

PLAN PEGASUS



Canadian Forces Experimentation Centre

*Canadian Forces Joint Concept
Development and Experimentation Plan
(CF JCD&E Plan)*

June 2005



FOREWORD

1. *Plan Pegasus 05* is the CF's strategic plan that details intended Joint Concept Development & Experimentation (JCD&E) activity for the coming year and outlines intentions for the next several years. Much has been learned through the execution of previous versions of *Plan Pegasus* about the potential that a coherent JCD&E approach has for our future force development. In particular, changes to the strategic environment departmentally, nationally and internationally, all point to the value to be gained by continuing to invest in a capacity that anticipates change and proactively seeks to optimise future CF capabilities cooperatively and cost effectively. The decision to transition the Joint Experimentation Capability Project (JEC) from definition to implementation is tangible proof of the broad based recognition of its value.
2. The successes in the execution of *Plan Pegasus 04* in Multinational Experiment 3 (MNE 3), the Joint Warrior Interoperability Demonstration (JWID) and the Atlantic Littoral ISR Experiment (ALIX), not only maintained and increased the CF's stature in the international CD&E community, they underscored the validity of our efforts in understanding concepts related to the areas of *Command and Control (C2)* and *Information and Intelligence (I2)*. They buttress the perspective outlined here last year that, in the "Information Age," the areas of initial Joint CD&E emphasis should relate to the acquisition, movement and management of information. Recent and projected operations cement the view that "understanding the operational environment and making sound, rapid decisions consistent with the Commander's broad intent at the lowest possible level, will be critical elements in the future integrated battlespace...."
3. The past year also highlighted a requirement for a more holistic, 'Team Canada' consideration of achieving desired "effects." Government direction, the evolving strategic environment and the recently articulated Chief of Defence Staff's (CDS) vision of joint, integrated and interdependent CF Task Forces, all point to new approaches and the engagement of numerous new partners, both civil and military. Through MNE, CWID and ALIX much was achieved to advance initiatives in these areas; however, much work remains to be done.
4. In many respects, 2005 represents a year for the CF to learn much from the analysis of the data, information and knowledge that has been acquired through the very hectic pace of the early years of implementing the JEC project. It is also a year when many of the management functions relating to JCD&E will evolve. It is appropriate, therefore, that the focus for *Plan Pegasus 05* be on solidifying JCD&E lessons learned, promoting the refinement of the JCD&E process and preparing for the attainment of Full Operational Capability. Laying this foundation will be key to the successful achievement of the transformation of the CF that has been put into play.
5. Comments on this plan may be forwarded to CFEC, the unit responsible for coordinating its production with departmental CD&E stakeholders.

Lieutenant General MJ Dumais, CMM, CD
Deputy Chief of the Defence Staff
April, 2005



EXECUTIVE SUMMARY

1. *Plan Pegasus 2005* is the strategic plan of the Canadian Forces (CF) that describes intended future Joint Concept Development and Experimentation (JCD&E) activities. It supersedes the previous plan endorsed by the Joint Capability Requirements Board (JCRB) in February 2004. The guidance provided by this strategic plan profits from the experience gained in the execution of previous Plan Pegasus' and is predicated on further development of the Joint Experimentation Capability (JEC) Project and the continuing maturation of the CD&E process.
2. Initial Operational Capability (IOC) of the Canadian Forces' Experimentation Centre (CFEC) was declared in November 2003. The Minister of National Defence approved transitioning the JEC project into the implementation phase in November 2004. It is anticipated that this will lead to construction of purpose-built facilities commencing in mid-2005 with building occupancy towards the end of 2006. It is expected that the declaration of Full Operational Capability (FOC) will follow demonstration of the experimentation facility's battle lab capabilities in the execution of a synthetic environment-based simulation event under the *Pegasus Series* of national joint experimentation. This event is in its initial planning phases and its success will be dependent upon assignment of appropriate personnel, technology and fiscal resources.
3. The major activities outlined in *Plan Pegasus 04* were successfully executed:
 - a. Concept development was advanced in:
 - (1) Net Enabled Operations (NEOps) through a major symposium hosted by the VCDS as well as lessons learned derived from the Atlantic Littoral ISR Experiment (ALIX);
 - (2) Advanced Collaborative Autonomous Robots (ACAR) through live demonstrations and presentations to JCRB; and
 - (3) Sustainment through support to the development of a Sustain JCAT Campaign Plan.
 - b. Command and Control *integrating concepts*, and experimentation and prototyping activities were conducted in the *functional concept* areas of:
 - (1) Collaborative Information Environment (CIE);
 - (2) Effects-based operations (EBO) and the supporting Operational Net Assessment (ONA) and Knowledge Management (KM) during Multinational Experiment (MNE) 3; and
 - (3) The Joint Warrior Interoperability Demonstration (JWID).
 - c. Within the integrating concept area of *Information and Intelligence*, the highly successful ALIX employed a Medium Altitude Long Endurance (MALE), Beyond Line of Sight (BLOS), multiple payload uninhabited aerial vehicle (UAV) within an Integrated Intelligence, Surveillance and Reconnaissance Architecture (IISRA). Lessons learned from previous CFEC experimentation activities in airspace integration, flight approval authority, frequency management, UAV staffing, and information exploitation were



reinforced. Additionally, significant understanding was progressed into the practicality, implications and benefits of becoming net-enabled for the conduct of operations. Many of these lessons and observations have already been applied to operations and are shaping the further development of a number of related, ongoing departmental initiatives in C4ISR.

- d. In support of these efforts, the Synthetic Environment Coordination Office (SECO) made significant advances in Modeling and Simulation (M&S) policies and standards; establishing a framework for an M&S Resource Repository (MSRR); shaping the approach to Verification, Validation and Accreditation (VV&A); and, to increasing the understanding and exchange of information regarding the utility of M&S and synthetic environments in force development and capability acquisition.
4. Given the dynamic, multifaceted and still maturing nature of Joint CD&E, a number of departmental, national and international initiatives and changes occurred during 2004 that will affect the future conduct, understanding and management of CF JCD&E activities.
 - a. Within DND/CF, continued refinement of the *Strategic Operating Concept* (SOC) that will incorporate the significant work on the CF joint operating concept, is expected to better focus future areas of investigation for JCD&E. As well, re-alignment of the management of concept development to better define strategic (VCDS) and operational (DCDS) responsibilities, plus interest in refining and expanding the joint capability management framework, are likely to impact the prioritization process and direction for future experimentation and concept implementation.
 - b. Nationally, successful engagement of other government departments (OGD) was progressed during MNE 3, JWID and ALIX. These advances, plus the government's interest in promoting a more integrated approach for the planning, coordination and conduct of security and defence activities (as directed in the recent National Security Policy), are expected to generate increasing interagency interest in CF JCD&E – particularly that which relates to management of information exchange in the realm of C4ISR. The results from ALIX are having a significant impact on the development of the Joint Intelligence and Information Fusion Capability (JIIFC) and the Maritime Security Operations Centres (MSOCs) which, in turn, are informing the development of the government's operations centres being developed by Public Security and Emergency Preparedness Canada (PSEPC).
 - c. Internationally, the execution of *Plan Pegasus 04* continued to give Canada a high profile within the international CD&E community. Active solicitation was received from NATO NATO Allied Command Transformation (ACT), the US, UK, Australia, People's Republic of China, Germany, Norway, Singapore and Sweden into CF JCD&E procedures and development. International findings from MNE 3 delayed the conduct of MNE 4 until 2006, with the intervening period devoted to refinement of the EBO process, organisation and technology through the conduct of a series of collaborative, multinational Limited Objective Experiments (LOE). Canada is leading the MN LOE in Knowledge Management (KM). Canada continues to be a leading participant in CWID



(renamed Coalition WID vice Joint WID) and is an active player in furthering the Combined Federated Battle lab Network (CFBLNet). Late in 2004, the US designated that all of its future Title X war games will be “joint” with Joint Forces Command (JFCOM) being a major planner. This initiative spurred development of a National Security Workshop within the US government, to which several coalition allies were invited, that helped shaped the geo-political and interagency framework for the conduct of these war games for 2005. The primary implications for Canada revolve around increased strategic and interagency visibility in these war games and the requirement for joint (versus service specific) coordination of participation. Future VCDS, DCDS and OGD involvement is under active consideration.

5. Combined, the aforementioned promise to significantly influence the direction of future CF experimentation, thus the preparation of this strategic CF JCD&E Campaign Plan. Given these realities, *Plan Pegasus 05* is presented as a work in progress leading towards laying the foundation for achieving FOC in the expected future environment. With these perspectives in mind, the following assumptions were used in developing the 2005 CF JCD&E Campaign Plan:

- a. It is anticipated that the identification of the CF joint force development functional capability areas outlined in the Strategic Capability Investment Plan (SCIP) will be adopted. Consequently, the terms *Command and Sense* (combining the former areas of *Command and Control* and *Information and Intelligence*), *Effective Engagement* (replacing *Conduct Operations*), *Support, Sustain and Mobility*, (replacing *Sustain*) and *Force Generation* (replacing *Generate*) have been adopted for use in this version of *Plan Pegasus*. The proposed CFEC FOC experiment team organization reflects these terms.
- b. Although concept development responsibilities between VCDS and DCDS are under review and likely to result in process change during the period of this campaign plan, the overall thrust of current concept development activity is not. As a result, exploratory and detailed concept development activity outlined in *Plan Pegasus 05* reflects responsibilities and initiatives of the organizations that currently exist.
- c. Until such time that the CF SOC is promulgated, national experimentation will be largely restricted to delivering currently conceived national C4ISR capabilities and maintaining C4ISR and Sustainment interoperability with our coalition partners. Once articulated, it will begin to spur and inform development of concepts for how the CF will operate as a joint, integrated force. In turn, this will identify and help prioritize experimentation activities in the functional capability area of *Effective Engagement*, which will identify other avenues for national concept development and experimentation in the remaining functional capability areas. The proposed CFEC FOC organization and initial planning for the *Pegasus Series* of national experimentation is framed in anticipation that guidance from the SOC and the CDS’ recently initiated CF re-orientation will be forthcoming.
- d. At the time of writing, there were no indications of intention to significantly augment CFEC’s currently assigned personnel resources. As these resources are already completely engaged in previously committed national and international experimentation



activities, new initiatives will need to be accompanied by the appropriate personnel, fiscal and infrastructure resources required to execute them. Failure to do so risks detriment to:

- (1) Current personnel from work-related stress and overtime;
- (2) Efficient progress of future initiatives due to lack of analytical exploitation of results from previously conducted activities; and
- (3) International standing with and access to CD&E organizations, particularly JFCOM.

6. Given the foregoing, *Plan Pegasus 05* proposes to allocate anticipated CF JCD&E resources in support of activities in five principal areas:

- a. Advanced concept development will continue in EBO, 'Network Enabled Operations' and ACARs. Concept development in support of the future *Sustain* JCAT's campaign plan will be furthered. Initial 'scoping' activities to plan a venue (wargame, crisis management event, etc.) and develop a synthetic environment in support of *operating concept* development will be pursued.
- b. Concept development in C4ISR and Sustainment through active experimentation will be focused on maintaining and promoting interoperability with likely coalition partners by continued CFEC coordination of CF participation in multinational experimentation venues such as CWID and MNE. Leadership of the multinational LOE for KM will be a significant activity. Coordination of future Canadian participation in US Title X joint war games will be developed in concert with DGJFD and DGSP staffs.
- c. With the successful completion of the previously planned UAV and IISRA experimentation campaign culminating in ALIX, analytical resources will be focused on analyzing amassed data to maximize identification of the requirements for and implications of achieving such capabilities. Resources permitting, lessons identified will be transferred to aid in the development of the UAV Joint Program Office, JIIFC, MSOCs and in support of the C4ISR Campaign Plan.
- d. Significant effort will be devoted to progressing achievement of the procedures, resources, and partnerships required to develop the optimal organization, processes and technologies needed to exploit the potential of the JEC project. This includes incremental achievement of the proposed FOC organization; monitoring and, where resources permit, assisting refinement of the future CF SOC and its implementation; furthering the interaction of CD&E partners within the CF, government and the international community; and, laying the foundation for the future synthetic environment capabilities of the intended CFEC Battle lab and federated components when required.
- e. SECO will continue the MSRR and VVA initiatives; promote awareness of models and synthetic environments within the department; and, support CFEC towards improving an in-house M&S capability.

7. Given the resources available and the work plan envisioned, it is not expected that CFEC will have significant demand upon, or engagement with, Strategic Collective Training Plan



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(SCTP) events and the Strategic Exercise and Experiment Reserve (SEER) in FY 05/06. Implementation of the *Pegasus Series* of national experiments in support of the *Effective Engagement* capability area and the resulting resource implications, if any, for FY 06 and beyond will be refined during execution of *Plan Pegasus 05*.



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CF Experimentation Centre (CFEC)

Mission

As the Centre of Excellence for Joint CD&E, CFEC will lead the exploration of emerging concepts and the experimentation of capabilities that support CF transformation.

INTRODUCTION

1. *Plan Pegasus 05* (PP-05) is the strategic plan of the Canadian Forces (CF) that describes intended future Joint Concept Development and Experimentation (JCD&E) activities. It supersedes the previous plan endorsed by the Joint Capability Requirements Board (JCRB) in February 2004.

PROGRESS OF CANADIAN JCD&E IN A DYNAMIC ENVIRONMENT

2. The development and progress of Canadian JCD&E activities continued their rapid pace during the execution of *Plan Pegasus 04*. Significant JEC/CFEC accomplishments are outlined below, followed by broader departmental, national and international changes in the CD&E community.

JEC/CFEC 2004 Accomplishments

3. Specific to the JEC project:
 - a. The CF JCD&E Concept of Operations was updated and approved;
 - b. CF JCD&E Standard Operating Procedures (SOP), to describe the JCD&E process from concept through experimentation to the integration of new capabilities, were published; and,
 - c. Ministerial approval was given to transition the Joint Experimentation Capability (JEC) Project from development to implementation, which, in essence, approves the construction of a new facility for CFEC. Construction is expected to begin in the fall of 2005 with building occupancy currently scheduled for the early 2007. The goal is to declare Full Operational Capability (FOC) within six months of the demonstration of the new facility's battle lab capabilities.
4. CFEC has continued to mature and to increase its presence within the national and international CD&E community:
 - a. A FOC organization for CFEC was submitted as part of FY 05/06 Business Plan and is included in Annex E;



- b. Through its national leadership in the Multinational Experiment series (MNE), the Joint Warrior Interoperability Demonstration (JWID) and the Atlantic Littoral Integrated Information Surveillance and Reconnaissance (ALIX) Experiment, CFEC has furthered its rapport with other government departments (OGD) with respect to ongoing national and international JCD&E;
 - c. CFEC continued to promote integration of CD&E activities vertically within the CF to identify synergies and to optimize harmonization; and, horizontally within the broader multinational and multi-agency CD&E community to identify best practices, opportunities for collaboration and concepts appropriate for adoption by the CF (A table listing these engagement activities is included at Annex B); and,
 - d. The Canadian Forces Experimentation Network (CFXNet), the Canadian portion of the global Combined Federated Battle Lab Network (CFBLNet), continued to expand within the Canadian JCD&E community.
5. Significant CD&E accomplishments achieved during the execution of *Plan Pegasus 04* are presented according to their areas of activity:
- a. Concept Development was furthered in the *Effects Based Approach (EBA)* integrating concept along with significant foundation work in preparing for and executing a highly successful major international symposium on *Net Enabled Operations (NEOps)*. Additional significant effort was spent in researching, demonstrating and highlighting the potential use of *Adaptive Collaborative Autonomous Robots (ACAR)*.
 - b. From an experimentation perspective, much work was progressed in the *Command and Sense* and the *Support, Sustain & Mobility* functional capability areas.
 - (1) Within *Command and Sense*, emphasis continued on maintaining and enhancing coalition interoperability and on supporting national surveillance and IISRA initiatives.
 - (a) On the *Command* side, significant experimentation and prototyping activities in Effects Based Planning (EBP), Collaborative Information Environment (CIE) and the supporting Operational Net Assessment (ONA) were conducted during MNE 3 and JWID 04. EBP was the focus of MNE 3 in preparation for coalition interoperability experimentation transitioning to Effects-based operations (EBO) in MNE 4 (February 2006). During MNE 3, it was realized that the EBP process had a number of shortcomings that required resolution prior to conducting MNE 4. It was decided to use a series of Limited Objective Experiments (LOE) to address them and CFEC volunteered to lead the multinational effort in Knowledge Management (KM) with a planned experiment in 2005. During JWID 04, Canada led five Coalition Interoperability Trials (CIT) and participated in a further thirteen. Defence Research and Development Canada (DRDC) Valcartier successfully field-tested its mobile Collaborative Operations Planning System



(COPlanS) connected to the CF Experimentation Network (CFXNet) at Shirley's Bay.

