



Defence Research and
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Recherche et développement
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Air S&T Strategic Road Map Synopsis

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Defence R&D Canada – Corporate

Technical Note
DRDC Corporate TN 2012-006
September 2012

Canada

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Abstract

In response to the Air Force Science & Technology Implementation Directive (AFSTID) published in July 2010, DRDC Partner Group 3 (PG3)-Air produced a science and technology (S&T) Strategic Road Map as a long-range planning process to ensure that DRDC meets the S&T requirements of the Royal Canadian Air Force (RCAF) in providing timely deliverables and advice on long-term science and technology. This document presents a series of 2-page high-level fact sheets derived from the Air S&T Strategic Road Map, one for each of the AFSTID objectives. The aim is to quickly introduce, in a clear and concise manner, the strategy in addressing the AFSTID objectives.

Résumé

En réponse à la Directive sur la mise en œuvre du programme de science et technologie de la Force aérienne (DMPSTFA) publiée en juillet 2010, le groupe partenaire 3 (GP3) – Air a produit une feuille de route stratégique de science et technologie (S & T) en guise de processus de planification à long terme pour faire en sorte que RDDC réponde aux besoins en S & T de l'Aviation royale canadienne (ARC) en fournissant des livrables et des conseils opportuns concernant la S & T à long terme. Le document présente une série de fiches de renseignements généraux de deux pages découlant de la feuille de route stratégique de S & T de la Force aérienne, c'est-à-dire une fiche pour chacun des objectifs de la DMPSTFA. Le but consiste à présenter rapidement, de façon claire et concise, la stratégie adoptée pour atteindre ces objectifs.

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Table of contents

Abstract	i
Résumé	i
Table of contents	iii
List of figures	iv
1. Introduction.....	1
1.1 The AFSTID	1
1.2 The Air S&T Strategic Road Map	1
1.3 Aim of this Document.....	2
2. AFSTID Objective 1 – Precision Application of Force.....	3
3. AFSTID Objective 2 – Persistent Aerospace Management and Control.....	5
4. AFSTID Objective 3 – RF and IR Countermeasure Development.....	7
5. AFSTID Objective 4 – Surveillance and Reconnaissance Capabilities.....	9
6. AFSTID Objective 5 – Reducing the Environmental Impact.....	11
7. AFSTID Objective 6 – Alternate Energy Sources.....	13
8. AFSTID Objective 7 – S&T Support to Operations.....	15
9. AFSTID Objective 8 – Reduction in Ownership and Operating Costs	17
10. AFSTID Objective 9 – Reducing Training Costs.....	19
11. AFSTID Objective 10 – Enhance the Man/Machine Interface.....	21
References	23
Distribution list.....	24

List of figures

Figure 1: Strategic Road Map Construct 2

1. Introduction

In response to the Air Force Science & Technology Implementation Directive (AFSTID) [1] released in July 2010, Scientific Advisor-Air produced an Air Science and Technology (S&T) Strategic Road Map that will guide program formulation in order to provide the RCAF with a relevant and effective S&T response to its current and future S&T needs.

1.1 The AFSTID

The AFSTID[1] is a strategic-level document that describes ten strategic S&T objectives with the purpose of focussing and aligning long term S&T efforts with the RCAF vision. The ten objectives are as follows:

- Objective 1 – Precision Application of Force
- Objective 2 – Persistent Aerospace Management and Control
- Objective 3 – RF and IR Countermeasure Development
- Objective 4 – Surveillance and Reconnaissance Capabilities
- Objective 5 – Reducing the Environmental Impact
- Objective 6 – Alternate Energy Sources
- Objective 7 – S&T Support to Operations
- Objective 8 – Reduction in Ownership and Operating Costs
- Objective 9 – Reducing Training Costs
- Objective 10 – Enhance the Man/Machine Interface

The AFSTID aims to support the delivery of the “*Right technological innovations and advice at the right time and place.*” [1] and to “*...maximize the impact of the Departmental Science and Technology investment in accordance with the Defence Science and Technology Strategy. It will also serve to guide, shape and focus the way ahead for implementing the Science and Technology elements inherent in Air Force strategic documentation in order to achieve the Air Force Vision.*” [1]

1.2 The Air S&T Strategic Road Map

Defence science and technology outputs must be relevant and effective. Relevance is achieved through linkage and alignment to strategic direction and operational requirements. Effectiveness is achieved through timely delivery of exploitable outputs, in a cost effective manner. Given the broad nature of the ten AFSTID objectives it was recognized that a clear articulation of the RCAF problem space was required; one that would facilitate a clear linkage between higher RCAF guidance and operational

requirements, to that of the S&T Enterprise capabilities in delivering advice, innovation, integration and S&T leadership. A basis upon which to derive a performance management and long-range planning framework was also required. It was directed that a science and technology road map be developed to address these requirements.

1.3 Aim of this Document

A detailed breakdown and description of each AFSTID objective and S&T way ahead is articulated in the Air S&T Strategic Road Map document [2]. The Air S&T Strategic Road Map will be issued as direction within the S&T community through the DRDC Partner Group 3 (PG3) to guide program formulation. Thrust Strategic Plans will be developed to define a program of work in response to this guidance. This strategic road map construct will deliver a relevant and effective Air S&T program that will be managed within the PG3 governance structure (see Figure 1).



Figure 1: Strategic Road Map Construct

This document presents a series of 2-page high-level fact sheets derived from the Air S&T Strategic Road Map, one for each of the AFSTID objectives. The aim is to quickly introduce, in a clear and concise manner, the SA(Air) strategy in addressing the objectives. The first page, describing each objective, presents a précis of the relevant RCAF problem space. The second page focuses on the intended DRDC S&T way ahead to address the particular AFSTID objective. In addition, an assessment is made of the capability of the S&T Enterprise (as defined by the Defence S&T Strategy [3]).

2. AFSTID Objective 1 – Precision Application of Force

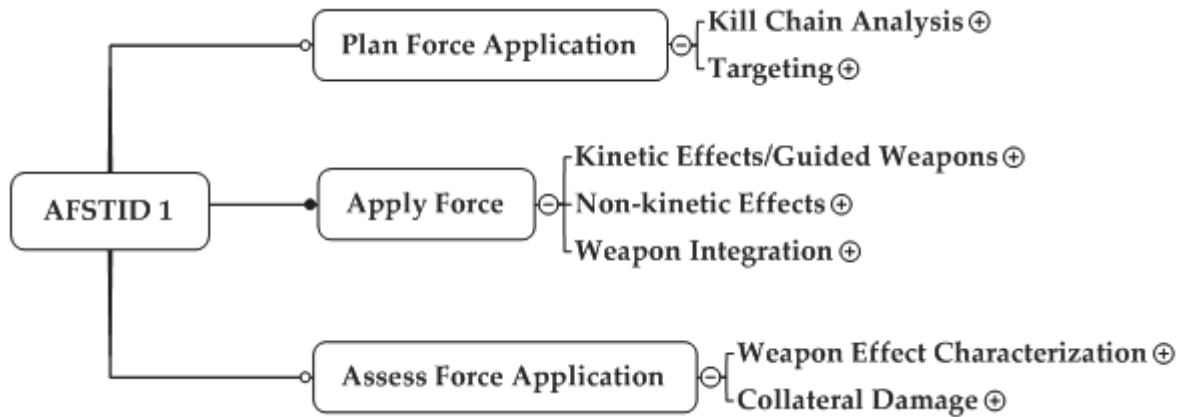


Objective Statement: Develop new concepts and relevant technologies for the precision application of force, including tunable effects and non-conventional weapons to support force application in asymmetric theatres by 2020.

