Human Centric Architecture Framework

Human Views in DNDAF - Interim Report

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Abstract

As a result of information technology and acquisition reform within Allied defence communities architectural approaches have emerged and are evolving as a structure for the development of a systems architecture or enterprise architecture. While international architecture frameworks evolve to include new concepts in System Engineering, the portrayal of the human as a unique part of the system has not been addressed. A Human View is required to explicitly represent the human and to document the unique implications humans bring to and impose on the system design. To that end, the idea of Human Views, which leverages Human System Integration principles, has emerged. The purpose of the Human View is to capture the human requirements and to cater to and inform on how the human interacts with the system. This report defines the Human Views that are applicable to the Department of National Defence / Canadian Forces Architecture Framework (DNDAF).

Résumé

En raison de la réforme de la technologie de l'information et des acquisitions au sein des communautés de la défense des pays alliés, de nouvelles démarches architecturales émergent et continuent d'évoluer en tant que structure d'élaboration d'architectures de systèmes ou d'entreprise. Bien que les cadres d'architecture internationaux continuent d'évoluer pour prendre en charge de nouveaux concepts en ingénierie des systèmes, la représentation de l'humain en tant que composant unique du système n'a pas été abordée. Une vue humaine est requise pour représenter l'humain de manière explicite et pour rendre compte des aspects uniques des humaines dans la conception de systèmes. Émerge à cette fin le concept de vues humaines, qui s'appuie sur les principes de l'intégration des systèmes humains. L'objet de la vue humaine est de saisir les exigences humaines, ainsi que de refléter les interactions des humains avec le système et d'en rendre compte. Le présent rapport définit les vues humaines qui s'appliquent au cadre d'architecture du ministère de la Défense nationale et des Forces canadiennes (CAMDN).

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Executive summary

Human Centric Architecture Framework: Human Views in DNDAF - Interim Report

Curtis Coates; Andrew Stewart; Michael Perlin; DRDC Toronto CR 2012-048; Defence R&D Canada – Toronto; June 2012.

Introduction: As a result of information technology and acquisition reform within Allied defence communities architectural approaches have emerged and are evolving as a structure for the development of a systems architecture or enterprise architecture. These approaches are applicable to large systems with complex integration and interoperability challenges that could be used by the planning, design and acquisition communities to describe the overall system. An architecture framework defines a common approach for development, presentation, and integration of architecture descriptions. The products generated can be used to support stakeholder perspectives and depict multiple, complementary aspects of a complex system. These views can then be integrated together to reconstruct the system.

While international architecture frameworks evolve to include new concepts in System Engineering, the portrayal of the human as a unique part of the system has not been addressed. A Human View is required to explicitly represent the human and to document the unique implications humans bring to and impose on the system design. To that end, the idea of Human Views (HVs), which leverages Human Systems Integration (HSI) principles, has emerged. The purpose of the Human View is to capture the human requirements and to cater to and inform on how the human interacts with the system.

Human Views promise to enable an understanding of the human role in systems/enterprise architectures. They offer a basis for supporting stakeholder decisions by providing a structured linkage from the requirements and engineering communities to the manpower, personnel, training, and human factors communities. They also provide a way to integrate human system integration into the mainstream acquisition and system engineering process by promoting early consideration of human roles. Thus, HVs provide early coordination of human related information between system engineering and human factors teams. A universally accepted Human View concept would go a long way toward enabling consistency and commonality across service elements and international forces. By capturing the necessary decision data in the Human Views and integrating this complementary outlook with the rest of the architecture framework, the framework would be improved and provide a more complete appreciation of the overall system requirements.

Results: The research team identified key stakeholders in the Directorate of Enterprise Architecture (DEA), the group responsible for implementing DNDAF, and other DND stakeholder organizations, and conducted semi structured interviews/ focus group discussions.