- (b) Regarding *Sense*, CFEC completed its experimentation campaign plan to assess the employment of Uninhabited Aerial Vehicles (UAV) and their potential contributions to an Integrated Information, Surveillance and Reconnaissance Architecture (IISRA). The final live field experiment took place in August 2004 and involved integrating a Beyond Line of Sight (BLOS) UAV into previously scheduled strategic collective training exercises Narwhal and ARCON. It successfully tested the integration and exploitation of multiple sensors supporting an IISRA, including the assessment of UAV employment as a sensor platform, and produced a Common Operating Picture (COP) incorporating land, sea, air and space based sensors, weapons and decision makers at the three levels of command (tactical, operational and strategic). Of particular note was the expansion of the network into OGDs through the use of Web based technology over the Canadian Maritime Network (CANMARNET). Not only was it a most successful experiment, but it was the first pragmatic assessment of a net-enabled operation and a proof of concept for the future of North American surveillance. The results are being passed to DJFC for further exploitation of a joint UAV capability for the CF and to exploit lessons learned regarding NEOps for consideration within the national surveillance architecture, the C4ISR Campaign Plan and the Joint Information and Intelligence Fusion Capability (JIIFC) project.
- (2) In the functional concept area of *Support, Sustain & Mobility*, work was progressed with the Sustain Joint Capability Assessment Team (JCAT) in exploring conceptual developments related to logistical support requirements to determine the most fruitful opportunities for transformation prior to preparation of an experimentation campaign plan. Additional significant work and support in the development of logistics concepts and experimentation venues was also provided to the multinational community through cooperation with NATO Allied Command Transformation (ACT) and the Multinational Interoperability Council (MIC) Logistics Working Group (Log MIWG).
- c. The Science and Technology (S&T) and the Operational Research Analysis (ORA) teams also had a busy year working closely with CFEC's experimentation teams to ensure scientific rigor in the design, conduct and analysis of experiments. Nationally, they supported the analysis of the Pacific Littoral ISR Experiment (PLIX) and the design and conduct of ALIX. Given the scale of ALIX, additional members of the OR and S&T communities were recruited to augment the scientific effort and to engage in certain aspects of the analysis. In multinational experimentation, through its lead in the assessment of technology requirements for EBP, the assessment of KM within the CIE, and for developing elements of an ONA, Canada made significant contributions to the U.S. Joint Forces Command's final report of MNE 3. During JWID 04, the ORA team led the design, planning and analysis of CITs and facilitated participation in multinational trials in C4ISR and interagency information sharing. Within the international defence science community, members of the S&T/ORA teams were also actively involved with



the NATO Research and Technology Organization (RTO) panel on Human Factors and Medicine, and The Technical Cooperation Program (TTCP). ORA contributions, particularly in capturing best practices, lessons learned and case studies from the conduct of military experimentation, greatly enhanced the work of TTCP Joint Systems Analysis (JSA) Action Group 12 in their work to develop a guide for understanding and interpreting defence experimentation.

- d. The Synthetic Environment Coordination Office (SECO) made substantial progress in adopting the role of departmental Modeling and Simulation (M&S) policy and standards coordinator. Final drafts of Defence Administrative Orders and Directives (DAOD) governing the implementation of M&S are on circulation for approval. As M&S has significant potential for application in CD&E, Research and Development (R&D), training and Material Acquisition and Support (MA&S), the departmental Synthetic Environments Working Group (SEWG) has been active in publicizing ongoing M&S work. Efforts are now underway to encourage equivalent committees within the jurisdiction of each Level 1 making use of M&S. Finally, work is ongoing to develop a DND Modelling and Simulation Resource Repository (MSRR) to catalogue the various models and synthetic environments that currently exist. SECO was also the prime organizer and coordinator of CFEC's fall workshop that brought together operators and subject matter experts (SMEs) to determine the M&S and SE requirements for CFEC's future battle lab.

The Dynamic CD&E Environment

6. The foregoing JEC and CFEC activities were accomplished in a dynamic national and international CD&E environment. Some of the noteworthy changes, evolutions and advancements in areas of interest relevant to national and international CD&E were:
 - a. There is an ongoing discussion between the DCDS and VCDS regarding responsibilities for Concept Development.¹ The preliminary establishment of CFEC (a DCDS organization) assigned this function to the co-located Advanced Concept Development (ACD) cell of Directorate Defence Analysis (DDA), a VCDS organizational element. Since CFEC's inception, however, it has become apparent that concept development and experimentation are not necessarily two distinct entities. Theoretically, both notions of concept development and experimentation may be considered in isolation. Given the learning that occurs through spiral development, however, the reality is that *operationally relevant* concepts are developed and refined through experimentation.² Therefore, while ACD has conducted notable concept development work through its support to CFEC experimentation, conceptual 'tensions' have arisen from having a single small concept development cell responsible for both Tier 1-Horizon 3 and Tier 2-Horizon 2 focused

¹ This issue was initially identified at paragraph 14, note 5, of *Plan Pegasus 04*.

² The consideration of relevance is largely temporal in that operational (versus scientific) experimentation requires relatively nearer term policy, operational, legal, technical, economic and moral contexts for it to be appropriately designed and conducted. This differentiation is not meant to denigrate the importance of, or requirement for, long range strategic 'blue-sky' thinking and concept development. Nor is it intended to discount 'out-of-the-box' disruptive concepts that have applicability in the nearer term.



concepts.³ An in-depth study was sponsored by DDA and the results point towards relocating this section back within DDA in NDHQ. Experience gained in the conduct of JCD&E, however, indicates that the CF requires concept development resources devoted to both levels. At the strategic level, there is a clear need for Horizon 3 “blue sky” evolutionary and disruptive thinking to identify the future security environment and its technological, sociological and operational implications for the future CF. The DCDS, however, also requires operationally focused concept developers that can mature and transition appropriate and more temporally relevant ideas and potentially disruptive concepts through experimentation for nearer term CF capability integration. The CFEC FOC manning proposal recognizes this requirement and includes a DCDS level Concept Development cell. Work to resolve this issue continues; however, it is anticipated that the embedded VCDS cell may be relocated in mid-2005.

- b. Significant work was progressed during 2004 on the development of the CF Strategic Operating Concept (SOC) and a joint operating concept entitled Joint Vision 2015 (JV2015). These foundation documents were to provide the conceptual framework to describe the conduct of future joint CF operations; which, in turn, would describe the areas of greatest interest for future research, concept, experimentation and capability development. Late in the development of this version of *Plan Pegasus*, however, a reorientation of the future CF was articulated that fundamentally challenged many of the assumptions upon which these draft documents were based. As understood, this reorientation focuses future force development on the more probable threats posed to Canada from asymmetric threats versus the less likely near competitor - international conflict. As such, it contains an interagency and binational security and defence focus that will be supported by prosecution of foreign-based asymmetric threats with joint, integrated CF force packages capable of rapidly conducting operations independently and with our coalition partners in support of Canadian national interests. At this juncture, it is understood that the SOC is being redrafted to incorporate many of the elements of JV2015 and that an integrating concept for joint operations will follow. It is anticipated that the full implications of this reorientation, which will be significant and broad based from structural, organizational and process perspectives, will become apparent late in 2005. In the interim, it is assessed that the current focus of this version of *Plan Pegasus* on capturing the lessons of the work to date and laying the organizational foundation for future experimentation activities (which will support this reorientation) are sound.
- c. It is anticipated that this reorientation will reinvigorate the refinement of the capability management process itself. To date, of the five existing capability areas within the capability based planning construct,⁴ only the *Command and Control and Information and Intelligence (C2I2)*, and the *Sustain Joint Capability Assessment Teams (JCAT)* have been stood up. It is anticipated that definition of the operational vision will spur the stand up of the *Conduct Operations JCAT*. As noted in the draft SOC, it is also anticipated that

³ During 2004, ACD provided excellent Tier 2 support in assisting with EBP for MNE 3 and MNE 4; assembling a CONOPS for a proposed IISRA in support of ALIX; and furthering progress in NEOps, while at the same time trying to satisfy Tier 3 requirements for long range strategic conceptualizing.

⁴ The five existing capability areas are: Conduct Operations, Command and Control and Information and Intelligence (C2I2), Sustain, Generate and Corporate.



the names of the *C2I2* and *Conduct Operations* JCATs are likely to be changed to *Command and Sense*, and *Effective Engagement*, respectively. CFEC has reoriented its experimentation teams and this JCD&E campaign plan with that expectation in mind.

- d. A harmonization initiative, sponsored by VCDS, is underway to align Defence Planning & Management (DP&M) processes. This will likely impact the management and processing of prospective concepts under development and their resultant capability delivery. This initiative will encompass the following departmental processes:

- (1) Strategic Visioning;
- (2) Capability Based Planning;
- (3) Resource Prioritization;
- (4) Business Planning;
- (5) In-Year Management; and
- (6) Performance Management.

- e. The Environmental Chiefs of Staff (ECS) have progressed the establishment or expansion of their environmental CD&E capabilities. The CMS is acting on a report recommending expansion of the CF Maritime Warfare Centre (CFMWC) to include a CD&E capability structured similarly to that of CFEC. The CF Air Warfare Centre (CFAWC) is expanding its staffing and has undertaken further development of its processes with CFEC assistance. The CF Army Experimentation Centre (CFAEC) is moving into new facilities in Kingston to facilitate its ongoing CD&E activities.
- f. The United States has changed the preparation and conduct of the individual services' Title X war games. Previously planned and executed as a service specific activity where allied sister services were invited, the US government has mandated that US Joint Forces Command (JFCOM) co-sponsor all future war games. As a result, these war games will all be conducted as joint activities with other nations' invitations to participate being coordinated by JFCOM. While the mechanism for Canadian participation continues to be refined, it is anticipated that DGSP will liaise with JFCOM and other government agencies to coordinate broad Canadian participation, while DGJFD/DPDT will coordinate joint and service-specific Canadian participation.

7. The foregoing provides an insight into the dynamic and rapid pace of events that is driving the joint CD&E world. That CFEC has been able to continue to take a prominent role in national and international activities is a testament to the dedicated efforts of its small, multidisciplinary military and civilian staff. For information, a list of papers, reports, publications and major presentations produced in FY 04/05 by CFEC and its personnel in the course of assigned duties has been included at the end of this document.

PROPOSED JCD&E ACTIVITIES FOR 2005 – 2009

8. *Plan Pegasus-05* gives an overview of intended current (FY 05/06) and projected (FYs 06-09) JCD&E activities. In recognition that CFEC is currently only at Initial Operational Capability (IOC) and that resources (facilities, people and fiscal) are anticipated to remain



limited for the period covered by this version of *Plan Pegasus*, immediate future JCD&E initiatives must be measured. Indeed, the efforts described in this JCD&E plan are aimed at completing the analysis and reporting of previously conducted activities (PLIX, JWID, MNE 3, ALIX), preparing for previously committed support in multinational events such as the Coalition Warrior Interoperability Demonstration (CWID) 2005 and MNE 4 supporting the work of JCATs where appropriate, and to laying the foundation for achieving Full Operational Capability (FOC). Any new initiatives not identified within this plan must provide their own resources and be oriented towards maximizing the benefits within those areas that are specific to the CFEC mandate – namely, promotion of concepts and capabilities with joint application at the operational level.

9. The following is an overview of the intended concept development, experimentation and modeling and simulation activities for the period of 2005-09. It progresses the direction and work laid out in *Plan Pegasus-04* and continues to support refinement of the broader force development process. The actual progression of work will depend upon a number of factors including the refinement of the concepts themselves, pace of international collaboration, discoveries and CFEC's capacity. It can also be expected that new priorities may be provided in response to changes in operational, organizational or policy initiatives throughout the year.

10. This work plan reflects the division of labour under the proposed CFEC FOC organization and uses the major headings of ACD, Joint Experimentation, International Programmes, Synthetic Environments and Battle Lab, Operations Research Analysis and SECO. Within each section as appropriate, information on previous CD&E activity may be included to aid clarity and a working 'hypothesis' statement may be provided to orient the reader to the general thrust (vice the definitive experiment hypothesis) of an activity. The plan concludes with a discussion of some considerations relevant to the proposed FOC.

⁵ Plix = Pacific Littoral Intelligence, Surveillance & Reconnaissance (ISR) eXperiment. JWID = Joint Warrior Interoperability Demonstration. MNE 3 = Multinational Experiment 3. ALIX = Atlantic Littoral ISR eXperiment.



ADVANCED CONCEPT DEVELOPMENT (ACD)

11. The ACD team is an element of DDA co-located at CFEC. Its focus is on identifying, researching, exploring and developing emergent concepts and applying analytical rigor to amplify and assess those concepts that will, in turn, inform force development and other DND/CF policy and programs. A concept can be thought of as an idea or theory describing the conduct of military operations and/or generation of Departmental capabilities. Implicit in the definition is that an Advanced Concept has a temporal component, a future focus that addresses future warfighting and forces. As such, it may challenge traditional doctrine, norms and policies. Concepts evolve with technology and serve to stimulate and enable “Transformation.” An understanding of the relationships between concepts is required to facilitate prioritization. While the following describe some of the concepts being examined, it should be noted that considerable effort will be devoted to institutionalizing CD&E co-ordination and developing a tool suite to support a Strategic Level war-gaming capability.

12. A distinction is often made between armed forces of today, tomorrow and the future. Doctrine captures current thinking and practices while future concepts, as they mature and are endorsed by JCRB, begin to guide force development. Proposed strategic operating concepts are designed for endorsement. Conversely, concepts such as EBO will remain a future concept whose hypotheses remain to be tested, and whose implementation implications remain to be investigated in the national context. ACD is entrusted with focusing on the realm of future concepts and, to complement CFEC’s mission, one of the management challenges is to identify and progress those concepts that can be transitioned to experimentation for further development.

13. The draft SOC, when approved, will become the Capstone Operating Concept for the CF. In the hierarchy of concepts, it will be supported by integrating, functional, and environmental operating concepts, each of which must include the core ideas of the SOC. Integrating concepts are those (Joint, EBA, NEOps) that describe how various broad core operational activities relate and will be integrated into a cohesive operating system. Functional concepts describe the performance of a military field of specialization within a broader operating context. These concepts have broad applicability throughout the CF and are aligned with the Strategic Capability Investment Plan capability thrust areas.⁶ Environmental operating concepts describe how individual Environmental Commands (ECs) conduct operations within the context of the SOC, the integrating, and the functional concepts. The concepts under active assessment are:

- a. Effects-based operations;
- b. Networked Enabled Operations (NEOps); and,
- c. Adaptive Collaborative Autonomous Robots;

⁶ SCIP Capability Areas = *Command and Sense, Effective Engagement, Support Sustain and Mobility, and Force Generation*



EFFECTS-BASED OPERATIONS (EBO)

HYPOTHESIS

14. If ends-ways-means synchronization (tools and processes) is improved, then an outcomes-based approach to planning and operations is possible. This would guide DND efforts and contribute to the achievement of national objectives.

