trough to allow the pendant to raise or lower approx 3(70 mm) above the runway surface. The width of the trough is not wider than 1 ½” (38 mm) wide enough to allow the passage of the pendant and for some variation in the pendant shape. Additional electrical, electronic and pneumatic controls and equipment are co-located inside the energy absorber pit.

3.2.5. Mobile Aircraft Arrestor System Pads. The design of the Mobile Aircraft Arrestor System pads is to provide a suitable surface to bolt the Mobile aircraft arrestor system into place with minimal tools and in minimum time. The pads shall be constructed parallel to the runway approximately 100 – 150 feet (30 – 45 m) from the edge of the runway. Construction of the pads will be with

reinforced concrete substantially flush with the surrounding airfield terrain. Anchor nuts will be embedded in the concrete in designed locations to expedite the bolting of the Mobile aircraft arrestor system and the nuts will be of such design that they will be sealable when not in use and flush with the concrete surface.

3.2.6. All terrain will be IAW Mil 312 and all surface areas will be sloped for drainage. All soils will be seeded to prevent FOD.

3.4 AAS Configurations.

Configuration management should be used to ensure maximum commonality between the fixed and mobile AAS.

All new pits, CRS and 3–roller edge sheaves will be constructed to ensure that there is maximum commonality between all locations.

All new Mobile AAS pads will be constructed to ensure that there is maximum commonality between all FOL locations. All Mobile AAS pads will be flush with the existing terrain. Any Mobile AAS from the inventory can be bolted in at each location.

3.5 Environmental Sustainability

A formal environmental assessment will be required to ensure minimal impact of these facilities as set forth by the Canadian Environmental Assessment Act (Defence Adminsitration Order and Directive DAOD 4003-2).

3.6 Safety and Health

Adequate heating and ventilation is required to facilitate normal operation and maintenance functions while in the confined space.

A fume extraction system is required in the pits as the AAS rewind engines are often run indoors during maintenance or to warm the engines. These engines have proper exhaust systems piped directly to the out of doors but fumes from the engines may still be present.

Lightening protection will be included to protect equipment and prevent fires.

4. Life Cycle & Technical Requirements

It is expected that any new facility provided as a result of this SOR would be designed for a minimum 20-30 years life expectancy.

The facility will meet minimum NBC 2005 seismic standards.

Geotechnical investigations, which would include drainage studies and topographical surveys, will be required for each site where a new facility is being provided.

A Waste Reduction Plan will be undertaken in accordance with the DND Sustainable Development Strategy for the demolition of existing facilities.

An environmental assessment will need to be undertaken which will encompass the provision of new facilities, demolition of existing facilities and/or renovations of existing infrastructure, all as determined by the Option Analysis (OA).

5. Special Design Phase / Construction Period Considerations

5.1.1 TABLE 2 - Project Milestones

PPA	July-2008 (EPA in 2010)
SOW	Feb 2010
Soil Analysis	Done in 2008 Except Greenwood
Environnemental Assessment	In Progress
Construction Start (Tentative)	2011
Project Completion (Tentative)	2015

6. Requirements Table

6.1.1 Table 3 summarizes requirements by Wing is as follows:

TABLE 3

Wing	Pits	CRS	3 Roller Sheave	Fairlead Tubes	Pads
3 Wing	**6X**		**6X**	**6X**	
8 Wing	**4X**	**2X**	**4X**	**4X**	
14 Wing	**2X**	**2X**			
19 Wing	**4X**	**2X**	**4X**	**4X**	
Inuvik					**1**
Yellowknife					**X**
Rankin Inlet					**X**
Iqaluit					**X**

All pit, CRS, 3-roller sheave and fairlead tube dimensions are the same in all locations. Pad dimensions are the same size for all FOL with the exception of Inuvik, which has only modifications to the existing pad to accommodate the Fixed Barrier Arresting System AAS.

6.1.2 Table 4 – Functional Area Requirements

Functional Area	Space	Comments
AAS Pits		The construction in this area will be standard for all AAS pits
Reinforced concrete pits with steel entrance hatch	$64m^3$	
CRS		Applies to 8,14 and 19 Wings only
Reinforced concrete trench and supports in runway	$300m^3$	
3 Roller Sheave		Applies to 3,8 and 19 Wings
Reinforced concrete sheave foundation and edge sheave rollover protection	$202m^3$	
Fairlead Tubes		Applies to 3,8 and 19 Wings
Reinforced concrete footings and support columns	$10m^3$	