Based on stakeholder input, acquisition and Human Factors expertise, the team further developed a core set of Human Views, by adapting the set of NATO Human Views to reflect the context of the Canadian Forces (CF) landscape. In addition to the content of the Views themselves, the Canadian HVs are organized in accordance with the Human System Integration domains. This

will result in an easier adoption of the views from the system engineers and project managers as Human Systems Integration is a familiar construct within the CF.

This interim report clearly articulates DND's general plans for DNDAF development and broadly outlines DEA's requirements on Human Views, particularly how Human Views can be integrated into DNDAF.

Significance: This work advances the development of a set of Human Views for inclusion with the current set of DNDAF Views. The Human Views provide DNDAF with a set of architecture constructs that describe the human functions and roles inside an enterprise architecture. This work will further integrate Human Systems Integration processes with System Engineering process. The Human Views also supports Capability Engineering in application domains such as capital acquisition.

The proposed Human Views will ensure the human aspects are captured and considered alongside system and operational issues during acquisition. The intent of DNDAF/HV is to provide guidance and directions to DND organizations in their effort to create/apply/maintain architectural products. The decision to focus on acquisition in this project was due to the significance and relevance of acquisition to HSI R&D. However, in this report, the description of HV development work can be interpreted with respect to its applicability to a broader range of DND activities such as ongoing operations or programs.

Future plans: The next steps of this research project are to develop and apply the Human Views to a case study of either the Joint Support Ship project or the Virtual Combined Air Operations Center.

Sommaire

Human Centric Architecture Framework: Human Views in DNDAF - Interim Report

Curtis Coates; Andrew Stewart; Michael Perlin ; DRDC Toronto CR 2012-048 ; R & D pour la défense Canada – Toronto; juin 2012.

Introduction ou contexte: En raison de la réforme de la technologie de l'information et des acquisitions au sein des communautés de la défense des pays alliés, de nouvelles démarches architecturales émergent et continuent d'évoluer en tant que structure de l'élaboration d'architectures de systèmes ou d'entreprise. Ces démarches s'appliquent à de grands systèmes qui présentent des défis complexes d'intégration et d'interopérabilité et pourraient être utilisés par les communautés de planification, de conception et d'acquisition afin de décrire le système global. Un cadre architectural définit une approche commune d'élaboration, de présentation et d'intégration de descriptions d'architectures. Les produits générés permettent d'appuyer les perspectives des intervenants et d'illustrer de multiples aspects complémentaires d'un système complexe. Les diverses vues peuvent ensuite être intégrées pour redéfinir le système.
Bien que les cadres architecturaux internationaux continuent d'évoluer pour prendre en charge de nouveaux concepts en ingénierie des systèmes, la représentation de l'humain en tant que composant unique du système n'a pas été abordée. Une vue humaine est requise pour représenter l'humain de manière explicite et pour rendre compte des aspects uniques des humains dans la conception de systèmes. Émerge à cette fin le concept de vues humaines (VH), qui s'appuie sur les principes de l'intégration des systèmes humains (ISH). L'objet de la vue humaine est de saisir les exigences humaines, ainsi que de refléter les interactions des humains avec le système et d'en rendre compte.

Le concept des vues humaines peut améliorer notre compréhension du rôle des humains dans les architectures de systèmes ou d'entreprise. Ces vues permettent d'appuyer la prise de décision des intervenants en établissant un lien structuré entre les communautés d'ingénierie et de formulation d'exigences, d'une part, et celles de la main-d'œuvre, du personnel, de la formation et des facteurs humains, d'autre part. Elles permettent aussi d'intégrer les systèmes humains au processus principal d'acquisition et d'ingénierie de systèmes en encourageant la prise en compte des rôles humains au début du processus. Ainsi, les VH assurent une coordination précoce des renseignements relatifs aux humains entre les équipes d'ingénierie de systèmes et de facteurs humains. Par conséquent, un concept généralement reconnu des vues humaines contribuerait à assurer un traitement cohérent et commun dans l'ensemble des éléments de service et des forces internationales. La capture des données décisionnelles requises sur les vues humaines et l'intégration de cette perspective complémentaire au reste du cadre architectural permettent d'améliorer le cadre et d'assurer une meilleure compréhension des exigences globales du système.