15. This somewhat obtuse hypothesis means, in essence, that if an adversary is considered to be a system of systems and analysis is conducted to map out the relationship of each of its major elements to identify their vulnerable points of intersection, then the appropriate tools of national and coalition power (economic, diplomatic, information, military, political, moral, etc.) can be brought to bear to achieve the desired effects consistent with national objectives. For example, if an operational commander and staff employ EBO, then they will have the ability to create a holistic understanding and representation of the operating environment, the adversary, and friendly and neutral forces, sufficient to develop and refine an operational plan that establishes clear links between the commander's end states and the effects that must be created in order to achieve those objectives. He will be able to identify the joint, interagency, and multinational resources (military and non-military) needed to conduct the operation and will be able to assess the operation's progress towards achieving the desired end state.

CONCEPT DEVELOPMENT SCHEDULE

16. ACD will continue to explore and develop EBO as a national high-level integrating concept. The adoption of an effects based approach will rely heavily on enabling concepts – specifically the integration of a multi-disciplinary and multi-agency ONA in the EBP decision-making cycle.

17. A prerequisite for EBO is the development of appropriate theoretical and analytical constructs that consider and integrate political, military, economic, social, legal, ethical, environmental, information & infrastructure and science & technology (PMESII) dimensions across the conflict spectrum. Such a framework relates effects to actions and national objectives, provides for a continual assessment of operational outcomes, intended and unintended consequences, and facilitates the coordination and optimization of interagency efforts.

18. ONA and EBP will continue to be investigated collaboratively with allies in a series of multinational exercises and workshops. ACD will contribute to concept development and post exercise analysis. ACD's role also includes evaluation of the national implications. Accordingly, Research Notes will continue to be produced and collaborative linkages with the appropriate agencies, including DFAIT, PCO, SOLGEN and PSEPC, will be developed to provide a holistic appraisal.



19. Additionally, and in support of the Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Campaign Plan, the national headquarters organization will continue to be studied. Two distinct models - the US Standing Joint Force HQ construct and an ACD-proposed Joint Interagency C2 model – are being investigated. The latter envisages a deployable C2 construct with an imbedded Joint Interagency Co-ordination Group (JIACG).

SPONSOR: DGSP

COLLABORATION

Principal Canadian Partners: PCO, DFAIT, Sol Gen and DRDC

Principal Multinational Partners: US Joint Forces Command (JFCOM), UK Joint Doctrine and Concepts Centre (JDCC), NATO and The Technical Cooperation Program (TTCP)

DELIVERABLES

Post MNE 3 Analysis Reports, Research Note EBO, HQ Structure Spring 05

ANTICIPATORY FUTURES

HYPOTHESIS

20. If instability can be anticipated and mapped against Canadian interests, and success of intervention calculated, then the CF could be optimally positioned to support national interests.

CONCEPT DEVELOPMENT SCHEDULE

21. Considerable academic research has gone into developing indices to explain and predict instability and state failure, and to assess the opportunities for successful and timely intervention. The intent of this initiative is to investigate, introduce and integrate a quantitative approach and to assess the feasibility of relating predictive state failures to Canadian national interests. As noted in *Plan Pegasus 04*, the initial deliverable was to be a Project Report on methodologies, tools and prospects for Early Warning that might allow DND/CF to focus intelligence and direct contingency planning efforts. Unfortunately, contractual difficulties, resource availability and other work priorities have required further work in this area to be suspended.

SPONSOR: DGSP

COLLABORATION

Principal Canadian Partners: Carleton University, DG Int and ADM (Pol)

DELIVERABLES

TBD once work recommences



NETWORK ENABLED OPERATIONS (NEOps)

HYPOTHESIS

22. If forces are effectively networked and share information, enhanced synchronization will increase mission effectiveness.

CONCEPT DEVELOPMENT SCHEDULE

23. Network Enabled Operations (NEOps) can be defined as the conduct of military operations characterized by common intent, decentralized empowerment and shared information, enabled by appropriate culture, technology and practices. It offers the promise of the synergistic integration of personnel, technology, information, policy and doctrine in order to achieve increased operational tempo and responsiveness at lower costs and risk, through the leveraging of knowledge and capabilities, leading to enhanced operational effectiveness and efficiency. To date, many nations including the United States, United Kingdom, Australia and Sweden, have invested heavily in NEOps (at times under the heading of Network Centric Warfare (NCW), Network Centric Operations (NCO) or Net-Enabled Capability (NEC)). The US DoD Office of Force Transformation refers to NCO as “the core concept that guides the transformation of the U.S. military.” Activities include participation in the TTCP Tiger Team and support for the Departmental-level symposium co-sponsored by the VCDS, DCDS and ADM(S&T). ACD has drafted the initial Integrating Concept, will contribute to the production of Research Note and the Symposium Report and will continue participation in a US-led series of conceptual framework workshops and case studies. Following completion of these reports and draft Integrating Concept, it is intended that ACD will transition further refinement of this concept to the assigned operational sponsor.

SPONSOR

DGSP

COLLABORATION

Principal Canadian Partners: DRDC and ADM (IM)

Principal Multinational Partners: US JFCOM, Evidence Based Research Inc. (EBR), TTCP, UK JDCC and NATO

DELIVERABLES

Symposium Report

NEOps for the CF Research Note



ADAPTIVE COLLABORATIVE AUTONOMOUS ROBOTS (ACAR) IN CF COMBAT OPERATIONS

HYPOTHESIS

24. If enabling technologies emerge as anticipated, concepts of operation are developed, and their potential accepted, Adaptive Collaborative Autonomous Robots (ACAR) will both complement and enhance CF capabilities.

CONCEPT DEVELOPMENT SCHEDULE

25. This concept hypothesizes that in 25 to 30 years, robotic entities will be employable in combat operations either alongside humans or in place of humans. To date, a technology study/survey has been completed that indicates that many of the enabling technologies identified in the study are currently available and employed in real world applications but have not yet reached a level of maturity to implement the concept with any degree of trust. Today, although capable of operating with a degree of autonomy in redundant, simple tasks, robots are generally employed in a tele-operated mode which implies direct human control. In arriving at this juncture the ACD Cell has worked with the CDWG through 2004, conducted two seminars and made presentations at a JAG conference and to JCRB. Further work in this area requires assignment of a sponsor.

SPONSOR
DGSP

COLLABORATION

Principal Canadian Partners: DRDC, CMS, CLS and CAS.

Principal Multinational Partners: US JFCOM and Defense Advance Research Project Agency (DARPA)

DELIVERABLES

Presentation to JCRB

ACD RESOURCE IMPLICATIONS

FY 2005/2006

Personnel: Regular Force: 1PY, Civilian: 3PY.

Budget: \$338,000



JOINT EXPERIMENTATION

26. In an era of complexity and uncertainty, military experimentation employs a multidisciplinary approach based on the scientific method to rigorously examine emerging operational concepts. The anticipated outcomes of this experimentation are validated integration recommendations as to the utility and acceptability of the concept. The purpose is to mitigate risk associated with complexity to enable development of credible recommendations concerning concept evolution and force development decisions.

27. CFEC has built its organization around multi-disciplinary experimentation teams, each focused upon one CJTL Capability Area. Ideally, each team is aligned with a Level 1 sponsor and conducts its work in support of a JCAT. CFEC's experimentation teams were initially organized before the CF/DND had developed a structured hierarchy of concepts or other guidance to focus the JCD&E effort. With the advent of documents such as the National Security Policy and the emerging CF Strategic Operating Concept (CF SOC), the experimentation teams are being re-aligned to be in consonance with the future force development requirements contained in these documents. Additionally, an International Programmes Coordination Cell is being created to coordinate CFEC's extensive JCD&E collaboration with other countries and NATO. The following paragraphs lay out the revised experimentation team orientation and outline each team's intended activities.

EFFECTIVE ENGAGEMENT TEAM

INTRODUCTION

28. Anticipating that a Conduct Operations JCAT will be stood up to commence work in fulfilling direction contained in the CF SOC, CFEC will establish an Effective Engagement Team during 2005 to focus on the Conduct Operations and Force Protection Capability Areas as well as the tactical level⁷ of the Mobility Capability Area of the CJTL. This team will grow incrementally over the year with initial emphasis on gaining situational awareness on the topic and working with the ECS' and DCDS staffs to lay a strong foundation for developing the CF SOC's Joint Operations Integrating Concept. These CJTL Capability Areas are the core of combat power and represent the unique and most crucial military contribution to Canada's national instruments of power. They are also the areas most significantly affected by the developing reorientation of the CF as articulated by the CDS.

29. The nature of combat power is fundamentally shifting from mass to precision and agility. This requires detailed examination of how the CF needs to adapt to be capable of applying precision effects, which requires a shift from a platform-centric to a network-centric mode of operations, and from a kinetic weapons-based to an effects based approach to operations. Precision and agility, in turn, require the ability to operate more effectively in a joint and combined environment because the range, capability and lethality of precision fire have

⁷ The Strategic and Operational levels of the CJTL Mobility Capability Areas focus on strategic and operational lift and force movements and reception tasks, which are to be examined by the Sustain JCAT. The tactical level focuses on combat manoeuvre tasks.



increased the battle space such that individual service elements' combat power must be coordinated to reduce fratricide, respond to critical targets, provide flexibility and to reduce consumption of assets. Combat forces will increasingly be task-tailored and required to operate in a more distributed fashion, massing combat effect without massing forces to the same extent as in the past. Whether or not future CF contingents conduct joint operations independently or separately as part of coalition or Alliance combat components, the future military operating environment will require an enhanced joint and combined operations capability. JCD&E work in these Capability Areas require close coordination with the ECS Operating Concepts and their respective CD&E efforts to ensure that emerging operating concepts are aligned to be coordinated across all levels of war. The concept focus of the Effective Engagement team is outlined below:

CJTL Capability Areas	Integrating Concepts	Functional Concepts	Joint Employment Concepts
Operations (Conduct Operations, Mobility, Force Protection)	Joint Ops EBA NEOps	Effective Engagement	Joint Fires
			JIMP
			Joint Manoeuvre
			National Security

Table 1 – Effective Engagement Team Conceptual Focus

SPONSOR

30. The sponsor is DCDS, with collateral interest of the ECS'. This team should be aligned with a JCAT covering the CJTL Capability Areas of Conduct Operations, Force Protection and the Mobility (combat manoeuvre portions thereof) once it is stood up.

HYPOTHESIS

31. The hypothesis underpinning the eventual Effective Engagement experimentation campaign plan is:

If the CF had the capability to rapidly and globally deploy, operate and be sustained as a national joint force to conduct limited peace stabilization operations independently, and as tactically self sufficient units (TSSU) for combat operations in a coalition, then Canada's ability to pursue its national interests would be enhanced, thereby increasing its influence in international affairs.

EFFECTIVE ENGAGEMENT EXPERIMENTATION ACTIVITIES

32. Once established, resourced and the necessary situational awareness is attained, the Effective Engagement Team will begin developing an experimentation campaign plan encompassing the emerging operating concepts in the abovementioned CJTL Capability Areas. The Effective Engagement team will contribute to the development of the Effective Engagement



Functional Concept contained in the CF SOC, examine the emerging Joint Integrating Concept and will focus on developing collaborative linkages with the ECS-level CD&E efforts. Additionally, the team will become involved in the ongoing multinational effort examining emerging joint operational concepts such as Joint Fires, Joint Manoeuvre, and JIMP.

The *Pegasus Series* of Experiments

33. A key national initiative to be undertaken by the Effective Engagement Team will involve laying the groundwork for CFEC's proposed *Pegasus Series* of synthetic environment based experiments. These experiments will focus on examining the CF SOC's Joint Integrating Concept and the Effective Engagement Functional Concept using appropriate synthetic modelling and simulation tools to determine how the CF should conduct joint operations in both domestic and international contexts. It is intended that the first *Pegasus Series* event will serve as the proof of concept to demonstrate the capabilities of the future battle lab in the new facilities to support declaration of CFEC FOC.

34. Given its obvious relationship to *Plan Pegasus*, the JCD&E strategic campaign plan, the *Pegasus Series* is intended as the umbrella term for synthetically based operational level JCD&E. As such, it is intended to have the capability to investigate and validate implementation strategies for high level operating concepts. These experiments will focus on both domestic and expeditionary force planning scenarios under the monikers of *Pegasus Guardian* and *Pegasus Venture* respectively. The first event, *Pegasus Guardian 07*, is currently planned for mid-2007 and is intended to support the further refinement of potential future operating concepts in preparation for a proposed national live JOINTEX roughly 18 months later. At this point, it is proposed that the scenario setting for *Pegasus Guardian 07* be the 2010 Olympics in Vancouver. It is considered that this scenario is the most appropriate given its joint, interagency and littoral setting and the fact that there will be a requirement to plan and conduct joint interagency exercises in preparation for the actual event itself. Initial areas considered appropriate for modelling and simulation and experimentation in synthetic environments are thought to be joint and interagency command and control, CF force sustainment and CF force protection. Lessons learned in these areas should guide and inform the set-up and the conduct of both live exercises and the actual event itself.

35. Specific objectives will be established in the early planning conferences in conjunction with the appropriate sponsor and associated stakeholders, however, the following are likely candidates:

- a. Solutions to facilitate operational information sharing across Environmental and interagency domains;
- b. Solutions to address in-transit Security of information being shared between fixed information environments and mobile/tactical information providers/users;
- c. Enhanced Situational Awareness capability, scalable in both time and scope within and between information domains;
- d. Enhanced sharing of ISR products across information domain boundaries;
- e. Means or methods to transfer information between dissimilar databases in order to permit timely utilization by users within respective C4ISR systems;



- f. Concepts, Doctrine, SOPs, and Tactics, Techniques and Procedures (TTP) for use in the planning and conduct of Joint Operations within a National Security framework;
- g. Collaborative Planning supporting the conduct of Domestic Joint Operations; and
- h. Definition of required collective and individual competencies and skill levels supporting Joint Task Force Operations.

EE COLLABORATIONS

Sponsor: DCDS

Principal Canadian Partners: DCDS, ECS, DGJFD, NDHQ Joint Staff, CF JOG, JIIFC, NDCC, Sustain JCAT, J4 Mat/DG Log, CF JOG/JSG ECSs and other Government Departments.

Principal International Partners: US JFCOM/ Joint Logistic Transformation Center (JLTC)/ Joint Deployment Process Owner (JDPO), MIC Log MIWG and NATO CDE.

PEGASUS SERIES

Principal CF Partners: Proposed – DCDS, CF JOG, J2 Int, JIIFC, NDCC, J4 Log and CFMG.

Principal National Partners: Proposed – PCO, DFAIT, PSEPC, CCRA, RCMP, Vancouver City Police, Canadian Olympic Organizing Committee, and Vancouver City Olympic Committee.

Contributing Partner: Proposed – CFCS II, AFCCIS, LFC2IS, MCOIN, DRDC / COPlanS, COP 21 and the Command Decision Support Capability

EE RESOURCES

FY 2005/2006

Personnel: Regular Force: 0 PY. Res Force: 2 PY

Budget: \$315,500

FY 2006/2007

Personnel: Regular Force 2 PY

Budget: \$500,000

SEER: \$2,000,000

FY 2007-08

Personnel: Regular Force 3 PY

Budget: \$500,000

SEER: \$3,000,000

FY 2008-09

Personnel: Regular Force 5 PY

Budget: \$500,000

SEER: \$200,000



COMMAND AND SENSE TEAM

INTRODUCTION

36. The Command and Sense Team’s task is to examine concepts applicable to the Command and Control as well as the Intelligence and Information Capability Areas of the CJTL. These two Capability Areas are closely linked and must be examined holistically as shown by the existence of integrating conceptual terms such as C4ISR that describe “...the collective combination of people, processes, organizations and technologies that form the “brain” and “central nervous system” of the CF’s ability to command and conduct operations.”⁸ The future security environment described in the emerging CF Strategic Operating Concept (CF SOC) and other high level guidance documents is envisioned as volatile, uncertain, complex and adaptive, and will require enhanced capabilities to enable the CF to effectively command and control forces employed under these circumstances.