Relevance to the RCAF: Shaping of the battle space by air forces is typically accomplished through the use or the threatened use of force to create effects in both the physical and moral domains. The RCAF must have the ability to apply a level of force that is appropriate to the situation, primarily through the delivery of kinetic and non-kinetic aerospace power to achieve desired effects. Whether it is through the use of conventional weapons or psychological techniques, force application must be precise and tailored in order to minimize cost and eliminate collateral damage. This can be achieved through a complete understanding of weapon effects, immediate access to weapons and the ability to properly coordinate actions.

Problem Breakdown: Objective 1's breakdown seeks to address the various elements outlined in the notion of battle space shaping. The decomposition of the objective is done along the following three concepts: accurately plan the appropriate application of force to achieve the desired effect, precisely apply the proper force to minimize cost and collateral damage and assessing the effects of the application of force both in the physical and moral domains. Efforts under this objective should therefore increase the RCAF's capability to deliver appropriate force and support the decision making process.

DND/CF stakeholders: DG Air FD, D Air FR, DAR, 1 Cdn Air Div, DGAEPM.



Pictorial Representation of S&T Way Ahead for Objective 1

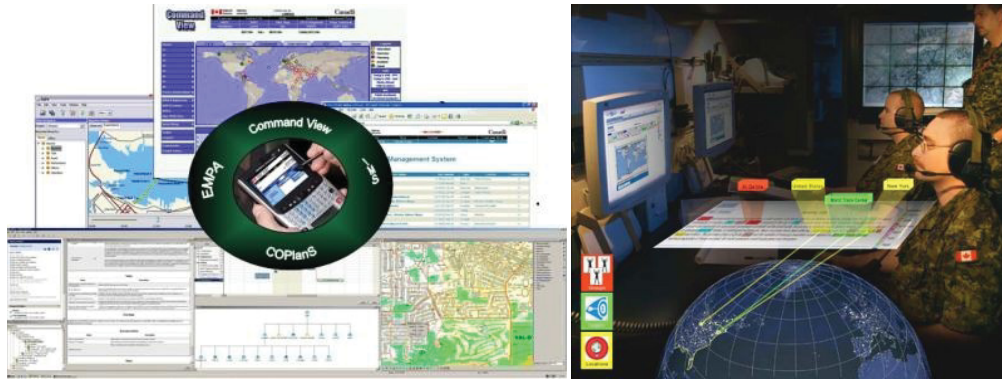
S&T Way Ahead: In order to answer the S&T requirements set by Objective 1 Problem Breakdown, the S&T Enterprise will further the:

- Planning of Force Application through the analysis of all aspects of the kill chain (find, fix, track, target, engage, assess or F2T2EA) and a more in-depth analysis of the targeting aspect of F2T2EA designed to ensure the correct information is available to target the expected enemy unit;
- Applying the Force through the analysis of weapons delivering kinetic and non-kinetic effects (including the moral domain), guided weapons as well as the integration of weapons on various platforms; and
- Assessing the Force Application through the analysis of current weapons effects on various known targets and the study of the possible collateral damage made by weapons in RCAF inventory.

S&T Enterprise Capability: The S&T enterprise possesses the capability to support this objective, specifically to understand the offensive and defensive applicability of relevant technologies, as well as their vulnerabilities. Modern weapons must be effective against a variety of targets in challenging environments such as urban terrain. S&T expertise includes identification and characterization of lethal and non-lethal weapons as well as the application of new weapons concepts to meet CF requirements.

S&T Delivery Centres: DRDC Valcartier, DRDC Toronto.

3. AFSTID Objective 2 – Persistent Aerospace Management and Control



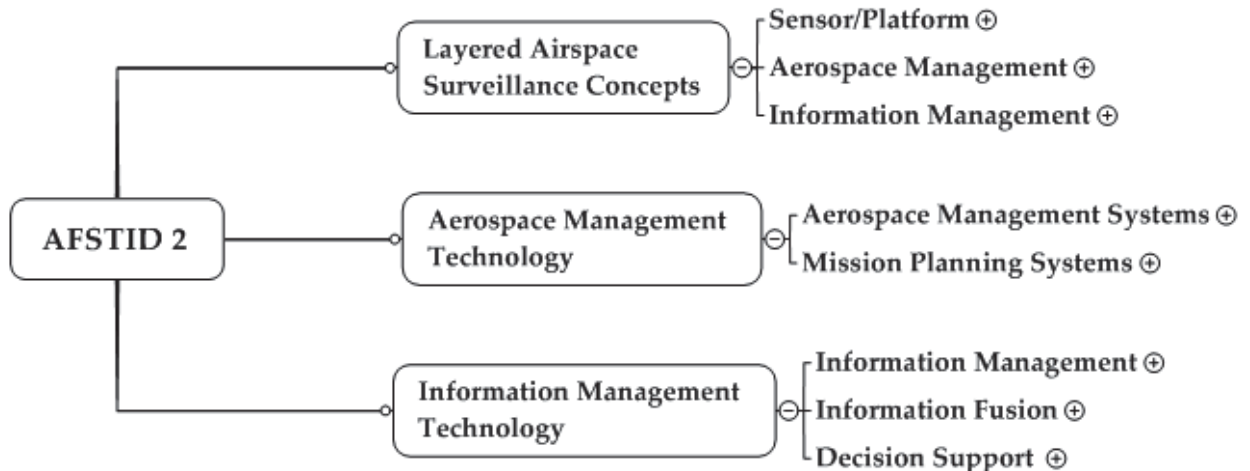
Objective Statement: Develop contributions to a layered airspace surveillance approach to support persistent aerospace management and control over Canadian areas of responsibility (AOR). Support acquisition of a new urban/vital point region capability by 2014 and develop non-cooperative target recognition capabilities for 2020. Develop wide area surveillance concepts and relevant technologies to support possible acquisitions by 2020.

Relevance to the RCAF: The Air Force Strategy on future operating environment describes the need for enhanced interoperability and C4ISR. It directs that the future Air Force requires comprehensive and sustained intelligence, surveillance and reconnaissance capabilities to achieve full-spectrum situational awareness, from targeted urban/vital point surveillance to wide area surveillance of the land, sea and air environments. As directed by VCDS, CFD is responsible of the development of an integrated fully functional and interoperable C2 Information System. As such, there lies a necessity that the RCAF C4ISR structure and requirements to align with the VCDS C4ISR Capability Development Strategy.