APPENDIX A

Fixed Barrier Arresting Systems and General Support Equipment Dimensions

Type	Length (m)	Width (m)	Height (m)
CRS	10’ (3m)	6’ (1.8)	6.5’ (2)
Floor Deflector Sheave	1.5’ (.45m)	1.5’ (.45m)	1’ (.31m)
Wall Deflector Sheave	1.5’ (.45m)	1.5’ (.45m)	1’ (.31m)
Sump Pump	.5’ (.15m)	.5’ (.15m)	.5’ (.15m)
Exhaust Fan	1’ (.31m)	1’ (.31m)	1’ (.31m)
Air Compressor	5’ (1.5m)	2’ (.61m)	4’ (1.2m)
Air Dehydrator	1.5’ (.45m)	1’ (.31m)	1’ (.31m)
Electrical Control Panel	4’ (1.2m)	3’ (.9m)	.5’ (.15m)
Electrical Distribution Panel	4’ (1.2m)	3’ (.9m)	.5’ (.15m)

Minimum Dimensions

Type	Length (m)	Width (m)	Height (m)	Area (m^2)
Fixed Barrier Arresting System Pit	20’ (6.1)	13’ (3.9)	9’ (2.7)	260 (23.8)
CRS	200’ (60.1m)	5’ (1.5 m)	2.5’ (.9 m)	1000 (90.2)
3 roller runway edge sheave	16’ (4.9m)	16’ (4.9m)	4’ (1.2m)	256 (24)
Roll over for runway edge sheave	60’ (18.2)	5’(1.5m)	1’ (.31m)	
Mobile aircraft arrestor system pad	30’ (9 m)	15’ (4.5 m)	5’ (1.5 m)	450 (11.4 m^2)

Note: Rollover protection is wedge shaped and tapered. The length is determined from the height of the 3-roller sheave at a ratio of 30:1. Slope of the wedge is at 45^0 from horizontal and tapers from the edge of the 3-roller sheave back to the edge of the runway surface.

APPENDIX B List of Acronyms and Abbreviations

AAS	Aircraft Arrestor System
AC	Alternating Current
AIT	Agreement on Internal Trade
ASIC	Air and Space Interoperability Council
ASU	Airfield Systems and Utilities
AUW	All-Up Weight
BAK	Barrier Arresting Kit
BY	Budget Year
CAS	Chief of Air Staff
CBR	California Bearing Ratio
CF	Canadian Forces
CFSTG	Canadian Forces Support and Training Group
CLCA	Comprehensive Land Claim Agreements
CRS	Cable Retraction System
CSA	Canadian Standard Association
DOB	Deployed Operating Base
DMS	Defence Management Staff
DND	Department of National Defence
ED	Electrical Distribution
EEMAC	Electronic and Electrical Manufacturers Association of Canada
EGS	Electrical Generating Systems
EPA	Effective Project Approval
EPC	Effective Project Completion

FOC	Final Operational Capability
FOD	Foreign Object Damage
FOL	Forward Operating Locations
GSE	General Service Equipment
IAW	In Accordance With
ILS	Integrated Logistics Support
IOC	Initial Operational Capability
ISO	International Standards Organization
LCC	Life Cycle Costs
LCMM	Life Cycle Material Manager
MAAS	Mobile Aircraft Arrestor System
MAG	Mobile Arrestor Gear
MCBF	Mean Cycles Between Failure
MEBM	Mean Engagements Between Maintenance
MIL-STD	Military - Standard
MITE	Military Individual Training and Education
MOTS	Military Off The Shelf
MTBF	Mean Time Between Failure
MTBO	Mean time Between Overhaul
NAFTA	North American Free Trade Agreement
NDHQ	National Defence Headquarters
NDT	Non Destructive Testing
NEMA	National Electrical Manufacturers Association
NP	National Procurement
OGD	Other Government Department
PCR	Project Completion Report
PD	Project Director
PL	Project Leader
PM	Project Manager
PMB	Project Management Board
PMP	Project Management Plan
PPRA	Project Profile and Risk Assessment

PRC	Procurement Review Committee
PSAB	Procurement Strategy for Aboriginal Business
PWGSC	Public Works and Government Services
RAMM	Realty Assets Management Manual
R&D	Research and Development
RM	Refrigeration Mechanical
R&O	Repair & Overhaul
SAG	Stationary Arrestor Gear
SCIP	Strategic Capital Investment Plan
SOR	Statement of Operational Requirements
SPAC	Senior Project Advisory Committee
SPQR	Special Personnel Qualification Record
SRB	Senior Review Board
SS (EPA)	Synopsis Sheet (Effective Project Approval)
SS (ID)	Synopsis Sheet (Identification)
SS(PPA)	Synopsis Sheet (Preliminary Project Approval)
STANAG	Standardization Agreement (NATO)
TA	Technical Authority
TOR	Terms Of Reference
UL	Underwriters Laboratories Incorporated
WATC	Wing Air Traffic Control
WCE	Wing Construction Engineering
WCEO	Wing Construction Engineering Officer
WTO-AGP	World Trade Organization Agreement on Government Procurement