37. To foster interoperability with traditional multinational partners as these emerging concepts mature and are progressively implemented, the CF SOC contains two Integrating Concepts, namely an Effects Based Approach (EBA) and Network Enabled Operations (NEOps). Additionally, the CF is developing a broader definition of interoperability, known as Joint Interagency Multinational and Public (JIMP), that reaches beyond the purely military aspects to encompass a more integrated, whole-of-country, ‘Team Canada’ approach to national security and defence and to international crisis. CFEC’s Command and Sense Team is thus being aligned with the C2 and I2 Capability Areas of the CJTL and will structure its experimentation campaign to examine these three Integrating Concepts, as well as the associated Command and Sense Functional Concept. The Command and Sense concept focus is pictured below:

CJTL Capability Areas	Integrating Concepts	Functional Concepts	Joint Employment Concepts
Command and Control	Effects Based Approach (EBA)	Command and Sense	Collaborative Information Environment (CIE)
			Knowledge Management (KM)
Command Intent			
Pol-Mil Planning			
Knowledge Base Development (KBD)/Operational Net Assessment (ONA)			
Information and Intelligence	Network Enabled Operations (NEOps)		Information Operations (IO)
			Integrated ISR Architecture (IISRA)
			Joint Information and Intelligence Fusion Capability (JIIFC)
			Intelligence All-Source Cell (ASC)
			Common Operating Picture (COP)

Table 2 – Command and Sense Team Conceptual Focus

⁸ A Time For Transformation – Annual Report of the Chief of Defence Staff 2002-03

⁹ Effects Based Approach (EBA) in Canada ada



38. The Command and Sense Team will be organized into two cells: one to focus on the *Command* aspect, including responsibility for the emerging EBA and NEOps integrating concepts; and, the second to focus on the *Sense* aspect of these integrating concepts, including progression of the national IISRA concept as a follow-on to CFEC's ALIX 04 experiment. Additional activities will include examination of as-yet undefined EBA and NEOps I2 aspects, support of the C4ISR Campaign Plan and JIIFC, and examination of emerging Intelligence concepts such as the All-Source Cell, Common Operating Picture (COP) and Information Fusion.

C&S SPONSOR

39. While the DCDS is the Level 1 sponsor for Command and Sense concepts, it is expected that the Command and Sense Experimentation Team will conduct its JCD&E activities in support of the C2I2 JCAT, in particular the C4ISR Campaign Plan and related initiatives such as the Joint Intelligence and Information Fusion Capability (JIIFC) project.

HYPOTHESIS

40. The following preliminary hypotheses will be examined during the Command and Sense JCD&E campaign:

Development of the capability to conduct NEOps and EBA in a multinational construct will permit the CF to operate in robust, distributed networks, enabled by new technology, over time and distance, to focus dispersed combat power, and to integrate military actions with non-military instruments of national power in support of strategic aims and objectives and effects based outcomes, while maintaining interoperability with allies and coalition partners.

COMMAND AND SENSE EXPERIMENTATION ACTIVITIES

41. While purely national experimentation awaits the promulgation of concept papers for EBA, NEOps and Joint Integrating Concepts, CFEC continues participation in multinational experiments and interoperability trials such as the MNE series and CWID. Insights from these activities will inform national concept development and experimentation.

C&S INTEGRATION PLAN

42. An integration plan has not yet been formulated.

¹⁰ Network Enabled Operations (NEOps) in Can



COMMAND & SENSE RESOURCE IMPLICATIONS

FY2005/2006

Personnel: Regular Force: 3 PY. Res Force 2 PY

Budget: \$315,000

FY2006/2007

Personnel: Regular Force: 5 PY. Res Force: 2 PY

Budget: \$500,000

SEER: \$500,000

FY2007/2008

Personnel: Regular Force: 7PY, Civilian 2PY.

Budget: \$750,000

SEER: \$1,000,000

FY2008/2009

Personnel: Regular Force: 7PY.

Budget: \$1,000,000

SEER: \$1,000,000

SUPPORT, SUSTAIN AND MOBILITY TEAM

INTRODUCTION

43. This section outlines the initial elements of a JCD&E campaign plan aimed at examining new concepts to strengthen the capability of the CF/DND to sustain CF operations in the future security environment described in Defence Strategy 2020, the CF SOC and related guidance documents. This guidance points to the need for enhanced capability to deploy military forces to distant locations and sustain operations in austere environments under difficult conditions. The daunting challenges associated with the conduct of such expeditionary operations in a global environment will require investment in enhanced CF/DND sustainment capabilities as well as collaboration with other nations' militaries and support organizations across the JIMP context.

44. The envisaged Sustain JCD&E campaign plan is situated within the framework of the Sustain and Strategic/Operational level Mobility Capability Areas of the CJTL. It is envisaged that this work will be guided by a future Support, Sustain and Mobility Functional Concept paper under the capstone CF Strategic Operating Concept (CF SOC). Concept examination will encompass all relevant military sustainment functions to include logistics, equipment management, military sustainment engineering, health services support, personnel support and military police support. The focus will be on the provision of support to deployed operations and not on routine domestic support activities. In particular, the three integrating concepts described in the CF SOC – Network-Enabled Operations (NEOps), Effects based Approach (EBA) as well as a new CF Joint Concept – must be examined to determine the consequences of these emerging



concepts for the sustainment of future CF operations. The anticipated concept focus is outlined below:

CJTL Capability Areas	Integrating Concepts	Functional Concepts	Joint Employment Concepts
Sustain	Joint Operations	Support, Sustain and Mobility	Network-Enabled Sustainment
			Multinational Logistics
	EBA		Global Distribution
	NEOps		Anticipatory Logistics
			Strategic Mobility
			Sustain COP

Table 3 – Sustain Team Conceptual Focus

SSM SPONSOR

45. During 2005, the Sustain JCAT will develop a campaign plan to govern capability-based force development activities within its purview. J4 Materiel is the Chairman of the Sustain JCAT and will serve as the sponsor for the JCD&E work to be undertaken by CFEC in support of the Sustain JCAT campaign plan.

WORKING HYPOTHESIS

46. A preliminary working hypothesis to guide initial JCD&E work in this area is as follows:

Future CF support units must be globally deployable, mobile, combat-capable and operable in a NEOps and EBA environment to be able to deploy and sustain modern forces that are task-tailored, globally-deployable, combat-capable and responsive, both domestically and internationally in a JIMP framework.

SSM EXPERIMENTATION CAMPAIGN PLAN

47. The Sustain Team will be augmented with additional reserve personnel during 2005 to assist with the planning and execution of the experimentation campaign plan. A detailed JCD&E campaign plan will be developed during 2005 in parallel with the Sustain JCAT’s plan to develop a Sustain JCAT campaign plan. In the meantime, the following precursor activities will be undertaken as these will contribute to the attainment of the Sustain JCAT’s work regardless of the details of the eventual campaign plan.

48. Sustain Synthetic Environment Development. CFEC has begun work to identify and develop Modeling and Simulation (M&S) software to create Synthetic Environments (SE) to support detailed examination of some of the joint support concepts to be contained in the Sustain



JCAT campaign plan. A SE capability will provide a means of analyzing support processes, comparing scenarios and conducting course of action analyses. The envisioned SE will allow for the rigorous examination of proposed mission capability packages designed to deliver proposed support capabilities. To this end, a service level agreement was signed with the DRDC Future Forces Synthetic Environment section in November 2004 to conduct a survey of appropriate M&S tools and to develop a High Level Architecture (HLA) interface with a business process re-engineering analysis tool. Initial milestones and deliverables associates with this initiative are as follows:

- a. Develop Initial Sustain SE capability - Acquire M&S software, develop HLA interface and map out the materiel distribution process with a view to analysing different concepts for developing and enhanced global materiel distribution capability. A key to enhancing our expeditionary support capability is to develop a more flexible means of delivering materiel and services to deployed forces that are operating on a more widely distributed basis across vast regions while simultaneously conducting non-contiguous activities within theatres of operation. The intention is to commence SE development with the materiel distribution process and then progressively broaden the scope of the SE to include other sustainment functions. The goal is to complete and test the Sustain SE by 31 Dec 05 with a view to integrating the Sustain SE into the broader SE to be developed to support Pegasus Guardian.
- b. Support the National Military Support Capability project (NMSC) during its project definition phase by employing the envisaged Sustain SE capability to assist with validating the support capabilities required by the future CF Joint Support Group; and,
- c. Support possible CF participation in an ongoing NATO Asset Tracking trial, involving the employment of Radio Frequency Identity (RFID) tagging technology and supporting infrastructure to track the movement of materiel into Afghanistan. This initiative relates directly to both expeditionary and network-enabled capability and for a very small investment will quickly deliver a follow-on capability to our CF contingent deployed in Afghanistan. Additionally, it will facilitate accumulation of experience in logistics asset tracking in a multinational context.

49. Multinational Logistics JCD&E Collaboration. CFEC, in collaboration with the J4 Logistics Doctrine staff (also serving as the Sustain JCAT Secretariat), is participating in the Multinational Interoperability Council Logistics Working Group (Log MIWG), composed of senior logisticians from Australia, Canada, France, Germany, UK and the USA. This MIWG works to enhance Coalition Logistics collaboration. It has developed a Coalition logistics requirements work plan and serves as a focal point for investigating opportunities for multinational collaboration on JCD&E initiatives. One of the first accomplishments involved the production, under Canadian leadership, of a logistics planning annex to the MIC Coalition Building Guide. These countries also participated in logistics play in MNE 3 to examine logistics implications of the Effects-based operations concept. Logistics play in MNE 4 will continue. Additionally, NATO's Strategic Commanders have released a new Strategic Vision that contains two logistics-oriented strategic objectives – integrated logistics and expeditionary capability – both directly relevant to Canada's future capability development requirements. NATO ACT is



developing a CD&E programme related to two key logistics objectives – expeditionary operations and multinational integrated logistics. Both objectives relate directly to CF capability requirements in the Sustain Capability Area. It is envisaged that CFEC and the Sustain JCAT will become involved in NATO Logistics JCD&E activities as these initiatives come on line.

50. Advanced Sustain Technologies Research. It is anticipated that the CFEC Support, Sustain and Mobility Experimentation team will advance the preliminary research work conducted by ACD. The intent is to identify emerging technological developments that might translate into breakthroughs in reducing the physical mass of the sustainment burden represented by the consumption of fuel, water, ammunition and rations.

SSM COLLABORATION

Principal Canadian Partners: Sustain JCAT, J4 Mat/DG Log, CF JOG/JSJ and ECS.

Principal International Partners: US JFCOM/Joint Logistics Transformation Center (JLTC)/Joint Deployment Process Owner (JDPO), MIC Logistics MIWG partners, NATO/AC-T Logistics CD&E cell.

SSM RESOURCES

FY 2005/2006:

Personnel: Regular Force 1 PY, Civilian 1 PY, Res Force: 2 PY
Budget: \$281,000

FY 2006/2007

Personnel: Regular Force 2 PY, Civilian 1 PY, Res Force: 2 PY
Budget: \$500,000
SEER: \$500,000

FY 2007/2008

Personnel: Regular Force 4 PY, Civilian 1 PY
Budget: \$750,000
SEER: \$500,000

FY 2008/2009

Personnel: Regular Force 4 PY, Civilian 1 PY
Budget: \$1,500,000
SEER: \$100,000



FORCE GENERATION TEAM

51. The role of the proposed Force Generation Team is to examine concepts applicable to the Force Generation Capability Area of the CJTL. Force Generation is defined in the CF Strategic Capability Planning document as the process of bringing forces, or part of them, to a state of readiness for operations, by assembling and organizing personnel, supplies and materiel. This task includes the training and equipping the forces and the provision of their means of deployment, sustainment and recovery to meet all current and potential threats. Account must be taken of the need to cater for concurrent operations and timely recuperation. While it embraces the mobilization, regeneration and reconstitution necessary to meet a major conflict, changing strategic circumstances indicate a requirement for responsive adaptability for the more likely asymmetric threats posed to national security and defence. This strategic shift, combined with experienced force reductions and extended high operational tempo over the past decade, indicate a requirement for new concepts for generating and sustaining the deployment of operational forces. The Force Generation team would be established to conduct experimentation in support of the activities of the Force Generation JCAT, which is anticipated to be established in 2005.

52. A very important aspect of Force Generation is the need to ensure that appropriate consideration is taken of factors relating to Human Integration. In particular, training and education of the current forces, and those that will be recruited in the future are of immediate importance. Given that issues pertaining to occupational frameworks, career management and cultural changes must be examined, coordination with both ADM(HR-Mil) (engaged in HR Systems transformation) and ADM(HR-Civ) (key members of the overall Defence Team) must be included. The anticipated concept focus is outlined below:

CJTL Capability Area	Integrating Concepts	Functional Concepts	Joint Employment Concepts
Force Generation	Joint Operations	Force Generation	TBC

FG SPONSOR

53. At this point, a Sponsor for Force Generation concepts has not been identified. It is presumed that this will be determined in due course once the proposed Generate JCAT is established.

WORKING HYPOTHESIS

54. An experimental hypothesis has not yet been developed for this concept area.

FG EXPERIMENT CAMPAIGN PLAN

55. An experiment campaign plan will be developed once the Force Generation JCAT and the proposed experiment team are established and concept development work progresses. In the



near term, work will be progressed with collaborative partners already engaged in some of the issues mentioned above to lay the foundation for and to inform the establishment of the Generate JCAT when it is activated.

FG COLLABORATION

Principal Canadian Partners: VCDS, DCDS, ECS, ADM HR (Mil), ADM(HR-Civ), ADM (Mat), Proposed Force Generation JCAT

Principal International Partners: N/A

FG RESOURCES

FY 2005/2006:

Personnel: Regular Force 0 PY, Reserve 2 PY, Civilian 0 PY

Budget: \$50,000

SEER: 0

FY 2006/2007:

Personnel: Regular Force 2 PY, Reserve 1 PY, Civilian 0 PY

Budget: \$75,000

SEER: 0

FY 2007/2008

Personnel: Regular Force 5 PY, Civilian 0 PY

Budget: \$200,000

SEER: 0

FY 2008/2009

Personnel: Regular Force 5 PY, Civilian 0 PY

Budget: \$500,000

SEER: 0



INTERNATIONAL PROGRAMMES COORDINATION TEAM

56. The requirement to collaborate internationally was included in the recommendations from the CF/DND CD&E and M&S Symposium in 2000. From CFEC inception, this was managed through engagement of the initial experimentation teams as appropriate to their areas of investigation. It became apparent, however, that the effort required to coordinate national participation in multinational events such as JWID/CWID and the MNE series demanded assignment of full time personnel resources such that national concept development through experimentation in these areas was not possible given the resources allotted. As well, devotion of full time resources fostered establishment of the multinational human networks and the national expertise to maximize Canadian participation in these events. The International Programme Coordination Team was established in recognition of the requirement to provide this centre of expertise and to enhance the access, coordination and management of Canada's growing international collaboration in JCD&E activities.