Problem Breakdown: Objective 2's breakdown seeks to address the various concepts and technologies necessary for effective C4ISR. The decomposition of the objective is done along the three following themes: the overarching concepts related to effective layered airspace surveillance, the aerospace management technologies for sensors and air vehicles, and finally the technologies and procedures relating to information management and control. Efforts under this objective should therefore increase the RCAF's C4ISR capability.

Note 1: The concepts and technologies related to surveillance sensors will be covered under AFSTID Objective 4 – Surveillance and Reconnaissance Capabilities.

DND/CF stakeholders: DG Air FD, 1 Cdn Air Div, CFAWC, DGAEPM.



Pictorial Representation of S&T Way Ahead for Objective 2

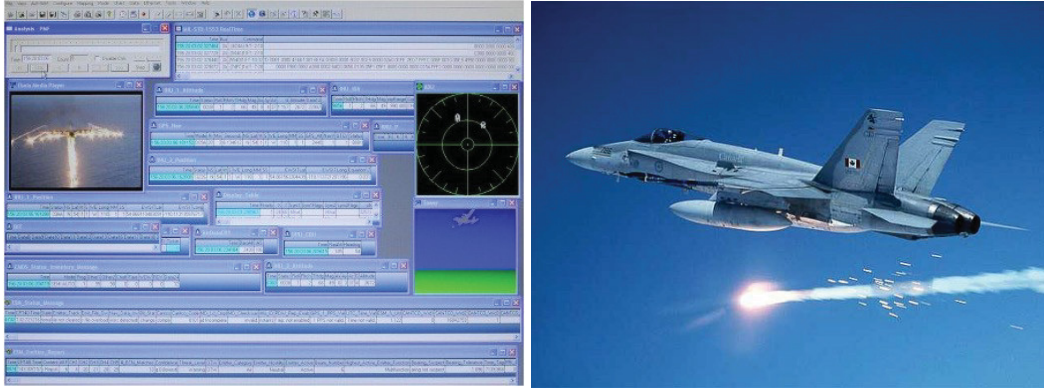
S&T Way Ahead: In order to answer the S&T requirements set by the Objective 2 Problem Breakdown, the S&T Enterprise will further the:

- Layered Airspace Surveillance Concepts through the options analysis of sensors and air platforms, the analysis of concepts related to the management and control of aerospace and aerospace resources, and the analysis of concepts related to the management and control of surveillance information;
- Aerospace Management Technology through the investigation of aerospace monitoring, warning and mission planning technologies and procedures through the development of comprehensive, integrated and collaborative C2 systems (sensors will be covered under Objective 4)
- Information Management Technology through the investigation of technologies and procedures for the exploitation of sensor information for effective C2, the analysis of sensor data/information fusion at all levels, and the investigation of effective methods in supporting planning teams and the decision making process.

S&T Enterprise Capability: The S&T Enterprise possesses world class and leading capability in support of many technology areas; however, the Defense S&T Enterprise is not directly engaged in S&T related to the design of future air vehicles. Air vehicle design is conducted on behalf of DND through private industry.

S&T Delivery Centres: DRDC Ottawa, DRDC Valcartier, DRDC Toronto, DRDC CORA, DRDC CSS, CRC (Communications Research Centre).

4. AFSTID Objective 3 – RF and IR Countermeasure Development



Objective Statement: Develop knowledge and technologies relevant to RF and IR countermeasure development and validation capability within the forces that is able to address priority threats to the CF from airborne platforms, focussing on maintaining relevance with the forecast future battle space. Enhanced defensive capability against the threats of highest priority (to be promulgated in a classified document) should be available by 2019.

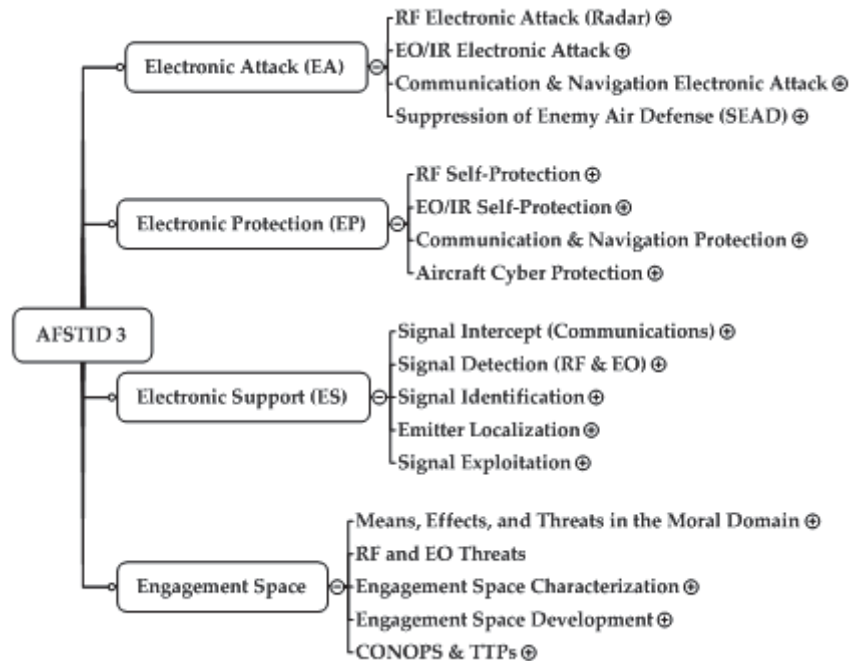
Relevance to the RCAF: As described in the Aerospace EW Doctrine:

“The CFDS acknowledges the proliferation of legacy and advanced weapons ... It is within this context that Air Force EW policy and Aerospace EW doctrine is articulated to express the requirement for the capability to operate effectively today and the capacity to operate effectively in the future. This necessitates Electronic Warfare sovereignty ...”

In order to allow the RCAF and DND/CF to respond in accordance with doctrine guidance and policy directives a thorough understanding of the EW environment and the ability to validate, verify, and re-program, the when and where required, the capabilities of the systems needed to operate within that environment is a necessity.

Problem Breakdown: Objective 3’s breakdown seeks to address the various elements outlined in the Aerospace EW doctrine under the definition of EW. The decomposition of the objective is done along the four concepts: electronic attack, electronic protection, electronic support and an understanding of the engagement space. Efforts under this objective should therefore increase the RCAF’s capability across the EW spectrum.

DND/CF stakeholders: DG Air FD, D Air SP, DAR, 1 CAD, DGAEPM, CFAWC.