Résultats: L'équipe de recherche a identifié les principaux intervenants de la Direction de l'architecture d'entreprise (DAE), le groupe chargé de la mise en œuvre du CAMDN, et des autres organisations d'intervenants. L'équipe a aussi mené des entrevues semi-structurées et des discussions de groupes.

En se fondant sur les commentaires des intervenants, ainsi que sur un savoir-faire en matière d'acquisition et de facteurs humains, l'équipe a aussi développé un ensemble de base de vues humaines en adaptant l'ensemble de vues humaines de l'OTAN pour tenir compte du paysage des Forces canadiennes (FC). En plus de leur contenu, les VH canadiennes présentent une organisation fondée sur les domaines d'intégration des systèmes humains. Cela simplifiera l'adoption des vues par les ingénieurs de systèmes et les gestionnaires de projets, puisque l'intégration des systèmes humains est une structure connue au sein des FC.
Le présent rapport provisoire articule clairement les plans généraux du MDN en vue de l'élaboration du CAMDN et décrit en général les exigences de la DAE relatives aux vues humaines et, notamment, comment ces vues peuvent s'intégrer au CAMDN.

Importance: Les travaux font progresser le développement d'un ensemble de vues humaines à ajouter à l'ensemble actuel de vues du CAMDN. Les vues humaines ajoutent au CAMDN un ensemble de structures architecturales qui décrivent les fonctions et les rôles humains dans le cadre d'une architecture organisationnelle. Les travaux intégreront encore davantage les processus de systèmes humains à ceux d'ingénierie de systèmes. Les vues humaines appuient aussi l'ingénierie des capacités dans des domaines d'application comme l'acquisition d'immobilisations.

Les vues humaines proposées assureront que les aspects humains sont capturés et pris en compte en même temps que les questions de systèmes et les enjeux opérationnels au cours du processus d'acquisition. Les VH du CAMDN visent à fournir une orientation et des directives aux organismes du MDN dans le cadre de leurs efforts pour créer, mettre en œuvre et maintenir des produits architecturaux. La décision de mettre l'accent sur l'acquisition dans le cadre du projet était fondée sur l'importance et la pertinence de l'acquisition pour la recherche et le développement en ISH. Par contre, la description des travaux de développement de VH présentée dans le présent rapport peut être interprétée par rapport à son application à une plus vaste gamme d'activités du MDN, par exemple les opérations ou les programmes en cours.

Perspectives: Les prochaines étapes dans le cadre du présent projet de recherche sont le développement des vues humaines et leur application à une étude de cas du projet du Navire de soutien interarmées ou du Centre multinational d'opérations aérospatiales virtuel.

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1 Project Background

As a result of information technology and acquisition reform within Allied defence communities architectural approaches have emerged and are evolving as a structure for the development of a systems architecture or enterprise architecture. These approaches are applicable to large systems with complex integration and interoperability challenges that could be used by the planning, design and acquisition communities to describe the overall system. An architecture framework defines a common approach for development, presentation, and integration of architecture descriptions. The products generated can be used to support stakeholder perspectives and depict multiple, complementary aspects of a complex system. These views can then be integrated together to reconstruct the system.

While international architecture frameworks evolve to include new concepts in System Engineering, the portrayal of the human as a unique part of the system has not been addressed. A Human View is required to explicitly represent the human and to document the unique implications humans bring to and impose on the system design. To that end, the idea of Human Views (HV), which leverages Human System Integration (HSI) principles, has emerged. The purpose of the Human View is to capture the human requirements and to cater to and inform on how the human interacts in the system.