57. The role of the International Programmes Coordination Team will be to coordinate the planning and execution of international CD&E activities, thereby permitting the experimentation teams to concentrate on the substantive examination of emerging operational concepts. The intent is to employ a matrix approach where this team will form the central core of CFEC teams participating in international events while the experimentation teams, augmented as appropriate by personnel from across the CF/DND, will join these teams to further the examination of emerging concepts through participation in international events. The insights and knowledge gained from this activity will then be returned through the IPC team to further enhance multinational collaboration capabilities, and through the experimentation teams to national JCD&E requirements in each of the capability areas. The following paragraphs summarize ongoing international CD&E activities:

MULTINATIONAL EXPERIMENT (MNE) SERIES

58. This is a US JFCOM-led initiative initially involving five other countries and NATO and now expanding to include Finland and Sweden. It focuses on progressing, in a coalition and Alliance context, a number of inter-related concepts and enablers that will provide the capability to conduct multinational Effects-based operations (EBO). The focus of MNE 3, conducted during February 2003, was the conduct of Effects Based Planning within a Coalition Task Force Headquarters (CTFHQ) in parallel with a NATO Response Force deployment to Afghanistan. The overall aim of MNE 4 will be "to explore concepts and supporting tools for EBO within a coalition environment involving stability operations with increasing levels of violence in order to assist the development of future processes, organizations and technologies at the Coalition Task Force level of command."

59. MNE 4, scheduled for February 2006, will be preceded by a number of supporting Limited Objective Experiments (LOEs) conducted by the MNE 4 nations and NATO, each geared to refining a sub-component of the four core functions of the EBO process – Knowledge Base Development, Effects Based Planning, Effects Based Execution and Effects Based Assessment - or one of several EBO enablers. The LOEs include: EBO Process, Strategic Context (i.e. Coalition Pol-Mil Planning), Knowledge Base Development (including Operational



Net Assessment (ONA), Intelligence, Multinational Interagency Group (MNIG), Knowledge Management (KM), Information Operations (IO), Coalition Information Sharing (CIS) and Effects Tasking Order (ETO). As part of Canada's contribution to MNE 4, CFEC is leading a the KM LOE aimed at applying KM techniques to enhance the dissemination of knowledge within a CTFHQ. This is an attempt to deal with a key challenge facing contemporary operational commanders – there is too much data and information but insufficient relevant knowledge to enable effective operational decision-making.

60. Given Canada's multilateral approach to international engagement, the MNE series' focus on developing more effective coalition and Alliance EBO responses to the complex nature of contemporary international crises such as Afghanistan, has direct relevance for our future international engagement. The effects based approach to operations, involving the integrated application of all instruments of national power, both military and non-military, is aligned with the Government of Canada's National Security Policy intent to pursue a more holistic and integrated approach (Defence, Diplomacy and Development – the three Ds) to international engagement; is one of the CF SOC stated integrating concepts; and, is directly in line with the CDS' intention to adopt a joint and integrated 'Task Force Maple Leaf' approach for future CF operational deployments. The criticality for Canada to be fully informed of conceptual developments in this area is underscored by the reality that:

- a. Our principal allies the USA and the UK have already decided to develop a capability to plan and execute EBO and are expending considerable efforts to develop this capability;
- b. Other allies and partners such as Australia, France, Germany and now Finland and Sweden are actively examining EBO through the MNE series and will likely decide to develop the capability to participate in EBO; and,
- c. NATO is also working to develop EBO capabilities, initially for use by the NATO Response Force.¹¹

61. In summary, MNE 4 provides the best opportunity for Canada to examine and co-develop, with key partners in a cost-effective manner, the capability to undertake multinational EBO involving integrated military and non-military actions. Given that future US-led coalitions and NATO Response Force operations will involve the conduct of EBO, Canada must develop the knowledge and capacity to participate in these missions if we are to remain relevant. Specific Canadian objectives for MNE 4 are:

- a. Participate in the refinement of the EBO concept to develop the knowledge required to develop the Effects Based Approach Integrating concept contained in the CF SOC;
- b. Conduct the KM LOE to successfully review the KM concept of operations, and develop the CTFHQ KM team role, structure and processes and technology, MNE 4 KM plan, standard operating procedures and tactics, techniques and procedures;
- c. Participate in the other MNE 4 LOEs in order to contribute to the overall refinement of EBO processes, organizations and technologies; and

¹¹ The recent NATO Bi-Strategic Command Strategic Vision states; "...the focus will increasingly be on effects that need to be created in order to achieve the strategic campaign objectives. Given these factors, future Alliance operations will be more efficiently conducted by adopting an effects-based approach."



- d. Examine specific EBO enablers relevant to the Command and Sense Capability Area, including ONA and Collaborative Environment (CIE).

62. CFEC's International Programme Coordination Team will coordinate CF/DND participation in MNE 4 and will engage CFEC staff from the Command and Sense, the S&T and the ORA teams, and the CFEC Battle lab. CFEC will engage other CF/DND units and organizations, and other government departments as appropriate, to augment this team and to coordinate the provision of Canadian augmentees to the NATO MNE 4 Team.

MNE 4 COLLABORATION

Principal Canadian Partners: DCDS, ECS', C2I2 JCAT Membership, NDHQ Joint Staff, CF JOG, JIIFC Project

Principal International Partners: USA, NATO, UK, Australia, France, Germany, Finland, Sweden

COALITION WARRIOR INTEROPERABILITY DEMONSTRATION 05 (CWID 05)

63. CWID has a slightly different orientation from the MNE series in that it is intended to prototype near term, primarily technical, solutions to identified current operational capability shortfalls. As such, the annual events, normally conducted in June, tend to be more discrete, individual events focussed on trialling technical applications that promote coalition interoperability. Participants trial and validate prototype and emerging C4ISR technical solutions to enhance interoperability, information sharing and collaborative planning across the JIMP framework prior to implementation of these tools into operational service. In Canada, the event is run on the CFXNet and connects to multinational partners through a link to the Combined Federated Battle Laboratory Network (CFBLNet). To date, responsibility for hosting and coordinating CWID has been assigned to a US combatant commander on a two year cycle. For JWID 04 and CWID 2005, this responsibility has been borne by Northern Command (NORTHCOM). This assignment has resulted in a significantly greater focus on elements pertaining to Homeland security and Defence while also catering to more traditional applications of combat power. The significant benefits for interagency engagement and cooperation that have stemmed from this assignment, given the current national and international strategic environment, suggest that there is potential for maintenance of some similar focus in the future. The impacts that this will have on future assignment responsibilities within the US are under discussion within the US.

63. Canadian CWID 05 objectives will include further investigation of 2004 areas as well as:
 - a. Solutions to facilitate the testing and integration of intelligent software products within a *Command & Sense* System or across multiple domains.
 - b. Data integration solutions to import information from unclassified to classified networks or from lower classified networks.



CWID 05 COLLABORATION

Principal Canadian Partners: CF Joint Operations Group (JOG), NDCC, CAS, CMS, CLS, J4 Log, PSEPC, RCMP, Coast Guard and CSIS.

Principal Multinational Partners: Director for C4 - US Joint Staff (J6), US NORTHCOM, Australia, New Zealand, United Kingdom, NATO (including Partnership for Peace (PfP)), the Multinational Naval Task Group, US Federal Emergency Management Agency (FEMA), US National Guard Bureau, US Coast Guard and the FBI.

Contributing Partners: DCDS/CFCS, ADM IM, DRDC COP 21, CF J2 Geomatics Imagery and Counter Intelligence (GICI), AFCCIS, LFC2IS and MCOIN 3.

IP RESOURCES

FY 2005/2006:

Personnel: Regular Force 0 PY, Reserve 2 PY, Civilian 0 PY

Budget: \$1.2M

SEER: 0

FY 2006/2007:

Personnel: Regular Force 1 PY, Reserve 2 PY, Civilian 0 PY

Budget: \$1.5M

SEER: 0

FY 2007/2008

Personnel: Regular Force 3 PY, Res Force: 1 Civilian 0 PY

Budget: \$1.8M

SEER: 0

FY 2008/2009

Personnel: Regular Force 4 PY, Civilian 0 PY

Budget: \$1.8M

SEER: 0

SYNTHETIC ENVIRONMENTS AND BATTLE LABS TEAM

CFEC SYNTHETIC ENVIRONMENTS (SE) MANAGEMENT CELL

64. Lessons learned from the development of the Army Synthetic Environment Cell within the Army Simulation Centre demonstrate the utility and responsiveness of having an in-house capacity for building, tailoring and adapting existing models for specific purposes. As well, the possession of M&S and SE SME provides a management and oversight capacity for determining SE requirements and conducting quality assurance on those M&S and SE delivered to the CF by



other sources of expertise.¹² The creation of a small SE Management cell within CFEC's FOC establishment is intended to provide this capacity as well as the ability to conceptualize, design and manage the creation of SEs that satisfy the most rigorous scientific and operations research requirements while maximizing utility to the experiment Sponsor. A project team is being established to develop and begin executing a SE development campaign plan. This plan will employ a spiral development approach through participation in upcoming events such as the CASE Project's War-in-a-Box (WIB) event and the modeling and simulation activities planned for MNE 4. Ultimately, this capability will oversee the creation of the SE required to support future synthetically based activities under the *Pegasus Series* of events. Given the dynamic nature of the technology, it is anticipated that the cell will be comprised largely of civilian defence scientists supported by specialized, contracted industry partners.

CFEC BATTLE LAB VISION

65. CFEC's future facilities will have the capacity to support and conduct significant experimentation in synthetic environments. The utility of synthetic environment exploitation stems primarily from its ability to cost-effectively trial new methodologies, ideas, concepts, capabilities, force structures and organizations using agreed and known scientific processes and procedures. The results from such exploitation, when conducted in an open, transparent and logical manner, can provide valuable, objective insights to inform and support future activities. Depending upon the scenario and the fidelity required to replicate it synthetically, these future activities could include anything from simple concept assessment, through determination of future force structure and capability requirements, to exercise and mission rehearsals. Using the approach found elsewhere in this document it is hypothesised that:

If M&S tools and processes can be developed to support the creation and use of Synthetic Environments with sufficient fidelity appropriate to the scenario presented; then future concept development experimentation will be supported, required joint force capabilities, structures and organizations can be identified, appropriate Joint Interagency and/or Multinational C2ISR linkages can be explored, Exercise and Operational mission planning can be conducted and, Sustainment requirements identified such that future CF effectiveness is increased.

66. The *Pegasus Series* of experiments is intended to provide the focal point for harnessing the resources, capabilities and resources required to achieve the vision of the future CFEC Battle lab and to realize the potential of this technology. Once such a capability has been acquired, it is submitted that it will be an integral element of virtually all future defence capability decisions relating to *Effective Engagement; Command and Sense; Support, Sustain and Mobility; and, Force Generation.*

¹² A Service Level Agreement has already been established with the DRDC Future Forces Synthetic Environment (DRDC/FFSE) Section to provide the additional SE development capability beyond that of the small SE cell at CFEC. This arrangement is already paying dividends as FFSE has commenced activities on behalf of the unit.

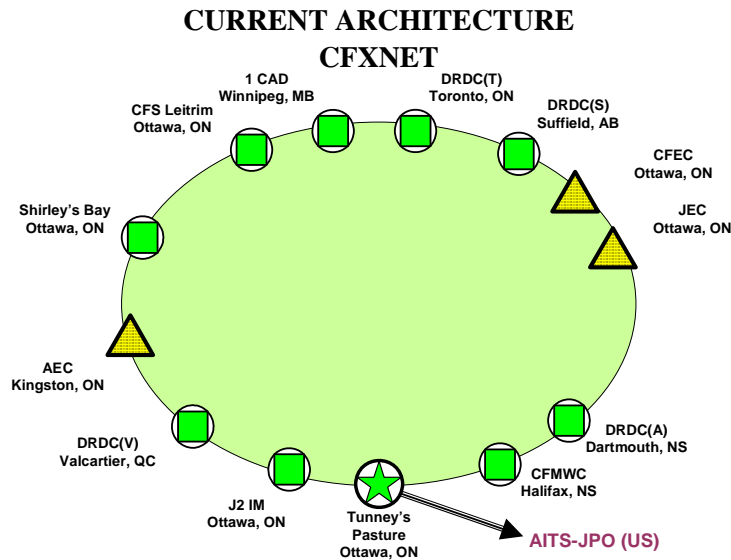


CANADIAN FORCES EXPERIMENTATION NETWORK (CFXNet) SUPPORT

67. A critical element for current and future online, in-house and distributed national, interagency and multinational synthetic experimentation is the network over which it is conducted. The CFXNet was established in 2002 as the Canadian domain of the Combined Federated Battle Lab Network (CFBLNet) that originated in the USA. The CFBLNet grew from the need, within the USA, to connect all of their CD&E venues with a robust classified non-operational network. This was extended to include the Combined Communications Electronics Board (CCEB) nations (AUSCAZUKUS) and NATO.

68. The CFBLNet charter dictates that all data, regardless of country of origin, will be treated as SECRET releasable (AUSCAZUKUS + NATO). As such, all nations have been entrusted to enact national security policies that will protect the data residing on the network. The primary purpose of the CFBLNet is to support Concept Development and Experimentation (CD&E) initiatives between one or more of the principal charter nations and the network charter was purposefully designed to avoid competition between experimentation, training and support for current real-world operations. The final requirement of the CFBLNet was to provide a venue where CD&E results could be shared in order to leverage activities and knowledge.

69. Currently, with the exception of the Army Simulation Centre, the CFXNet connects all of the experimentation facilities that support joint and single service activities.¹³ It also connects all of the major DRDC facilities. The following figure provides a complete diagram of all current sites within the CFXNet.



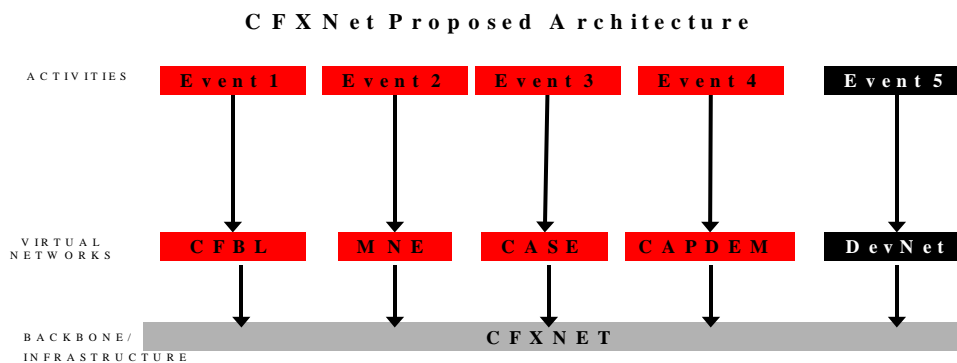
CFXNet Future Strategy

70. The past 18 months have witnessed a significant increase in unfulfilled network demand to support a growing number of competing requirements that are not able to utilize the existing operational (i.e. DWAN and CNET) nor experimentation networks. This unfulfilled demand

¹³ Technological and security concerns relating to the Army's new experimentation facilities preclude their connectivity at this point in time.



varies from requests to support security caveats that cannot be met by the current CFBLNet classification caveat; the fact that they fall outside of the CFBLNet charter; service specific requirements; unclassified domains that require more flexible venues beyond the existing lengthy certification and accreditation (C&A) process; and distributed collaboration that cannot be met by the current operational or administrative networks. To resolve these challenges, it is intended that the future CFXNet architecture will evolve to 3 layers – each of which is managed by an appropriate operational authority (OA). The backbone/infrastructure layer will be managed by CFEC and will include all connectivity to physical locations regardless of which logical networks are being used. The virtual (logical) network layer will be managed by an appropriate OA, responsible for network management/services and security including C&A. The activity/application layer will be the responsibility of the virtual (logical) network layer OA in conjunction with the event OPI as required.