Pictorial Representation of S&T Way Ahead for Objective 3

S&T Way Ahead: In order to answer the S&T requirements set by the Objective 3 Problem Breakdown, the S&T Enterprise will further the:

- Electronic Attack through the analysis of the usage of RF, EO/IR, communications and navigation electronic attacks techniques and equipment as well as of the suppression of enemy air defenses;
- Electronic Protection through the analysis of RF, EO/IR, communications and navigation protection techniques and equipment as well as aircraft cyber protection;
- Electronic Support through the analysis of signal interception, detection, identification and exploitation as well as emitter localization; and
- Engagement Space through the analysis of elements of the moral domain, the shaping of the engagement space, the study threats as well as CONOPS/TTPs.

S&T Enterprise Capability: The S&T enterprise possesses the capability to engage in supporting this objective, specifically to understand the offensive and defensive applicability of relevant technologies, as well as their vulnerabilities.

S&T Delivery Centres: DRDC Ottawa, DRDC Valcartier, DRDC Toronto.

5. AFSTID Objective 4 – Surveillance and Reconnaissance Capabilities

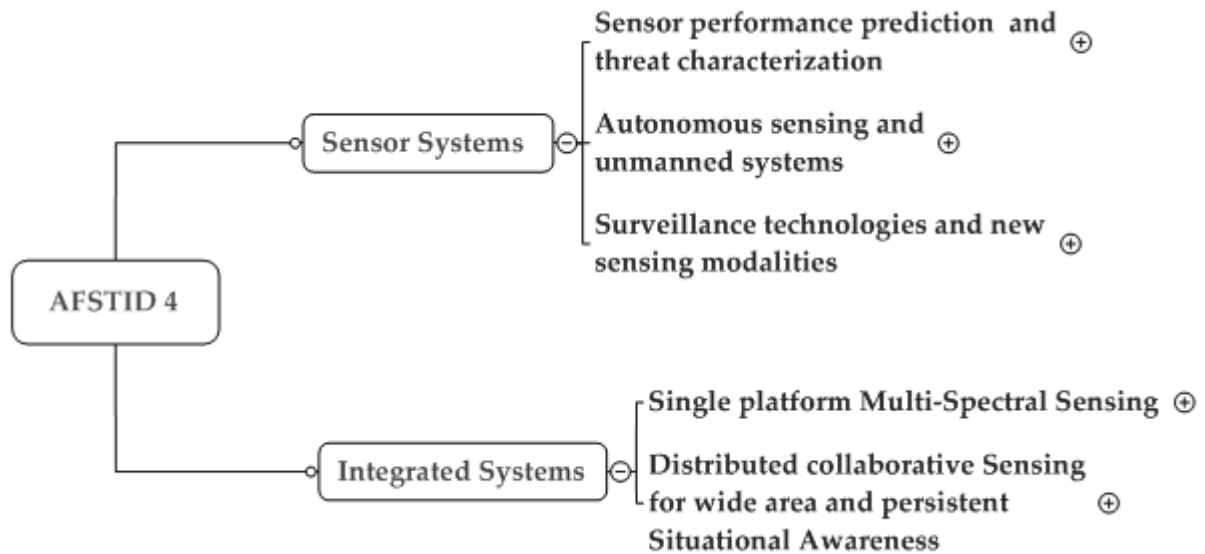


Objective Statement: Generate and access knowledge regarding surveillance and reconnaissance capabilities to support all CF Air Force missions, ensuring the management of the sensor derived information is compatible with CF and allied partners C4ISR capabilities. Specific effort should be applied to ensure that space-based capabilities can be supported by the Air Force by 2029.

Relevance to the RCAF: This objective is somewhat synonymous with the RCAF Sense Capability, defined as the function that provides the commander with knowledge to achieve decision superiority. The Sense Capability is highly related to the other six doctrinally defined RCAF capabilities to achieve proper decision making and generate the required effects in current and future operational theatres. Without the surveillance and reconnaissance capabilities, the RCAF may enter into battle with no or limited situational awareness.

Problem Breakdown: Objective 4's breakdown seeks to address the elements necessary to achieve higher surveillance and reconnaissance capability: the use of sensors (current or future) to increase mission effectiveness and the systems integration to limit information overload on the operators.

DND/CF stakeholders: DG Air FD, D Air SP, DAR, DGAEPM, DAEPM R&CS.



Pictorial Representation of S&T Way Ahead for Objective 4

S&T Way Ahead: In order to answer the S&T requirements set by the Objective 4 Problem Breakdown, the S&T Enterprise further the:

- Sensor Systems through an analysis of sensor performance and ways to increase performance, autonomous sensing and the use of unmanned sensing systems, and surveillance technologies as a whole; and
- Integrated Systems through addressing the use of multiple sensors aboard a single aircraft as well as from multiple aircrafts.

S&T Enterprise Capability: The S&T enterprise possesses the capability to engage in supporting this objective specifically in the development of world-class technology in Synthetic Aperture RADAR and the associated signal processing for detection of difficult targets in difficult land and sea clutter environments. The S&T enterprise has also world-class capability in designing and performance testing of Electro-optic and Infra-Red devices and systems across the spectrum including Hyperspectral technologies. This expertise and knowledge is used to develop and understand the offensive and defensive applicability of relevant technologies, as well as the technologies' vulnerabilities to Counter-Measures.

S&T Delivery Centres: DRDC Ottawa, DRDC Valcartier, NRC (National Research Council).

6. AFSTID Objective 5 – Reducing the Environmental Impact



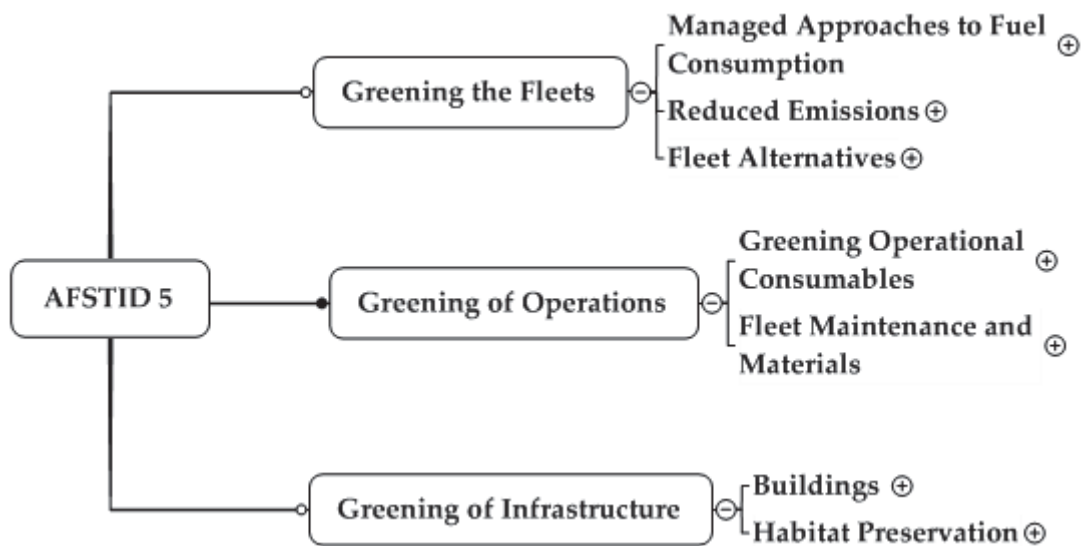
Objective Statement: Provide scientific advice, directly or indirectly through other government agencies, to develop energy and environment policies and procedures with the goal of reducing the environmental impact of Air Force operations by 50% by 2029, with an interim target of 20% by 2019.