Human Views promise to enable an understanding of the human role in systems/enterprise architectures. They offer a basis for supporting stakeholder decisions by providing a structured linkage from the requirements and engineering communities to the manpower, personnel, training, and human factors communities. They also provide a way to integrate human system integration into the mainstream acquisition and system engineering process by promoting early consideration of human requirements. Thus, HVs provide early coordination of human related information between system engineering and human factors teams. A universally accepted Human View concept would go a long way toward enabling consistency and commonality across service elements and international forces. By capturing the necessary decision data in the Human Views and integrating this complementary outlook with the rest of the architecture framework, the framework would be improved and provide a more complete appreciation of the overall system requirements, functionalities, and dependencies.

The overall objectives of this work were:

a. Identify and populate a core set of Human Views pertaining to the CF landscape as defined during the HFM-155 NATO HV Workshops held in Toronto (Canada), Birmingham (UK), and Kiev (Ukraine);

b. Integrate the Human Views into the Department of National Defence / Canadian Forces Architecture Framework (DNDAF); and

c. Verify and validate the Human Views based on a representative use case.

The scope of work covered by this task authorization included the following activities, as described in the project statement of work:

a. *Task 1:* Identify key stakeholders in the Directorate of Enterprise Architecture (DEA), and other DND organizations and conduct stakeholder interviews. The goals are to understand (1) DND's general plans for DNDAF development; (2) DEA's requirements on Human Views, particularly how Human Views can be integrated into DNDAF.

b. *Task 2:* Further develop the Human View based on the outputs from Task 1. The focus of the current task is to identify and elaborate a core set of NATO Human Views in the context of the CF landscape. Leveraging the previously completed work, refine and further develop a notional set of Canadian Human Views architecture data products.

   Also, proposed linkages between the HV architecture data products and the existing DNDAF will be provided. It is anticipated that this effort will require an extension to the DNDAF schema to ensure the necessary linkages are established between existing DNDAF and proposed HV architecture data products.

c. *Task 3:* Select one user case for the application of Human Views.

d. *Task 4*: Apply the Human Views to the user case.

e. *Task 5*: Organize and facilitate a Human Views workshop with DND stakeholders to present the Human Views architecture data products and the results from the user case study.

The intent of this project is to leverage the early Human View work done by Canada (Collaborative Capability Definition, Engineering and Management (CapDEM) TDP project and the "Human Centric Architecture Framework" proof of concept project completed by Defence Research and Development Canada (DRDC)) and the consolidation of the Human View work done by the Allied nations reported as the NATO Human Views.

This project will leverage the intent of the NATO HV work and tailor the data products, with a specific focus on major Crown acquisition projects, so as to ensure they are appropriate for Canada. This effort will help to provide a template whereby Human View products may provide a suitable mechanism to embed HSI into the decision making processes in DND capital procurement and ensure the single greatest cost driver, people, is addressed 'up front'.

The project work has been broken down into the following two (2) phases.

a. Phase I – October 1st, 2011 to March 31st, 2012 (covers Task 1 – 3); and

b. Phase II – April 1st, 2012 to March 31st, 2013 (covers Task 4 and 5)

These tasks were completed by the research team, which consisted of members from DRDC, DND and industry, as shown in Table 1.

This report will cover work done to date for Phase I of the project including Task 1, 2, and 3.

Table 1: Phase 1 Research Team Members

Dr. Wenbi Wang	Scientific Authority (SA) – DRDC Toronto
Mr. Walter Dyck	Defence Scientist – DRDC Corporate
Ms. Lily Au	Directorate of Enterprise Architecture
Mr. Andrew Stewart	Human System Integration – CMC Electronics
Mr. Michael Perlin	Modelling and Simulation – CMC Electronics
Mr. Curtis Coates	Project Manager – CMC Electronics

2 Methodology

The process followed was agreed upon between the SA and the research team prior to the commencement of work.

2.1 Task 1: Identify Key Stakeholders in DEA

CMC will undertake the following activities to identify key stakeholders in the Directorate of Enterprise Architecture (DEA) and other DND organizations, and conduct approximately five interviews to gather an understanding of DND's plans for DNDAF development and DEA's requirements on HV.