SE AND BATTLE LAB RESOURCES

FY 2005/2006:

Personnel: Regular Force 1 PY, Reserve 1 PY, Civilian 5 PY

Budget: SE Cell \$910,000, Battle Lab \$1.0M

SEER: 0

FY 2006/2007:

Personnel: Regular Force 1 PY, Reserve 1 PY, Civilian 5 PY

Budget: SE Cell \$1.0M, Battle Lab \$1.1M

SEER: 0

FY 2007/2008

Personnel: Regular Force 2 PY, Civilian 9 PY

Budget: SE Cell \$1.2M, Battle Lab \$1.2M

SEER: 0

FY 2008/2009

Personnel: Regular Force 2 PY, Civilian 9 PY

Budget: SE Cell \$1.0M, Battle Lab \$1.3M

SEER: 0



OPERATIONAL RESEARCH TEAM

71. The Experimentation Operational Research team (EXORT) at CFEC supports experimentation by providing expert scientific support, advice and research on design, conduct, and evaluation of experiments proposed by the other CFEC teams. Before an experiment design can be conceived, a good understanding must be gained for the concept being proposed, its attributes, concept of employment, and potential utility. For this reason, it is imperative that experiment designers engage in concept development consultations and discussions at the operational level to gain a broader and more in-depth appreciation of the concepts they are to test. The development or adaptation of so-called theoretical models is often required to formulate suitable hypotheses, to properly test concepts and to advance knowledge. This can only be done through a good appreciation of the anticipated value chain for each advanced concept, applicable scenarios and operational context. For 2005, this work includes the conduct and analysis of currently programmed events including CWID '05, the KM limited objective experiment, MNE 4 on Effects-based operations, and completing the analysis of the Atlantic and Pacific Littoral ISR Experiments. New concepts and support to forthcoming experimentation campaign planning will also be conducted as resources allow.

72. In addition to direct support to experimentation teams, OR scientists engage in national and international collaboration to advance the state of the art in experimentation methods, measures and analysis techniques. Nationally, the Experimentation OR team shall seek opportunities for collaborative work with other teams within the OR division. Work is already underway with the Joint Staff OR Team (JSORT) on JIIFC analysis for ALIX (a Command and Sense team concept) and the development of high level ISR metrics. International collaboration activities on methodologies include The Technical Cooperation Panel (TTCP) Joint Systems and Analysis (JSA) group, NATO SAS Panels, and the MIC MIWG M&S Sub-Working Group.

73. One important aspect of validation and advancement of their work is achieved through exposing results of experiments in international fora. Professional development is an important aspect of all scientists to maintain competencies in the most recent analysis, modelling, and simulation methods. For this reason, the work program of individual OR DSs is predicated on 9 months per calendar year, with the balance for leave and professional development. Although specific events are not confirmed at this time, anticipated areas of engagement include:

- a. Net-enabled operations and EBO analysis methods
- b. Command and Control frameworks
- c. Specialized topics related to advanced concepts and technologies
- d. Experimentation best practices, including use of M&S and Synthetic Environments

74. The experimentation OR team shall also contribute to the identification of M&S requirements for CFEC's Battle lab and the realization of capabilities to support the range of functional and employment concepts being considered. The development of effective Synthetic Environments is critical to experimentation requiring a careful balance between fidelity and cost. The goal is to rapidly develop SEs from available components which are "fit for purpose." The



OR team is developing requirements and implementation options for a CFEC survey and data acquisition capability which is required for efficient analysis and experiment control.

OR RESOURCES

75. The CFEC OR team will need to grow in numbers in order to support an increasing experimentation program involving multiple streams of joint concept development and experimentation activity at CFEC. Since team growth will be measured subject to availability of personnel within the OR division, areas of priority support will need to be defined and agreed.

FY 2005/2006:

Personnel: Civilian 4 PY

Budget: \$108,000

FY 2006/2007

Personnel: Civilian 5 PY (pending approval)

Budget: \$125,000

FY 2007/2008

Personnel: Civilian 6 PY (pending approval)

Budget: \$150,000

FY 2008/2009

Personnel: Civilian 6 PY

Budget : \$175,000

SCIENCE & TECHNOLOGY TEAM

77. The Science & Technology (S&T) team at CFEC supports concept development through experimentation by providing expert S&T advice on the design, conduct, and evaluation of experiments. The team also provides liaison between CFEC and Defence Research and Development Canada (DRDC) to identify and exploit opportunities for collaboration between CFEC's CD&E activities and DRDC's research and development (R&D) activities.

78. The specific activities of the S&T team are driven primarily by the needs of CFEC's concept development and experimentation teams. These activities include providing advice to advance the new concepts proposed above and support to forthcoming experimentation campaign planning, particularly the new *Command and Sense* team. It also includes supporting the currently programmed events -- CWID '05, the KM Limited Objective Experiment, and MNE 4 on Effects-based operations -- and contributing to the analysis of the Atlantic and Pacific Littoral ISR Experiments. The S&T team also undertakes original research to support the broader goals of the experimentation teams. For example, the team is investigating potential criteria for selecting crews for Uninhabited Aerial Vehicles and plans to investigate the inhibitive and facilitative aspects of culture on jointness in the Canadian Forces.



79. In addition to supporting the experimentation teams, members of the S&T team engage in national and international collaboration to advance the state of the art in military experimentation. Nationally, the S&T team will seek opportunities for collaborative work with DRDC's research centres, particularly with technology demonstration projects. International collaborations include participating in NATO's Allied Warrior series of exercises through the Human Factors & Medicine (HFM) panel of the NATO Research and Technology Organization (RTO), advancing knowledge management through The Technical Cooperation Panel (TTCP) Human Resources and Performance (HUM) Group, and helping TTCP to establish and strengthen linkages between the international defence S&T community and military CD&E organizations, including CFEC.

80. Professional development is an important aspect for all scientists, who need to maintain competency in their areas of expertise. One important aspect of validation and advancement of their work is realized through publishing and presenting their research in international fora. For this reason, the work programs of members of the S&T team take into account the need for professional development.

S & T RESOURCES

81. The CFEC S&T team needs to grow in order to support the evolving experimentation program, particularly in the areas of *Command and Sense* (adding 1 PY mid FY 2005/2006) and *Sustainability* (adding another 1 PY mid FY 2006/2007).

FY 2005/2006:

Personnel: Civilian 4 PY (pending approval)

Budget: \$260,000

SEER: 0

FY 2006/2007

Personnel: Civilian 5 PY (pending approval)

Budget: \$275,000

SEER: 0

FY 2007/2008

Personnel: Civilian 5 PY (pending approval)

Budget: \$280,000

SEER: 0

FY 2008/2009

Personnel: Civilian 5 PY

Budget : 285,000

SEER : 0



DND SYNTHETIC ENVIRONMENT COORDINATION OFFICE (SECO)

82. The DND Synthetic Environment Coordination Office (SECO) provides a full-time, centralized focal point for leadership, coordination, guidance and support of Modeling & Simulation (M&S) infrastructure and activities. It is anticipated that the provision of a central coordinating agency for M&S will ensure affordable M&S availability and usage, thereby improving DND/CF capability for M&S interoperability, reuse and consistency. This service is essential if DND/CF is to realize dramatic improvements in departmental acquisition programs by employing M&S for Synthetic Environment Based Acquisition (SEBA). The DND SECO long-term objective is to enable DND, and eventually other Government of Canada (GoC) stakeholders, to design and test interoperable and joint solutions as part of the spectrum of capability assessment, acquisition, operations and life cycle support.

83. The proposed work plan is presented under six activity vectors:

- a. Interoperability;
- b. Collaborative SE framework and Common Repository;
- c. Verification, Validation and Accreditation;
- d. Operational use of M&S/SE;
- e. Support to the CapDEM TDP; and
- f. M&S Education, Client Support and Communications.

84. The work focus for the FY 2005/2006 will be on the critical activities required to establish a basic M&S architecture and framework for the Department. These are:

- a. Continued development and execution of an implementation plan for a common repository;
- b. Continued development and introduction of VV&A processes;
- c. Continued development of a specification for a collaborative synthetic environment framework;
- d. Continued refinement and introduction of the simulation support plan into the Technology Demonstration Program as a pilot project; and
- e. Establishment of supporting management processes.

SECO ACTIVITY PLAN

SECO VECTOR 1 – INTEROPERABILITY

85. M&S Interoperability is defined as the capability to “seamlessly simulate together.” DND SECO is developing and staffing Departmental policy, management, standards and guidance strategies, as well as undertaking activities to enhance interoperability within the M&S/SE community. Deliverables will be as follows:

- a. Approved repository policy and draft high-level management plan, Spring 05;



- b. Approved VV&A policy & draft management plan, Summer 05;
- c. High Level Architecture Certification Facility will be in operation;
- d. 2nd Draft Departmental Strategic M&S Plan, Summer 05.

SECO VECTOR 2 – COMMON REPOSITORY AND COLLABORATIVE SYNTHETIC ENVIRONMENT

86. An implementation plan for a DND Modelling and Simulation Resource Repository (MSRR) is being developed. The repository will be the structure for the deposit, access and retrieval of information, models, Synthetic Environments (SE), scenarios and supporting documentation and databases required for M&S activities. A SEWG repository sub group has been established to investigate issues such as access to intellectual property, licenses, security, capital costs and O&M support. Cost estimates will be part of the process.

87. A comprehensive specification of an SE was produced and will be provided to principal DND users for review to establish mandatory and affordable properties and performance levels. The collaborative SE framework describes the properties and critical performance levels required to achieve interoperability amongst users. Deliverables are identified as follows:

- a. Implementation of Repository Implementation Plan Phase 1, Winter 06;
- b. Implementation of departmental M&S catalogue, Spring 06; and
- c. MSRR Policy approved, spring 05.

SECO VECTOR 3 – VERIFICATION, VALIDATION AND ACCREDITATION

88. DND requires a Verification, Validation and Accreditation (VV&A) process to assess risk and performance of the models and simulations and to ensure interoperability internationally. DND SECO is developing a user-friendly, risk/impact, affordability-based VV&A process. The process concept has been presented to SEWG members and International peers. Case studies to verify the process procedures are underway. Issues related to final selection, refinement and implementation of a common VV&A process such as resources, documentation, support tools, and management are being addressed with the SEWG. Further work will be required to expand this process to other aspects such as Federations, Synthetic Environments and human behaviour. Deliverables are intended as follows:

- a. V&A Policy approved and draft Implementation Plan, Summer 05;
- b. VV&A adaptive process Case studies, May 05; and
- c. VV&A adaptive process release #2, Fall 05.

SECO VECTOR 4 – OPERATIONAL USE OF M&S/SE

89. The direct integration and exploitation of M&S/ SEs into the operational community is the fundamental underpinning of all Defence M&S activities. DND SECO will execute a program of work that incorporates many of the activities from the other vectors with the intent of establishing a synthetic environment framework to support operational requirements such as the proposed Conduct Operations JCAT. Deliverables will be:



- a. Simulation Support Plan accepted as an optional DMS document, Spring 05;
- b. Provide support to the “War in a Box” project through participating on the Technical Task Teams for Infrastructure, VV&A and Terrain Data bases, Duration;
- c. ADM (Mat) SMARTS Initiative collaboration and support, Duration;
- d. Support to DRDC TP4, System Engineering for Defence Modernization, Jan 04-Dec 05;
- e. Development and implementation of cost benefit models, Winter 06;
- f. Continued support to the CASE project;
- g. Provide support to the ADM (MAT) SMARTS project through coordinated development of strategy and input to specific M&S management and infrastructure areas; and
- h. Provide liaison with other projects as required.

SECO VECTOR 5 – SUPPORT TO COLLABORATIVE CAPABILITY

90. The ADM (S&T) sponsored Collaborative Capability Definition, Engineering and Management Technology Demonstration Program (CapDEM TDP) was approved to establish a viable process to facilitate DND’s implementation of capability-based planning.¹⁴ Extensive use of M&S/SEs within this process has significant potential to contribute to effective capability planning. Deliverables will be continued support to the CapDEM TDP in the form of a team lead and monetary resources for items related to SECO activities.

SECO VECTOR 6 – M&S EDUCATION, CLIENT SUPPORT & COMMUNICATIONS

91. Activities contained in Vector 6 focus on providing tangible value added to the community by ensuring an awareness of M&S related issues. These include identification of educational/ training opportunities and, where appropriate, making these opportunities available to the M&S community; providing initial technical support and general-level guidance pertaining to policy, standards and best practices. Additionally, it is intended to maintain a comprehensive Communications Plan that will include DND SECO Web site support (Internet and Intranet); active leadership and participation in various national and international forums such as Simulation Interoperability and Standards Organization (SISO) and the recently formed Canadian Chapter; DND Working Groups; and, various NATO M&S Groups and TTCP activities. Deliverables are intended to be:

- a. 2-3 M&S / SE Training courses per year;
- b. Maintain DND SECO web pages, incorporate growth for new capabilities on a continuous basis; and
- c. Initiate and coordinate a series of M&S workshop.

¹⁴ The 3-year (with approximately a 1 year exploitation phase), \$8.5M project is managed by DRDC-Ottawa Future Force Synthetic Environment (FFSE) Section – it intends to employ Integrated Project Teams (IPTs) and integrated work streams across a ‘collaborative engineering environment’ both within the various DRDC labs, and DND team members (e.g., DMAPS), but also with The Technical Cooperation Panel (TTCP) Technical Panel 4 (TP4) partners (US, Australia, New Zealand, UK). Three use cases are proposed: (a) Joint Information Intelligence Fusion Capability (JIIFC); (b) TTCP Coalition Land Attack; and, (c) Concept and Development (Joint) through a UAV Case Study.



SECO COLLABORATIONS

Collaboration: SISO, SEWG, DRDC

SECO RESOURCE IMPLICATIONS

92. The Execution of this M&S Plan is guided by affordability and driven by cost effectiveness. The SECO has identified a recurring requirement for National Procurement funding to provide \$1.4 million for both hardware and software in support of these M&S initiatives. Investment in M&S will show returns in reduced risk associated with program acquisition.

FY 2005/2006

Personnel: Regular Force 1 PY, Civilian 3 PY

Budget: \$1,200,000

FY 2006/2007

Personnel: Regular Force 1 PY, Civilian: 4 PY

Budget: \$1,400,000

FY 2007/2008

Personnel: Regular Force 1 PY, Civilian: 4 PY

Budget: \$1,400,000

FY 2008/2009

Personnel: Regular Force 1 PY, Civilian: 4 PY

Budget: \$1,400,000



CONCLUSION
CFEC FOC – POSITIONED FOR THE FUTURE CF

93. The key philosophical underpinning to CFEC's approach to future CD&E is that the organization fulfills the "honest broker" role within the CF regarding future concepts and as such is required to maintain an 'arms length' relationship in its experimentation. In essence, it does not sponsor concepts for experimentation, but rather works with appropriate level 1 sponsors to conduct unbiased, scientifically based experiments that are intended to reveal the operational implications of adopting a given concept so that the sponsor, who has the executive authority to commit the CF to acquiring this capability, has the best information on which to base its decision. Within the realm of CD&E, however, as CFEC is the DCDS' executive agent for developing the tools, capacity, procedures and processes required to conduct CF JCD&E, CFEC itself is the sponsor. It is in this capacity that this version of *Plan Pegasus* is presented.

94. The experience gained to date in national and multinational experimentation and engagement have provided numerous insights into what JCD&E capability is most appropriate for Canada. Our allies, many of whom have resource challenges similar to our own, continue to show great interest in CFEC development and some have adopted similar CD&E capacities. Even our major allies have been influenced to collocate their existing "CD" with their "E" capabilities, harmonize the management of their national participation in the CWID and MNE events, and to embed scientific and operational research in their CD&E facilities. Our focus on capability areas, which link experimentation to lines of force development, is not unique; giving credence for its embracement as a founding organizing construct. The creation of an International Program Coordination 'centre of excellence' within CFEC for honing interagency and international engagement follows the practice of US JFCOM with its international programs office and is indicative of the importance and potential of this area. Finally, the ability to create, manage, distribute, tailor and operate a joint CF synthetic environment capability in-house, in cooperation with our CF, agency and industry partners, will be a significant advancement in the realization of CFEC's potential and the maturation of the JEC project.