Relevance to the RCAF: The RCAF is required by the Federal Sustainable Development Act (FSDA) and the Federal Sustainable Development Strategy (FSDS) to report on the environmental performance of its facilities and to reduce greenhouse gas emissions. Climate change is not the only motivation for implementation of environmental policies and procedures. The availability of fuel and the volatility of fuel prices directly impact annual operating costs.

Problem Breakdown: Assistant Deputy Minister (Infrastructure and Environment) Director General Environment is responsible for environmental policy within DND and has issued policy direction under DAOD 4003-0 which states that DND and the CF are accountable for the impact that defence activities have on the environment. Objective 5's breakdown seeks to address the various elements outlined in current policy. The thrust of the decomposition is the concept of "greening" the Fleet, the Operations, and the Infrastructure - "Greening" being defined as the process of making or becoming more aware of environmental considerations. Effort attributed under this objective should therefore strive to increase the RCAF's understanding of options and support the decision making process.

Note 1: Objective 5 seeks to "green" the RCAF, while an element of Objective 6 seeks to assess the green"ness" of technologies.

DND/CF stakeholders: Adm(IE)DCAE, Adm(IE)DEnvP, Adm(Mat)DAEPM, 1 CAD/A4 CE.



Pictorial Representation of S&T Way Ahead for Objective 5

S&T Way Ahead: In order to answer the S&T requirements set by the Objective 5 Problem Breakdown, the S&T Enterprise could further the:

- Greening of the Fleets through the analysis of fleets fuel consumption, possible reduction of emissions and the availability of alternatives to the current fleets;
- Greening of Operations through the analysis of the consumables used during operations and the fleet maintenance practices and associated materials; and
- Greening of Infrastructure through the analysis of current and future RCAF buildings and the potential for habitat preservation.

S&T Enterprise Capability: The S&T Enterprise capability and expertise to support this objective varies considerably across the technology areas and ranges from mature to no current capability. DRDC should be approached first to determine the level of capability available to support specific RCAF requirements.

S&T Delivery Centres: DRDC Toronto, DRDC Suffield, DRDC Valcartier, DRDC Atlantic, DRDC CORA, NRC (National Research Council), NRCan (Natural Resources Canada), ATESS.

7. AFSTID Objective 6 – Alternate Energy Sources



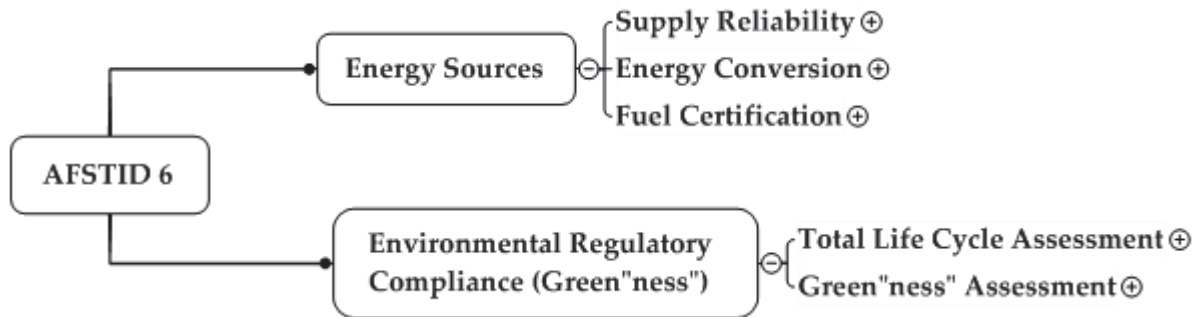
Objective Statement: Develop new concepts and relevant technologies for alternative energy sources to support future aircraft platform requirements commencing with the acquisition of new platforms beginning in 2020.

Relevance to the RCAF: The gas-turbine engine will likely remain the primary propulsion system for military aviation for the foreseeable future and understanding options for diversifying fuel sources will strategically put the RCAF in a better position to address issues related to the complex and fragile aviation fuel supply chain.

Problem Breakdown: Making use of and being prepared to exploit technological developments is critical to modern and agile armed forces. The intent of this objective is to satisfy the RCAF's requirement for knowledge relating to the evolving field of aircraft platform energy sources (including battery as power source), whether the energy is used as a means for propulsion or powering on-board systems and to understand the implication of potential energy generation design options within a military aircraft platform context. Focus will be on whether the source is sustainable in terms of supply and whether the energy chain meets environmental compliance requirements.

Note 1: Objective 5 seeks to “green” the RCAF, while an element of Objective 6 seeks to assess the green“ness” of a technology.

DND/CF stakeholders: DGMSSC - DF&L, DGLEPM (QETE) - QETE 3-3, DGAirFD (DAirProg) - DAirProg 3-5 Environment, DGAEPM (DTAES) - DTAES 7.



Pictorial Representation of S&T Way Ahead for Objective 6

S&T Way Ahead: In order to answer the S&T requirements set by the Objective 6 Problem Breakdown, the S&T Enterprise can support the RCAF in the following main areas:

- Energy Sources as they pertain to aircraft platforms by supporting the requirement for RCAF decision makers to fully understand the value of energy alternatives by facilitating access to research programmes, data, and to understand certification processes; and
- Environmental Regulatory Compliance in order that the RCAF can be fully informed as to whether employment of novel energy technologies will meet or exceed current and evolving regulatory standards.

S&T Enterprise Capability: The S&T Enterprise capability and expertise to support this objective is mature and primarily resides within QETE and NRC. Support to Total Life Cycle Assessment capability is limited and would require prior consultation with S&T delivery centres.

S&T Delivery Centres: NRCan (Natural Resources Canada), QETE, Environment Canada, Agriculture Canada, NRC (National Research Council), DRDC Atlantic, ATESS.