2.1.1 Coordinate Interviews with Stakeholders

With approval of the SA, CMC will contact key personnel within DND to identify relevant Subject Matter Experts (SME) regarding both DNDAF and the Human View. CMC will in turn contact all identified SME to explain the project and arrange a time for an interview.

2.1.2 Conduct Interviews

Once the relevant SME have been identified and contacted the five individuals deemed to have the most relevant expertise will be interviewed using a semi-structured interview approach. The semi-structured interview questions and format will be approved by the SA prior to conducting the interviews. The target is five interviews.

2.1.3 Capture Interview Results and Compile Report

Upon completion of the interviews, CMC will compile the results, summarizing the salient points/ observations that provide insight into the goals of Task 1; identify DND's general plans for DNDAF development and DEA's requirements for the Human View.

2.2 Task 2: Further Develop Human Views

Based on the outputs from Task 1 above, CMC will undertake the following activities to identify and further elaborate a core set of Human Views in the context of the Canadian Forces landscape.

2.2.1 Review Human Views Literature and Working Group Minutes

CMC will review existing work completed on the Human View with the intent of leveraging the previous work to refine and further develop a core set of Human Views. The review will be based on available data gathered both by the contractor and the SA.

2.2.2 Elaborate on Current Human Views

CMC will provide a short overview, purpose, expected use, detailed description including attributes and explanations of the attributes, and an example of each of the core set of architecture data product.

2.2.3 Make Links to DNDAF Architecture Framework

In consultation with DEA, CMC will propose linkages between the proposed set of core Human Views architecture data products and the existing DNDAF. CMC will identify the need for, and propose possible extensions to the existing DNDAF schema if required.

2.2.4 Compile Report

CMC will compile a report, format to be determined, detailing the work completed in Section 2.2.3 above and in accordance to project Statement of Work.

2.3 Task 3: Select User Case for the Application of Human Views

2.3.1 Select Project for Human Views Use Case

In consultation with the SA, CMC will select an appropriate major DND acquisition project in which Human Requirements are sufficiently complex so that the core set of Human Views can be applied. CMC will use the results from Task 001 of this contract as the primary guidance for the selection of an acquisition project.

2.3.2 Contact Project and Discuss Existing Data Products

Upon SA approval, CMC will contact the key personnel with the major acquisition project and start a dialogue regarding the subject use case objectives and data requirements.

3 Human View Stakeholder Workshop

In Phase 1, the research team was asked to identify key stakeholders in the Directorate of Enterprise Architecture (DEA), and other DND organizations, and conduct stakeholder interviews. A workshop was organized to achieve this objective.

During the workshop, there was a distinct focus on DND acquisition projects, particularly the activities that take place within the "options analysis" and "requirements specification" phases of an acquisition project. One particular area of interest was identified and it focused on issues associated with manpower and personnel requirements such as ship complement design and crew knowledge/skill requirement analysis. The complexity of such issues, particularly when they are considered in the context of various technological factors, such as the use of automation, leads the team to believe that Modeling and Simulation (M&S) may provide a very useful solution.

Main points discussed in the workshop were:

1. The HVs provide both a method and a tool to support stakeholder decisions related to CF personnel. The full spectrum of issues related to personnel is highly complex and they are currently managed in DND by a number of organizations;
2. Although the HVs can be utilized to describe any system where the human is an integral component, its benefit is most significant in new capability generation effort, e.g., DND acquisition projects. It is generally recognized that early consideration of personnel requirements and continual evolutions of these requirements in such projects are very important, as suggested by existing DND guidelines on handling personnel issues in acquisition; and
3. The lack of Human System Integration guidance during project development leads projects to adopt a platform-centric view, which heavily emphasizes the hardware and software aspects of a system, and minimizes the consideration of humans as integral components of the system.

A full summary of the workshop results can be found in DRDC Toronto Letter Report 3774-2008-14dd01.