95. As noted at the outset, national JCD&E in 2005 will be conducted in a dynamic environment. This dynamism stems from initiatives to harmonize future CF operations under an SOC that is reflective of the first Canadian National Security Policy; the rationalization of joint force capability development; and the recently stated intention of the new CDS to shift our strategic focus towards the more likely and probable asymmetric threats to Canada, to work in greater harmony with our national and continental partners, and to focus our expeditionary capabilities around a joint, integrated 'Team Canada' approach. The outcomes of these initiatives will only be fully realized in late-2005. While these changes will have fundamental impacts on the management, shape and direction of future JCD&E activities, it is assessed that the program that is laid out in *Plan Pegasus 05* is soundly based upon capitalizing on the information that has been garnered in experimentation activities to date, maintaining our focus on international interoperability, and to laying the ground work for achieving CFEC FOC. Indeed, given that the proposed FOC is focused solely on developing capabilities for joint experimentation, it is submitted that it is well positioned to be a core element of any future expanded capability should the current operational reviews substantiate it.



ARTICLES, REPORTS & PAPERS

Since the last iteration of Plan Pegasus, CFEC and its members have produced the following articles, reports, papers, and major presentations. For further information, please contact one of the principal authors whose name is underlined.

- A. USJFCOM. *Multinational Experiment 3 (MNE 3) Final Report*. Prepared by J9 Joint Experimentation Analysis Division with contributions from Australia, Canada (P. Farrell, P. Comeau, R. Grossman-Vermass, F. Lichacz, S. Villeneuve, and K. Wheaton), France, Germany and the UK, April 2004.
- B. Farrell, P. and S. Villeneuve. *Technology, Common Intent, and Knowledge Management Results for MNE III*. Presented by Dr P Farrell, TTCP TP-2 Command Information Interfaces, April 2004.
- C. Villeneuve, S and P. Farrell. *Vector Approach for analyzing Survey Questions*, Proceedings of the 2004 Command and Control Research and Technology Symposium (CCRTS). Presented by P. Farrell, San Diego CA, June 2004, 12 pp.
- D. Comeau, P. and G. Van Bavel. *Pacific Littoral ISR Experiment Lessons Learned*, presented to the NRC UAV Research Technology & Development Symposium, Ottawa, June 2004.
- E. Newton, LCol S.J., Maj M. Regush, P. Comeau, G. Van Bavel, R.K. Bowes, and A. Shurson. CFEC Experiment No. IISRA 2004-01 *Atlantic Littoral ISR Experiment Order (ALIX)*. DND/DCDS 3350/ALIX, June 2004, 23 pp + 26 Annexes.
- F. Comeau, P. and G. Van Bavel. *Through the Looking Glass: Intelligence, Surveillance and Reconnaissance Experimentation at the Canadian Forces Experimentation Centre*, the 9th International Command and Control Research and Technology Symposium, September 2004, 26 pp.
- G. Roy R. and J. Steeles. *Air Traffic Control Radar Options to TUAV Operations*, presented by P. Comeau at the 9th International Command and Control Technology Symposium (9ICCRTS), September 2004.
- H. P. Comeau and G. H. Van Bavel, ALIX Integrated ISR Architecture Experiment: Quicklook, presentation to ORD Annual Meeting, September 2004.
- I. Newton, LCol S.J., Maj M. Regush, P. Comeau, G. Van Bavel, R. K. Bowes, and A. Shurson. *EXPERIMENT QUICKLOOK REPORT Atlantic Littoral ISR Experiment (ALIX)*. Canadian Forces Experimentation Centre Report, October 2004, 33 pp.



- J. Comeau, P. *Update on Canadian Modelling & Simulation Initiatives*, presented at the MIC MIWG M&S Sub-Group meeting, October 2004.
- K. Wheaton, K., Maj. G. Clairoux, and L. Cochran. *Analysis of the Knowledge Management Process in Multinational Experiment 3*, Proceedings of the 9th International Command and Control Research and Technology Symposium, published by the Command and Control Research Program, October 2004, 18 pp.
- L. Bailey, Maj. P., Villeneuve, S., Wheaton, K. *Joint Warrior Interoperability Demonstration 2004 (JWID 04) Executive Summary*, 2700-30-1 (J9332-JWID). Letter dated 26 November 2004, 5 pp.
- M. JWID Joint Management Office. *Joint Warrior Interoperability Demonstration 2004 Final Report*. Contributions from the Assessment Working Group (incl. S. Villeneuve, K. Wheaton, and R. Funk), Network Operations Working Group, Systems Engineering Integration Working Group, and CWID Joint Management Office, November 2004.
- N. Comeau, P. and G. Van Bavel. *ALIX Integrated ISR Architecture Experiment: Design and Preliminary Evaluation*. Presented to the ALIX First Impressions Conference, November 2004.
- O. Comeau, P., and G. Van Bavel. *Atlantic Littoral ISR Experiment (ALIX) Design and Demonstrations*. Presented at the NATO CD&E Conference, Calgary, Alberta, November 2004.
- P. Wheaton, K.R., S. Villeneuve, and Maj. R. E. Kearney. *Joint Warrior Interoperability Demonstration 2003 (JWID 03) After Action Report*. CFEC Report 001-04, December 2004, 168 pp.
- Q. Comeau, P. *Applications of Defence Operational Research*, presented to the CF Advanced Military Studies Course (AMSC) 7. Canadian Forces Command and Staff College, Toronto, December 2004.
- R. Comeau, P. *Integrated ISR Architecture Concept Development and Experimentation*, presented to the SMi Conference on Persistent Surveillance: Maximizing the potential of manned and unmanned ISR. London UK, February 2005.
- S. Ingram, N. D. and G. Van Bavel. *Pacific Littoral ISR Experiment 2 Design*. DRDC ORD Tech Memorandum TM 2005-05, February 2005, 26 pp.
- T. Bernier, M., P. Farrell, and LCdr R. Elford. *Knowledge Management Workshop 1 Proceedings - October 2004*. DRDC ORD Technical Note TN2005-x, Release Pending, February 2005.



- U. Farrell, P., P. Comeau, R. Grossman-Vermass, F. Lichacz, R. Patrick, S. Villeneuve, and K. Wheaton. *CFEC Analyst Final Report for Multinational Experiment 3*. DRDC Toronto Technical Memorandum TM 2004-xx, publication forthcoming, 182 pp.
- V. Douglas, A. J. and G. Van Bavel. *Deception and the Task-Post-Process-Use Intelligence Cycle*. DRDC ORD DOR (MLA) Research Note RN 2004/13, publication forthcoming, 22 pp.
- W. Villeneuve, S. and Wheaton K.R., *Joint Warrior Interoperability Demonstration (JWID) 2004 Assessment Report*. DRDC ORD Technical Report TR 2005-xx, publication forthcoming, 159 pp.
- X. Villeneuve, S. and K.R. Wheaton. *Joint Warrior Interoperability Demonstration 2004 (JWID04) After-Action Report*. CFEC Report 2005-xx, publication forthcoming, 180 pp.
- Y. The Technical Cooperation Program. TTCP JSA AG-12 Report *TTCP Guide for Understanding and Interpreting Defence Experimentation (TTCP GUIDEx)*, with contributions from Australia, Canada (P. Comeau, P. Labbe, S. Villeneuve, and K. Wheaton), United Kingdom, and United States, publication forthcoming, 252 pp.



**CFEC NATIONAL AND INTERNATIONAL ENGAGEMENT
 1 APR 04- 31 MAR 05**

1. CFEC is mandated to interact with a multitude of national and international partners to progress development of Canadian CD&E. This interaction is intended to promote integration of CD&E activities vertically within the CF to identify synergies and optimize harmonization; and, horizontally within the broader multinational and multi-agency CD&E community to identify best practices, opportunities for collaboration and concepts appropriate for adoption by the CF.

2. CFEC engagement activities during the period covered by *Plan Pegasus-04* are outlined in the following table. These activities were in addition to the national and international coordination work necessary to progress development of the CFXNet and to prepare for significant events such as CWID (JWID), the MNE Series of events and its associated LOE, and ALIX.

DATE	INT'L CONF/ SYMPOSIA/ORG	NAT'L CONF/ SYMPOSIA/ORG	INT'L MIL	NAT'L MIL
APR 04			SECO BRIEF TO AUSTRALIAN MIL VISITORS	
17-24 APR	ITEC CONF			
4-6 MAY 04	MULTINATIONAL C4ISR CONF			
10 MAY 04			PRESENTATION UN LOGISTICS CRSE	
20 MAY 04			CHINESE PLA	
31 MAY 04				CMS ORO CRS
20 MAY-4 JUN 04			LIASON WITH AUS SECO/NEW ZEALAND ARMY SIM CENTRE	
JUN 04		NRC UAV RT&D SYMPOSIUM		
18-25 JUN 04	ASYMMETRIC WARFARE CONF			
14-15 JUN 04	SMI EFFECTS BASED OPS CONF			
14-18 JUN 04	C2 RESEARCH & TECHNOLOGY SYMPOSIUM			



DATE	INT'L CONF/ SYMPOSIA/ORG	NAT'L CONF/ SYMPOSIA/ORG	INT'L MIL	NAT'L MIL
16-17 JUN 04			MIC CD&E PEERS CONF	
21-23 JUN	VARIOUS NAT'L/INT'L MIL-CIV VISITORS TO JWID SITES			
29 JUNE 04			NATO MILITARY BUDGET CTTE	
6-7 JUL 04				ARMY SEWG MTG
18-25 JUL 04	ONA CONCEPTS REFINE WK SHIP FOR EBO MNE4			
11-13 AUG 04	J9 TRANSFORMATIO N CONF			
18-31 AUG 04	VARIOUS NAT'L/INT'L MIL-CIV VISITORS TO ALIX SITES			
1 SEP 04			AUS DEF FORCES	
10 SEP 04			BALTIC DEFENCE COLLEGE	
16 SEP 04			SWEDISH DEFENCE R&D	
21 SEP 04		AEROSPACE INDUSTRY ASSOC OF CDA		
13-17 SEP 04	NETWORK CENTRIC WARFARE CONF		CONSULTATION AUSTRALIAN DF	
19-23 SEP 04	SISO WKSHOP			
20-23 SEP 04	IOPC NCW CONF			
28-30 SEP 04			MIC CD&E MIWGs	
OCT 04	9 ICCRTS C2 CONF			
19 OCT 04				CF AEROSPACE SYSTEMS CRS
24-29 OCT 04		CFEC WORKSHOP ON M&S/SE		
22-29 OCT 04	SMI 6TH ANN NCW CONF			



DATE	INT'L CONF/ SYMPOSIA/ORG	NAT'L CONF/ SYMPOSIA/ORG	INT'L MIL	NAT'L MIL
2-4 NOV 04	NATO CD&E CONF			
4 NOV 04			BRIEF SINGAPORE MOD	
5-14 NOV 04	CMX 05 FINAL PLANNING CONF			
15-19 NOV 04		SEWG WORKSHIP & MTG		
30 NOV-2 DEC 04		NEOps SYMPOSIUM		
DEC 04				OR APPLICATIONS - AMSC 7 AT CFC
6-9 DEC 04	INTERSERVICE INDUS TRG, SIM & EDUC CONF (I/ITSEC)			
15-16 DEC 04			US DoD NAT'L SEC WKSP	
11 JAN 05				DGSP PERSONNEL
25-27 JAN 05	EUR DEF GEOSPATIAL INTELLIGENCE DGI 2005			
17-19 JAN 05			JUAV TSO BRIEFING ON ALIX	
26-28 JAN 05			BRIEF NATO GP4 ON ALIX	
FEB 05	SMI CONF ON PERSISTENT SURVEILLANCE			
3 FEB 05				DOMOPS CONF
8-10 FEB 05			TTCP WKSP	
22-23 FEB 05				PRESENTATION TO CFSATE
23-25 FEB 05			ADM(S&T) TIS WORKSHOP	
8-10 MAR 05			MIC CD&E MIWGs	



GLOSSARY OF TERMS, ABBREVIATIONS & ACRONYMS

- ACD** *Advanced Concept Development.* The first tier of the three-tier CF Concept Development and Experimentation process, ACD is viewed as a front-end force development activity. It is carried out by a staff cell (DDA 5) under Director of Defence Analysis (DDA). Coordinated by the VCDS/DGSP because of the overarching aspects of this function within the Pan-CF force development planning process, this function identifies ideas that could lead to breakthrough concepts and the resultant capability enhancement.
- ASC** *Army Simulation Centre.* Responsible not only for synthetic environment support to training, but also for support to Army operations and combat development. The ASC is a unique organisation in that its establishment includes personnel from the Regular Force, Primary Reserve, DND Public Servants and contracted personnel (both full time and part time) employed through the Alternate Service Delivery Process (ASD).
- AWC** *Air Warfare Centre.* The Chief of the Air Staff has authorized the establishment of an AWC to focus on air force combat capability development including CD&E issues. The Air Force Experimentation Centre (AFEC) element of the future AWC will be co-located with CFEC.
- CapDEM** *Capability Definition, Engineering and Management.* Collaborative CapDEM Technology Demonstration Program (TDP).
- CASE** *Canadian Advanced Synthetic Environment.* Project will provide the capability to use Tier 3 M&S processes for Requirements Definition, Doctrine and Tactics Development, T&E or Distributed Training.
- C2IS** *Command and Control Information System.* The current Command and Control System (C2S) is not capable of managing the increasing amount of information being presented to commanders and staffs in both the deployed and garrison domains. Current systems use different tools, which complicate user training, lack interoperability with each other and our allies and are costly to maintain (because there are many of them). The C2IS will provide commanders at all levels a single operating environment that can access or provide situation awareness and assessment, decision support, and tasking and control services.
- C4ISR** *Command, Control, Communications and Computers, Intelligence, Surveillance, Reconnaissance.* The establishment of a C4ISR Laboratory enables experimentation of new Command and Control concepts and processes for NDCC and the CF Joint Operations Group (JOG), with connectivity to a worldwide CD&E network to enhance collaboration with our international partners.



- CoDSC** *Command Decision Support Capability.* Based on the interaction of doctrine, structure, and information, CoDSC promotes the merging and integration of various information-related functions, which heretofore have been treated as independent disciplines, capabilities or activities.
- CDWG** *Capability Development Working Group.* The CDWG acts as a gatekeeper for proposals to be presented to the JCRB. All concept development experimentation must be coordinated through the CDWG.
- CFCS** *Canadian Forces Command System.* The CFCS consists of two relatively interoperable, robust, redundant systems for the planning, conduct and support of CF operations. The systems will be linked to selected GoC and international systems via a system of firewalls/guards or air gapping.
- CF JCD&E** *CF Joint Concept Development and Experimentation* is an iterative process of collecting, developing and exploring concepts to identify and recommend the PRICIE solutions required to achieve significant advances in transforming to future CF joint operational capabilities.
- CFMWC** *Canadian Forces Maritime Warfare Centre.* A longstanding Maritime centre that has historically focused its efforts on doctrinal and tactical development. Maritime staffs are exploring the impact of broadening CFMWC responsibilities to encompass CD&E for the CMS.
- CIE** *Collaborative Information Environment.* A US concept aimed at enabling enhanced cooperation between geographically-distributed forces. A CIE is the aggregation of individuals, organizations, system capabilities, processes, and infrastructure for the common purpose of creating and sharing the data, information, and knowledge necessary to plan, execute, and assess joint force operations and enable the commander to make better and faster decisions than the adversary. A CIE is an enabler to concepts such as NEOps and EBO.
- CJTL** *Canadian Joint Task List.* Based on Strategy 2020 and the emerging strategic environment, the CF conducted a validation of its capabilities, resulting in the CJTL Capability Matrix. It lists eight CF capability areas, establishes capability goals (high, medium, low) and current status (green, amber, and red at the strategic, operational and tactical levels). It also identifies a number of gaps that must be addressed by the CF in order to achieve the Strategy 2020 vision.
- Combined** Adjective used to describe activities, operations and organizations, in which elements of more than one nation participate.
- Combat ID** *Combat Identification.* Combat Identification is defined as the process of attaining an accurate characterization of detected objects in the battlespace to the



extent that high confidence, timely application of military options and weapons resources can occur.