8. AFSTID Objective 7 – S&T Support to Operations

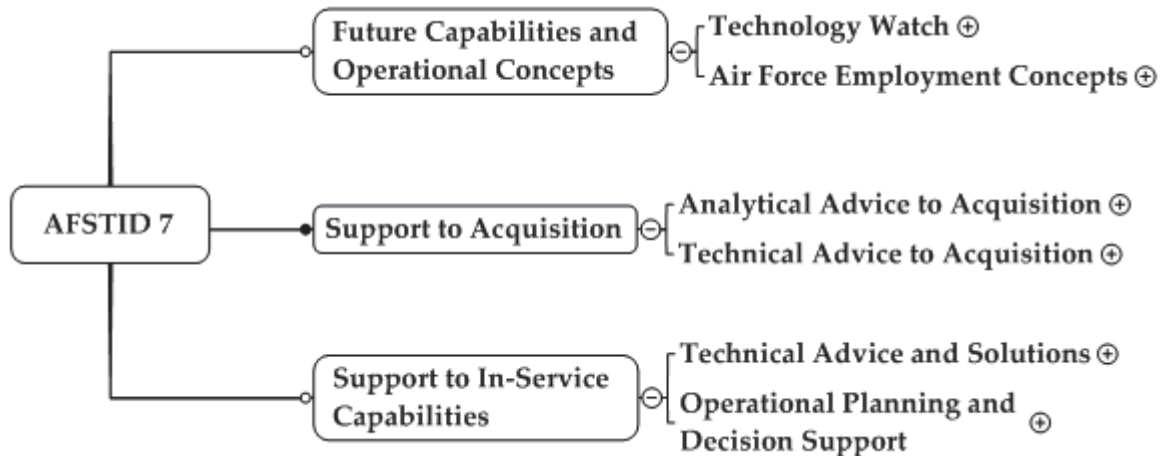


Objective Statement: Continue to ensure that the Air Force remains technologically relevant, by providing timely S&T support for operational issues, supporting Air Force future concept development, and providing early warning to the potential impacts of emerging technologies.

Relevance to the RCAF: In order for the RCAF to remain technologically relevant, a strong S&T Enterprise with the scientific and technical expertise is required to: provide timely advice and technical solutions for existing military operations and systems; support the acquisition process of the Department; enable the exploration of future capabilities in a scientifically rigorous and efficient way; and provide early warning of how emerging technologies could impact the effectiveness of RCAF capabilities. Enabled by a reachback support network, Defence Scientists also provide direct scientific support to deployed operations as part of the Commander's staff.

Problem Breakdown: Objective 7's breakdown seeks to address the current and future advice needs of the RCAF. The decomposition of the objective is done along the three following concepts: the forward looking aspects through the analysis of future capabilities and future operational concepts, a strong support to options analysis in support to acquisitions, and a direct, efficient support to expedition capabilities.

DND/CF stakeholders: DG Air FD, 1 Cdn Air Div, DGAEPM.



Pictorial Representation of S&T Way Ahead for Objective 7

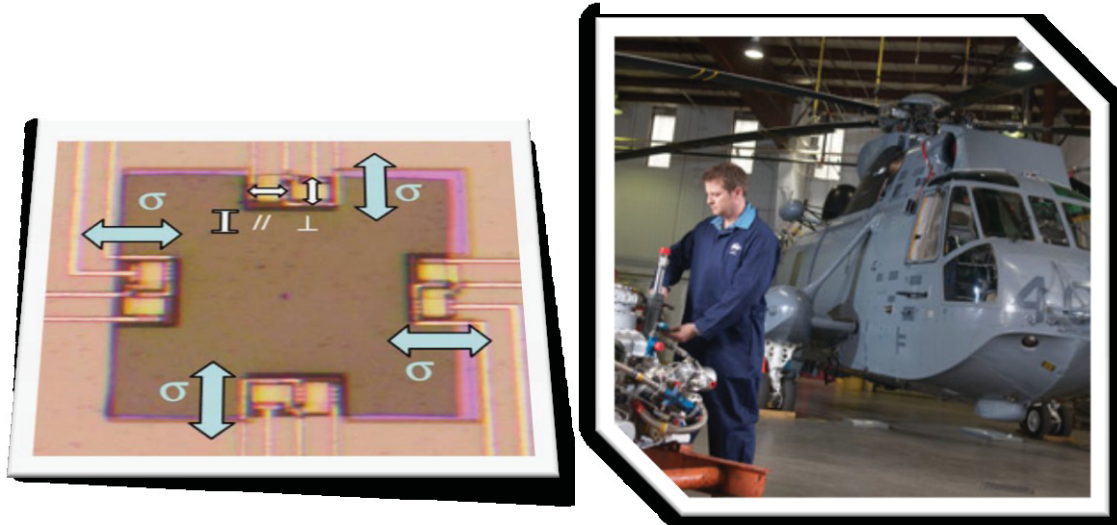
S&T Way Ahead: In order to answer the S&T requirements set by the Objective 7 Problem Breakdown, the S&T Enterprise will further the:

- Future Capabilities and Operation Concepts through an analysis of the governance, framework and delivery of a Technology and Early Warning capability, and through support to the definition of future operational concepts and associated tools;
- Support to Acquisition through advice of both technical and analytical natures tailored to each acquisition programme; and
- Support to In-Service Capabilities through the use of S&T specialist and technical support to Force Employers and Force Generators on current operations with respect to equipment usage (employment and maintenance), advice on how to better employ existing capabilities (i.e. equipment, structures, policies, procedures), and strategic planning.

S&T Enterprise Capability: The S&T Enterprise possesses world class and leading capability in support of many technology areas; however, the span of this objective is expansive and resources within the S&T Enterprise do not exist to address all areas of concern. A concerted effort will be needed to focus and prioritise areas of research.

S&T Delivery Centres: DRDC Ottawa, DRDC Valcartier, DRDC Toronto, DRDC Suffield, DRDC Atlantic, DRDC CORA, ADM(Mat), ADM(IM).

9. AFSTID Objective 8 – Reduction in Ownership and Operating Costs

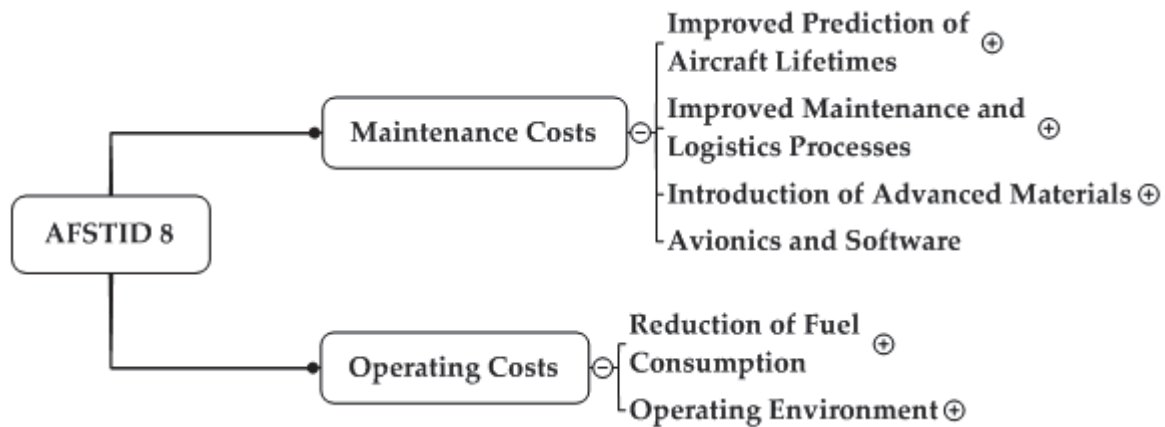


Objective Statement: Develop new concepts and relevant technologies for the reduction of costs associated with maintaining and operating Air Force defence systems. Specific goals, measured against 2009 baseline costs, include the reduction in “ownership and operating” costs by 10% by 2015 and by 20% by 2020.