4 Elaborate a Core Set of NATO Human Views

The objective of Task 2 is to identify and elaborate a core set of Human Views in the context of the CF landscape based on the outputs from Task 1. The goal was to leverage the previously completed work, refine and further develop a notional set of Canadian Human Views architecture data products. In addition, linkages between the HV architecture data products and the existing DNDAF were provided.

4.1 Human View Reference Documents

A number of relevant documents have been reviewed as part of this research project. The majority of the references have not been cited in the report therefore they are not listed in the references section. These documents were referred to by the research team to ensure there was a working knowledge of Human Views and Architecture Framework. The documents are:

a. Human Views Extensions to the Department of Defense Architecture Framework, (DRDC Corporate CR-2008-001). Baker, K., Stewart, A., Pogue, C. and Ramotar, R., 2008.
b. Human Views: Development of Human Personnel Employment Architecture Data Product, Phase III Summary Report. Baker, K., Scipione, A. and Zikovitz, D, 2008.
c. DND/CF Architecture Framework Version 1.8, Volumes 1 – 4.
d. NATO Human View Handbook
e. NATO Human View Quick Start Guide Final
f. The NATO Human View Development (Vol 1) June 2008
g. The NATO Human View Deskbook (Vol 2) June 2008
h. NATO (2010) Human systems integration for network centric warfare (RTO Technical Report,TR-HFM-155), Brussels, Belgium.
i. Human Factors Integration for MODAF: Needs and Solution Approaches, Bruseberg and Lintern – 2007 INCOSE.
j. Human Functional Analysis of Lean Staffing: Extensions to the Department of Defense Architecture Framework (DoDAF). Lintern, Gavan and Bruseberg, Anne (2007), Seventeenth Annual International Symposium of the International Council On Systems Engineering (INCOSE), San Diego, CA USA, 24 - 28 June 2007.
k. Human Views for MODAF as a Bridge between Human Factors Integration and Systems Engineering. Bruseberg A., Cognitive Engineering and Decision Making Journal.
l. Applying the Human Views for MODAF to the conception of energy-saving work solutions. Bruseberg, A. Proceedings of INCOSE 2008 (8th Annual International Symposium of the International Council on Systems Engineering, Utrecht, The Netherlands, 15-19 June 2008.
m. The Human View Handbook for MODAF, First Issue, 15 July 2008.
n. The Human View Handbook for MODAF, Draft Second Issue, 5 October 2009.
o. Department of Defense Architecture Framework (DoDAF) Version 2.0 Volumes 1 - 3.
p. Architecture Framework Human View: The NATO Approach, Handley and Smillie, August 2007.
q. Human View Dynamics – The NATO Approach, Handley and Smillie, October 2008.

r. NATO Human View Dynamics with the Improved Performance Research Integration Tool (IMPRINT), Handley, Imler, Mitchell, and Samms.

4.2 Introduction to DNDAF and Human Views

As a result of information technology and acquisition reform several Allied defence communities (e.g. United States, Department of Defense (DoD), United Kingdom, Ministry of Defence (MOD), and Canadian Forces, Department of National Defence (DND)) have been applying an emerging and evolving architectural approach in effort to apply analytical rigour and traceability within a System-of-Systems construct of capability based planning and system acquisition. This approach provides structure for the development of a systems architecture or enterprise architecture to describe large systems with complex integration and interoperability challenges.

While there are similarities between the allied defence communities architecture frameworks, for example all of them attempt to define a common approach for development, presentation, and integration of architecture descriptions, currently there is not a single set of frameworks ("views") that have been found to be applicable to all countries. For instance, the US Department of Defense Architecture Framework (DoDAF) is organized into four basic Views: All View (AV), Operational View (OV), Systems View (SV), and the Technical Standards View (TV). The Ministry of Defence Architecture Framework (MODAF) has extended the original four Views of DoDAF to include a Strategic View (StV) and the Acquisition View (AcV). The Canadian Department of National Defence Architecture Framework (DNDAF) extends the DoDAF Views (Common View (CV), Strategic View (StratV). Capability View (CapV), Operational View (OV), System View (SV), and Technical View (TV)) and includes an Information View (IV) and Security View (SecV).