- Concept** The identification of a problem area or concern together with a hypothesis to remedy the situation or solve the problem. It may also be revolutionary, evolutionary and/or innovative forces that drive the requirement for new technology, new structure, new business processes and partners.
- Concept Development** The process by which ideas are refined, accepted or rejected through the postulation of increasingly detailed hypothesis statements. This process permits the exploration of any concept to determine its merit and feasibility. While pertaining primarily to Tier 3 and to a limited extent Tier 2 CD&E, this could lead to interim operational capabilities or accelerate the operational introduction of new CF capabilities.
- COP** *Common Operational Picture.* A presentation of timely, fused, accurate and validated information that can be tailored to meet the requirements of planning staffs and decision makers at all levels. A COP is an essential element of Network Enabled Operations as it contributes to shared situational awareness.
- CWID** *Coalition Warrior Interoperability Demonstration.* An annual event for the international community to investigate C4ISR solutions to near-term joint and coalition interoperability challenges. Normally conducted annually in June, CWID participants trial and validate prototype and emerging technical solutions to enhance interoperability, information sharing and collaborative planning across the JIMP framework prior to implementation of these tools into operational service.
- Disruptive Technology** New or existing technology used in an innovative fashion that significantly alters established practices.
- DRDC** *Defence Research & Development Canada.* This DND Special Operating Agency has evolved from the *Defence Research and Development Branch*, which used to be a part of the ADM (Mat) Group. It consists of five research establishments; listed east to west they are: DRDC Atlantic, DRDC Valcartier, DRDC Ottawa, DRDC Toronto and DRDC Suffield. These establishments will support JCD&E in a number of ways.
- EBO** *Effects-Based Operations.* An over-arching process for obtaining a desired strategic outcome or “effect” on the adversary through the synergistic and cumulative application of the full range of military and non-military capabilities at the tactical, operational, and strategic levels.



- EBP** *Effects-Based Planning.* The process of planning for an EBO. Taking into account all parties to the JIMP process from the strategic to the tactical levels, it translates the commander's intent into an operational plan.
- ECS** *Environmental Chiefs of Staff.* Navy, Army, and Air Force commanders. ECS will focus on force concepts within their core competencies. The CF Experimentation Centre (Tier 2 CD&E) and the ECD&E Centres (Tier 3 CD&E) will share experience and knowledge and undertake CD&E initiatives across the three CD&E tiers.
- EGDS** *Enhanced Global Distribution System.* This is a draft concept initiated by J4 Logistics that envisages a high performance distribution-based logistic network with a global reach. It is the first component of a triad solution to enhance overall sustainment. The three components are: reduce sustainment demand (via a series of demand reduction technologies); approach the source from the point of consumption; and increase velocity of distribution (achieved by GDS).
- IISRA** *Integrated Intelligence Surveillance and Reconnaissance Architecture.* Supports the COP/CIE by actively managing joint capability, which integrates sensors, weapons, and databases with data fusion and decision supports tools to maximize the effectiveness at all levels to collect and integrate commanders' information requirements.
- Integration** The process whereby the results of a concept exploration are adopted, promulgated or otherwise made use of by the CF/DND.
- Interoperability** The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together.
- JCAT** *Joint Capability Assessment Team.* A team will be formed to examine each of the capability areas in the Canadian Joint Task List. They will have multi-disciplinary representation and they will be asked to propose capability goals, review long range functional plans, identify current and project future gaps, and recommend remedies and options and key indicators to monitor.
- JCRB** *Joint Capability Requirements Board.* The Board will review proposals, challenge issues and provide direction for the development of multi-purpose CF capabilities including the Long Term Capital Plan and Future Capability Plans.
- JEC Project** *Joint Experimentation Capability.* The Project was established to determine how a Joint CD&E capability will be delivered to the CF.



JIACG	<i>Joint Interagency Co-ordination Group.</i> The US Joint Forces Command-developed concept involving a proposed element to be embedded into a Joint Task Force in-theatre to provide liaison between military and civilian authorities. The multinational variant under development via the MNE series is known as the Multinational Interagency Group.
JIIFC	<i>Joint Information & Intelligence Fusion Capability.</i> A project aimed at delivering an integrated JIIFC capability (i.e. LANs), documentation, operational concepts, facilities, procedures, support, training and any other components, automated or non-automated to support a strategic ISR function, which in turn is integrated into the Strategic Level Command Function.
JIMP	<i>Joint, Interagency, Multinational and Public.</i> Command and Control concepts of specific interest will directly relate to interoperability issues associated with operations within the JIMP framework. Interoperability across JIMP categories will occur in three broad domains: information interoperability (the way we share information including technological and procedural aspects); cognitive interoperability (the way we perceive and think reflected in doctrine and decision processes); and behavioural interoperability (the way we carry out the selected course of action).
Joint	Adjective used to describe activities, operations and organisations in which elements of at least two services participate.
Joint Fires	This event will be conducted in 2005. Early information suggests emphasis on C2 of air and artillery fire support to ground forces. Certainly there is good potential for ISR and Command and Control concept development, with potential work progression on Combat Identification (Combat ID).
JSG	<i>Joint Support Group.</i> The centrepiece of the NMSC project will be the establishment of a CF JSG formation, capable of planning and executing in-theatre sustainment for the initial phases of CF contingency operations abroad.
Logistics	The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, the aspects of military operations which deal with: <ul style="list-style-type: none">• Design and development, acquisition, storage, transport, distribution, maintenance, evacuation and disposition of materiel;• Transport of personnel;• Acquisition, construction, maintenance, operation, and disposition of facilities;• Acquisition and furnishing of services; and• Medical and health service support.



- MIC** *Multinational Interoperability Council* is a multinational forum focused on identifying information interoperability issues, articulating actions and developing solutions that would contribute to more effective coalition operations. The participants are: Canada, Australia, France, Germany, UK and the US, with NATO as an observer. This is co-chaired by C3I and the Joint Staff J6 from the US Joint Chiefs of Staff.
- MIWG** *Multinational Interoperability Council CD&E Working Groups*. Formed under the MIC, a series of several Multinational Working Groups (MIWGs) have been established to explore problems in various aspects of coalition interoperability (Information Sharing, Doctrine, Logistics, etc), to identify and to clarify impediments and to prepare prioritized recommendations for approval by the MIC, and implementation by the participating nations.
- MNE Series** *Multinational Experimentation Series*. A series of multinational experiments led by US Joint Forces Command that focus on the concept of *Effects Based Operations* as well as related enabling concepts, processes, organizations and tools. Participants include Australia, Canada, France, Germany, the United Kingdom, the United States and NATO. For MNE 4, Finland and Sweden have observer status.
- Model** A model is a physical, mathematical, conceptual, or otherwise logical representation of a system, entity, phenomenon, or process.
- MSRR** *Modelling & Simulation Resource Repository*. Designed to facilitate the move towards operability and reusability, enhanced innovation, knowledge, creativity and productivity and also integrate new information technologies and management practices in the M&S/SE business plan. The MSRR will also provide the means to identify, protect and obtain reusable resources such as data/information, software applications, software components and analysis results.
- NEOps** *Network Enabled Operations*. The conduct of military operations characterized by common intent, decentralized empowerment and shared information, enabled by appropriate culture, technology and practices.
- NGO** *Non-Governmental Organization*. There are numerous NGOs that may be present in a theatre of operations; e.g. the Red Cross, Doctors Without Borders, all wanting to improve on the conditions faced by the local inhabitants.
- NMSC** *National Military Support Capability*. The NMSC Project was initiated to enhance the CF's capability to support deployed operations abroad. The centrepiece of the project will be the establishment of a CF JSG formation, capable of planning and executing in-theatre sustainment for the initial phases of CF contingency operations abroad.



ONA	<i>Operational Net Assessment.</i> A continuous and collaborative process that builds a coherent knowledge base and shared awareness of ourselves, the adversary and how the adversary views us. ONA is an enabling process to EBO.
Pegasus Series	A series of major validation events proposed for experimentation by CFEC, conceptually framed as joint and combined events. Focusing on domestic (<i>Guardian</i>) and expeditionary (<i>Venture</i>) operations, the Pegasus Series provides CFEC and the CF opportunities to validate potential future capabilities in order to accelerate the transformation of the CF in accordance with Strategy 2020.
PMESII	<i>Political, Military, Economic, Social, legal, ethical, environmental, Information & Infrastructure and science & technology.</i> A prerequisite for EBO is the development of appropriate theoretical and analytical constructs that consider and integrate PMESII dimensions across the conflict spectrum. Such a framework relates effects to actions and national objectives, provides for a continual assessment of operational outcomes and intended and unintended consequences, and facilitates the coordination and optimization of interagency efforts.
PRICIE	Personnel, Research & Development, Infrastructure and organization, Concepts, Doctrine and Collective Training, Information Management, and Equipment, Supplies and Services are the functional components of military capabilities. PRICIE is a construct employed the CF Capability-Based Force Development process.
SEBA	<i>Synthetic Environment Based Acquisition.</i> SEBA is intended to utilize M&S to shorten acquisition timelines and reduce the associated investment risk.
SECO	<i>Synthetic Environment Coordination Office.</i> It's mandate through the DND M&S Plan is to remedy M&S shortcomings through the establishment of an M&S/SE information sharing capability. Its primary focus will be to provide DND/CF with a comprehensive, standardized capability.
SEER	<i>Strategic Exercise and Experimentation Reserve.</i> The JCRB has approved the establishment of a SEER to fund select CF strategic-level exercises and experimentation activities. The JCRB will approve annual funding requirements for SEER while DCDS will apply for and administer the SEER through the business planning process.
SEWG	<i>Synthetic Environment Working Group.</i> The DND SECO will act in support with the DND SEWG stakeholders as the co-ordination centre for the setting of M&S/SE policy and standards, providing guidance, direction and/or leadership on M&S/SE and organizations.
Simulation	The implementation of a model over time.



SISO	<i>Simulation Interoperability and Standards Organization.</i> An international industry-based organization intended to rationalize product standards.
SMARTS	<i>Simulation & Modelling for Acquisition, Requirements, Training, & Support</i> initiative.
Sponsor	This is usually a Group Principal or ECS designated to be the leader in the change process in a specific area in the CF/DND. CFEC seeks a sponsor for each major concept under examination via the JCD&E process.
Strategy 2020	Defence Strategy 2020 is a DND strategy paper that provides the vision for adopting new technologies, developing new concepts of operation and for optimizing CF doctrine and organizational structures to achieve a capability-based, knowledge-centric military force positioned to operate effectively in the evolving strategic environment. The CF must now harness these new developments and changes to seek dramatic improvements in its military capabilities which, when applied judiciously, will achieve desired strategic results.
Sustainment	The requirement of a military force to maintain its operational capability for the duration required to achieve its objectives. Sustainment consists of the continued supply of consumables, maintenance and replacement of combat and non-combat equipment, military engineering services, health services support, and personnel management services, including personnel replacements.
SE	<i>Synthetic Environment.</i> An instantiation of any combination of models, simulations, and equipment, real or simulated, linked together to allow for interaction with the world being represented.
TDP	<i>Technical Demonstration Program.</i> A DRDC-led program that demonstrates and validates technical solutions for new or emerging CF operational systems and concepts.
Time Horizon	For Capability Based Force development planning purposes, the future time horizon has been divided into three segments; first five years (Horizon I), five to 10 years (Horizon II) and 10 to 25 years (Horizon III).
TTCP	<i>The Technical Cooperation Program.</i> This is an international organization that collaborates in defence scientific and technical information exchange; program harmonization and alignment; and shared research activities for the defence scientists from Australia, New Zealand, USA, UK, and Canada.
VV&A	<i>Verification, Validation & Accreditation.</i> <i>Verification</i> is the process of determining that a model implementation accurately represents the developer's conceptual description and specifications. <i>Validation</i> is the process of determining



the degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model. *Accreditation* is the official certification that a model or simulation is acceptable for use for a specific purpose.



CONSOLIDATED RESOURCE IMPLICATIONS

Activity	Reg Force PY	Res Force PY	Civ PY	Budget	NP	SEER
2005/2006						
ACD	1	0	3	338,000		
JCD	(Note 1) 1	0	0	408,000		
Command & Sense (C&S)	3	(Note 2) 2	0	315,000		
Support, Sustain and Mobility (SSM)	1	2	1	281,000		
Effective Eng	0	2	0	315,000		
Force Gen	0	2	0	50,000		
Int'l Prog	1	2	0	1,200,000		
SECO	1	0	3	1,200,000		
OR	0	0	4	108,000		
S&T	0	0	4	250,000		
IT/SE/Op Sp	(Note 3) 3	1	6	1,981,000	(Note 4) 708,000	
Corporate	3	3	3	(Note 5) 2,740,000		
Totals	14	14	24	9,186,000	708,000	
2006/2007						
JCD	4	0	0	608,000		
C&S	5	2	0	500,000		500,000
SSM	2	2	1	500,000		500,000
Effective Eng	2	2	0	500,000		2,000,000
Force Gen	2	1	0	75,000		
Int'l Prog	1	2	0	1,500,000		
SECO	1	0	4	1,400,000		
OR	0	0	5	125,000		
S&T	0	0	5	250,000		
IT/SE/Op Sp	3	1	6	1,981,000	848,000	
Corporate	3	3	3	2,740,000		
Totals	23	13	24	10,179,000	848,000	3,000,000
2007/2008						
JCD	4	0	0	608,000		
C&S	7	0	0	750,000		1,000,000
SSM	4	0	1	750,000		1,000,000
Effective Eng	5	0	0	500,000		3,000,000
Force Gen	5	0	0	200,000		
Int'l Prog	4	0	0	1,800,000		
SECO	1	0	4	1,400,000		
OR	0	0	6	150,000		
S&T	0	0	5	280,000		
IT/SE/Op Sp	5	0	9	1,981,000	938,000	

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Activity	Reg Force PY	Res Force PY	Civ PY	Budget	NP	SEER
Corporate	7	0	4	2,740,000		
Totals	42	0	29	11,159,000	938,000	5,000,000

Activity	Reg Force PY	Res Force PY	Civ PY	Budget	NP	SEER
2008/2009						
JCD	4	0	0	608,000		
C&S	7	0	0	1,000,000		1,000,000
Sustain	4	0	1	1,500,000		1,000,000
Effective Eng	5	0	0	500,000		3,000,000
Force Gen	5	0	0	1,000,000		
Int'l Prog	4	0	0	1,800,000		
SECO	1	0	4	1,400,000		
OR	0	0	6	175,000		
S&T	0	0	5	285,000		
IT/SE/Op Sp	5	0	9	1,981,000	823,000	
Corporate	7	0	4	2,740,000		
Totals	42	0	29	12,989,000	823,000	5,000,000

Note 1: This represents a proposed DCDS Concept Development capability. The position totals do not include three (3) proposed ECS-assigned concept developers to coord ECS-related CD&E activity.

Note 2: Reserve personnel are being engaged as a short-mid term measure pending approval and staffing of the CFEC FOC establishment. As proposed Regular Force positions come on line, Reserve support will be reduced accordingly.

Note 3: This chart includes Battle lab operations, IT costs and SE/M&S costs as well as general experiment operations support costs not assigned to experiment teams.

Note 4: National Procurement (NP) costs are for CFXNet network leasing and support services.

Note 5: Corporate figures for all FYs do not include Civilian SWE figure that is still being calculated at the time of publication of this document.



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