Relevance to the RCAF: The RCAF has recently introduced several new or replacement aircraft fleets that employ novel materials and technologies. In addition, it needs to maintain a number of aging fleets. In order to maintain high readiness levels to meet security demands and reduced defence budget, the RCAF requires a body of knowledge to support informed departmental replacement, repair, and modernize decisions.

Problem Breakdown: The Canada First Defence Strategy identifies the DND/CF cost model as comprising the four pillars of personnel, equipment, infrastructure and readiness. The readiness pillar is further divided into costs associated with operations and costs associated with maintenance. Although significant cost is vested in the personnel, equipment and infrastructure pillars, efficiencies that may be realized through S&T for these three pillars will be addressed under other AFSTID Objectives such as 5, 7, and 9. The focus of this objective will be on the two elements of the readiness pillar, hence, Maintenance Costs and Operating Costs were selected to align with the readiness pillar of the CFDS model.

DND/CF stakeholders: DGAEPM – DTAES.



Pictorial Representation of S&T Way Ahead for Objective 8

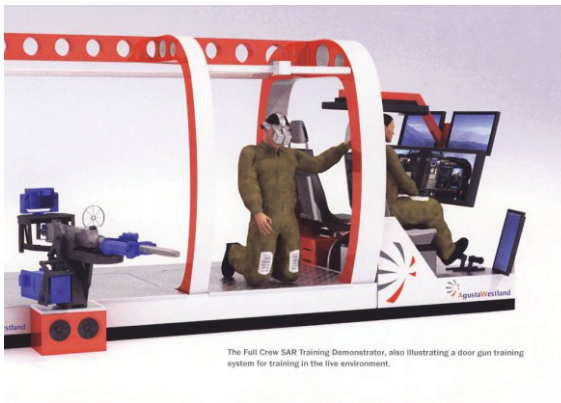
S&T Way Ahead: In order to answer the S&T requirements set by the Objective 8 Problem Breakdown, the S&T Enterprise can support the RCAF in the following main areas:

- Addressing Maintenance Costs through the development of knowledge in support of predicting aircraft lifetimes, improving maintenance and logistics processes, understanding advanced materials and supporting avionics and software. These efficiencies may result from improved practices during the maintenance process or gained indirectly through the R&O contracting process; and
- Addressing Operating Costs associated with airframes and power plant related technologies aimed at reducing the amount of fuel consumed during operations and costs associated with risk reduction technologies aimed at reducing aircraft vulnerability and attrition rates as a result having to operate in challenging environments. It is anticipated that significant cost reductions can be obtained when considered over the entire life cycle of the weapon system in both areas listed above.

S&T Enterprise Capability: The S&T Enterprise possesses world class and leading capability in support of many technology areas; however, expertise and capability is low in the area of advanced materials and would require a focussed priority effort to develop capability in this area.

S&T Delivery Centres: NRC (National Research Council), DRDC CORA, DRDC Atlantic, DRDC Toronto, DRDC Valcartier.

10. AFSTID Objective 9 – Reducing Training Costs

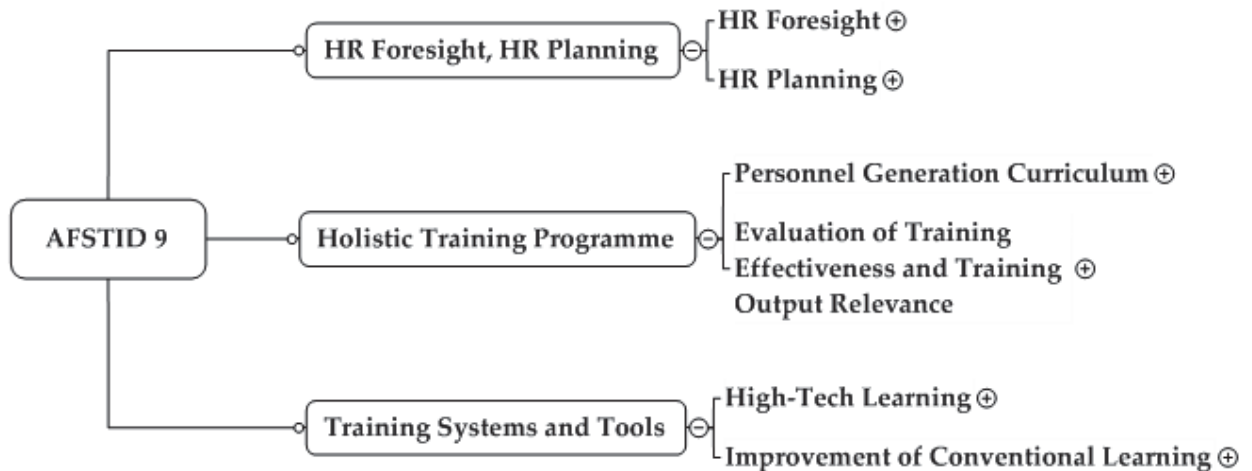


Objective Statement: Generate and access knowledge regarding Air Force personnel issues, specifically with a view to reducing training costs associated with all Air Force controlled Military Occupation Codes (MOCs) by 25% by 2019.

Relevance to the RCAF: As stated in the Air Force Strategy, the Future Air Force will be an agile, adaptive organization that facilitates learning for all its members and continuously transforms itself. Learning and training are an essential element of ensuring that the RCAF remains as an agile, relevant and knowledgeable organization. Keeping training costs under control becomes an issue if training is not properly planned and technology is not properly leveraged for effectiveness and efficiency.

Problem Breakdown: The S&T Enterprise can assist the RCAF in reducing training costs by examining different areas that may affect the cost of training. As training costs are becoming higher and higher, there is a need to examine how training can be done differently. Three key areas addressed by the S&T Enterprise include: Human Resource (HR) Foresight/HR Planning; holistic training programmes; and training systems and tools.

DND/CF stakeholders: DG Air PERS, D Air PERS Strat.