4.2.1 DNDAF

The Canadian DND/CF Architecture Framework (DNDAF) is similar in form and function to both the USA version (DODAF) and the UK version (MODAF). While DNDAF is currently in version 1.8, it is not mandated for use by DND projects and is not widely known outside the IT community. DNDAF is managed by the Directorate of Enterprise Architecture (DEA) within the Assistant Deputy Minister (Information Management) (ADM(IM)) Group.

As of now, DNDAF consists of 8 categories of views and a total of 37 sub-views. DNDAF products are stored in databases developed based on the Defence Architecture Data Model (DADM). The DADM defines the elementary architecture data entities and their relationships, and provides a logical basis for converting architecture descriptions, often in textural, tabular, or graphical forms, to structured architecture data that can be stored in a central data repository. The current version of DADM, before integrating HVs, has 210 entities (tables) and 1229 data attributes (fields).

DEA is currently moving ahead with the implementation of Qualiware, a tool to assist in the depiction of DNDAF views. DEA has yet to talk to the Qualiware providers about the Human Views.

4.2.2 Human Views

Through the development and use of the above mentioned architecture frameworks, there was an acknowledgement by all that there was a component of capability based planning and system acquisition missing; the human was not well represented in the Views. DoDAF [1], made an initial attempt to represent humans in the operational view products by including the role of the human and human activities associated with a system. In and around the same time as the Deskbook was being published, analytical efforts by both Canada and the United Kingdom were underway in an attempt to incorporate human requirements into the architecture frameworks with particular emphasis on the Human Systems Integration (HSI) domains of manpower, personnel, training, and human factors engineering.

Again, specialists within the engaged allied nations used complementary, but different analytical methods to establish emerging human view concepts. Some of the approaches followed a top down method by analyzing gaps of human requirements in existing architecture frameworks, while other approaches were based on evolving and specific needs to capture specific human data.

While differences within the architecture frameworks lent themselves to facilitating different approaches to human view development, the end result was largely the identification of a complementary set of core human elements. The similarity in core human elements identified an alignment between the intent of the human Views developed independently by the Allied nations. With this similarity of intent identified, a NATO RTO working group (HFM-155) held a Human View Workshop to produce a cross-nation set of Human Views that focused on the human part of a system. The purpose of this meeting was to evaluate the emerging human view concepts, propose and develop a set of candidate NATO-wide human view construct [2].

To this end the Ministry of Defense Architecture Framework (MoDAF), United Kingdom, contributed their set of human views that were developed to support Human Factors Integration (HFI). The suggested Human Views for MoDAF include Capability Constraints, HFI Quality Objectives and Metrics, Social Network Structure, Organizational Dependencies, Human Function Definitions, Human Functions to Role and Competency Mapping, and Human Performance Dynamics [8, 11].

The Canadian approach was to extend the existing DoDAF/DNDAF architecture products to focus on areas aimed at providing support to decision makers interested in the HSI areas of manpower, career progression, and training by providing insights into the definition of manpower requirements and the analysis of ‘gaps’ in personnel [3]. The goal of these views is to define how the human component will impact system or capability performance, and conversely, how the system impacts the human requirements. The suggested Human Views for DNDAF include Manpower Projections, Career Progression Roadmap, Individual Training Roadmap, and the Establishment Inventory.

Also, the Maritime Headquarters with Maritime Operations Center (MHQwMOC) provided their Human View concept to the workshop [9]. They were focused on the impact of Human System Integration (HSI) issues and how human views could help augment the Capabilities Based Assessment (CBA) of the US Maritime Headquarters with Maritime Operations Center (MHQwMOC). The MHQwMOC views include Responsibility Matrix, Activity to UNTL

Alignment, Knowledge, Skills and Abilities (KSA) per Activity, Role Requirements, Role Training, Workload, Locations and Reach-back, Organizational Structures, and Doctrine.