Pictorial Representation of S&T Way Ahead for Objective 9

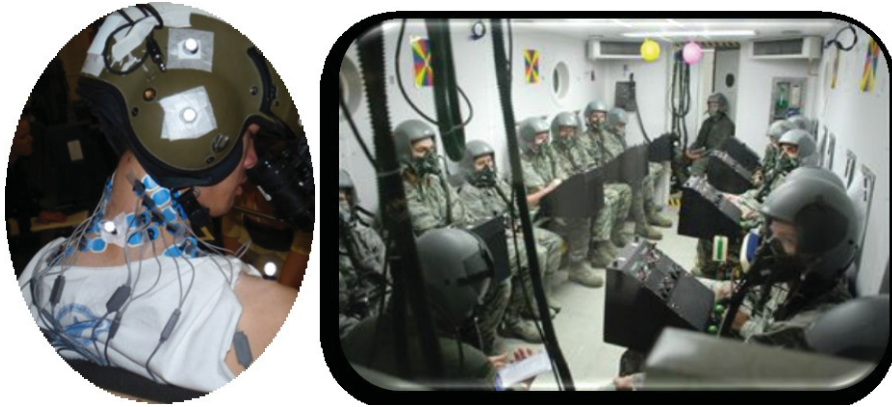
S&T Way Ahead: In order to answer the S&T requirements set by the Objective 9 Problem Breakdown, the S&T Enterprise can support the RCAF by:

- Focusing on the effects of changing demographics and operational environments on RCAF recruitment, retention and maximizing personnel efficiencies, and reduce attrition using HR modeling tools;
- Developing standardized assessment of training program and curriculum to avoid duplication and to ensure training effectiveness against well defined competencies;
- Exploiting current and future training tools and technologies (virtual, synthetic) and exploring intelligent learning systems (intelligent tutoring, accelerated, adaptive and embedding learning paradigms) that are cost effective.

S&T Enterprise Capability: The vast majority of the capability to support this objective already exists and resides primarily in the S&T Enterprise. Areas where S&T will need to be developed include foresight studies on HR requirements, operational environments and peer-to-peer learning potentials. Furthermore, the Enterprise may leverage the efforts by CDA on IT&E Modernization Strategy to ensure training relevance, and may maximize training output efficiencies by selectively contracting training to the private industry.

S&T Delivery Centres: DGMPRA, RMC, CFLI, CDA, DRDC Toronto, DRDC Valcartier, DRDC CORA, DRDC Ottawa, DRDC Atlantic, Universities, DGPFS.

11. AFSTID Objective 10 – Enhance the Man/Machine Interface

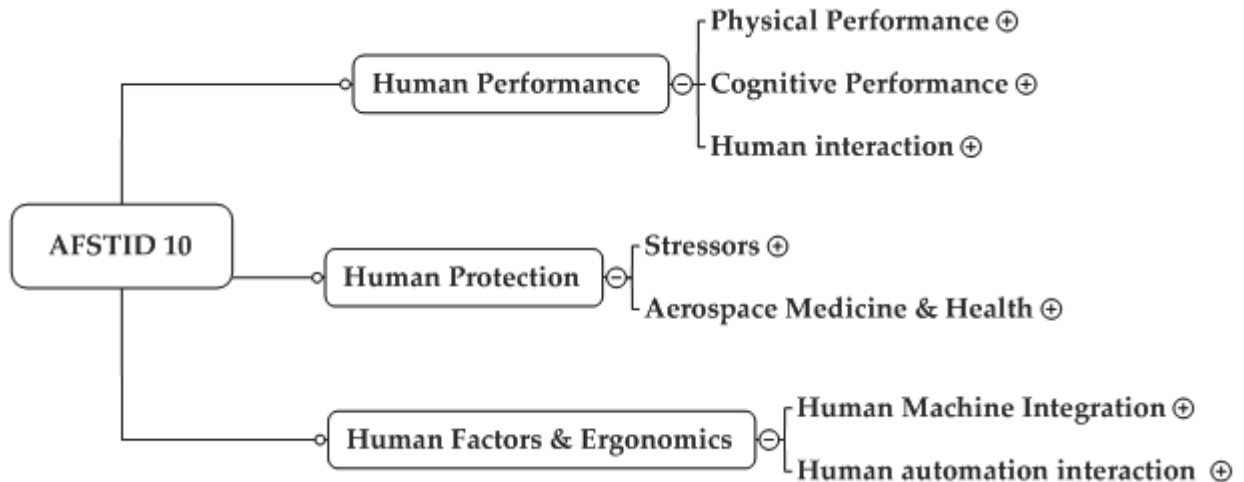


Objective Statement: Develop new concepts and relevant technologies to enhance the “man/machine” interface in order to maximize the utility of new and existing equipment and methodologies.

Relevance to the RCAF: With the advance in technologies, effective operations depend on the understanding of human systems across multiple domains and seek to expand beyond traditional cockpit performance. There is a requirement to deal with the broader expeditionary, demographic challenges and emerging technologies relevant to the RCAF. Specifically, research that will address aerospace life support, medicine, health, protection, survivability and research that can enhance individual and group performance are required. In addition, research that will enhance humans and machines interaction through improved interfaces, for example, in multiple manned, unmanned systems and networked enabled Air Force will maximize the utility of new and existing equipment and technologies.

Problem Breakdown: Optimization of the synergy between human and machine/system elements requires the understanding of the characteristics that define and shape human performance and protection and human-machine interaction at the individual and collective levels in a myriad of operational stressful environments.

DND/CF Stakeholders: DASP, DAR, DFS, SAR, 1 Cdn Air Div, 2 Cdn Air Div, CFHS.



Pictorial Representation of S&T Way Ahead for Objective 10

S&T Way Ahead: In order to answer the S&T requirements set by the Objective 10 Problem Breakdown, the S&T Enterprise can support the RCAF by:

- Focus on various factors, technologies, cultural awareness and human interaction behaviour that can sustain and enhance cognitive and physical performance;
- Inform personnel on the principles, procedures and techniques for global survival and provide effective life support equipment/systems for extreme and stressful operational environments;
- Apply the knowledge of human abilities and limitations of system designs in order to optimize the interaction between human and system elements to enhance safety, performance and satisfaction; and develop framework for human centred flexible and fault tolerant autonomous systems.

S&T Enterprise Capability: Subject-matter-experts in various areas of human performance, protection and human system integration reside within the DRDC enterprise. It is in a strong position to deliver recommendations, guidelines for doctrines, procurement decisions, and assessment of the protection vs. performance trade-off.

S&T Delivery Centres: DRDC Toronto, DRDC Valcartier, DRDC CORA, NRC.

References

- [1] Air Force Science & Technology Implementation Directive, July 2010
- [2] B. Arbour, LCol P. Holst, B. Cheung, Air S&T Strategic Road Map, DRDC Corporate TM 2012-004, September 2012.
- [3] Defence S&T Strategy: Science and Technology for a Secure Canada, December 2006

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In response to the Air Force Science & Technology Implementation Directive (AFSTID) published in July 2010, DRDC Partner Group 3 (PG3)-Air produced a science and technology (S&T) Strategic Road Map as a long-range planning process to ensure that DRDC meets the S&T requirements of the Royal Canadian Air Force (RCAF) in providing timely deliverables and advice on long-term science and technology. This document presents a series of 2-page high-level fact sheets derived from the Air S&T Strategic Road Map, one for each of the AFSTID objectives. The aim is to quickly introduce, in a clear and concise manner, the strategy in addressing the AFSTID objectives.

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