In addition, while not explicitly citing a Human View, the Royal Netherlands Navy (RNLN) Manning Program presented their approach for examining human issues (comparing crew concepts considering current and future technologies) in architecture design through dynamic modeling means (e.g., Integrated Performance Modelling Environment (IPME)). They assessed human integration issues on a number of levels; Micro (adaptive automation), Meso (adaptive teams) and Macro (overall system) [12].

The United States also presented their concept for Human Systems Integration Human View Dynamic Architect (HSI HVDA). As a prelude to prototyping, this model aims to capture behavioural insights to account for human information processing. They have been investigating ways to capture how the total system responds to events occurring within the operational environment, how operators interact with the system to achieve the mission, to tell the overall story of how the user will interact with the system.

4.2.3 NATO Human Views Development

The NATO RTO HFM-155 Human View Workshop took all of the allied nations inputs and established a concept for a core set of NATO-wide Human Views. The focus of the workshop was to develop a set of human view products by grouping existing human view elements into related themes, and then consolidate the themes into a manageable set of products. The human view products were then identified as either a discrete product in the human view, or a sub view to discrete product (capturing supporting element to another view). The result of the workshop was a set of products that have been established as the NATO Human Views:

- HV-A Concept
- HV-B Constraints
- HV-C Tasks
- HV-D Roles
- HV-E Human Network
- HV-F Training
- HV-G Metrics
- HV-H Human Dynamics

4.2.4 Approach to Tailoring the NATO Human Views

The NATO human view handbook presents a high-level concept of what human views could be if all potential HSI data was captured in a database. It provides a framework under which Human Systems Integration practitioners could perform variations of relevant data gathering, and some analysis, for a plethora of envisioned concepts where enterprise architecture could be employed to assist decision makers at various stages of the system-of-systems engineering lifecycle. While comprehensive, this concept requires a daunting amount information to be available if one was to attempt to implement the complete set of envisioned human views.

In order to tailor the NATO human views to be specifically applicable to Canadian Crown Acquisition projects, this project took a pragmatic approach; there needs to be a specific reason to

populate data, allow for analysis to be performed to provide answers to specific project questions, else there would be little value for the projects to create such data and thus a low probability of compliance. This project used data from a crown acquisition project to serve as baseline for decisions to be made regarding the required content, and level of information decomposition, of the different human views; largely based on the data's applicability to be incorporated into the Dynamic View where specific analyses could be performed to answer pressing acquisition questions, difficult to answer without such support.

The following descriptions of required Human View data elements is based on a proof of concept to date and will be further validated in Phase II of this project.

4.3 Tailoring Human Views

4.3.1 DNDAF Human View Alignment

The research team determined that leveraging the work on Human Systems Integration (HSI) was critical in the adoption of the HVs in DNDAF. HSI arose from the recognition of the importance of Human Factors in system effectiveness. This importance was noted in the conclusion of the 1983 North Atlantic Treaty Organization (NATO) Defence Research Group (DRG) Symposium (on "Man as the Limiting Element in Military Systems") which identified the human element as an important system component and that "we should not rely on technology alone to solve our defence problems" [3].

The goal of HSI is to incorporate human performance issues in the Materiel Acquisition and Support (MA&S) cycle for military systems to improve military performance. HSI can contribute to system effectiveness in a number of areas, including operability, safety, reliability, maintainability, availability and survivability. The concept and case of HSI in Canada are clearly described in [5].

Within the DND HSI is "defined as the technical process of integrating the five HSI domains, Human Factors Engineering, Manpower and Personnel, Training, System Safety, and Health Hazards, with a materiel system to ensure safe, effective operability and supportability" [5]. The five domains are shown in Figure 1. The overall intent of the HSI program is to ensure that system engineering considerations included the human component in all aspects of development, design, operations and disposal.

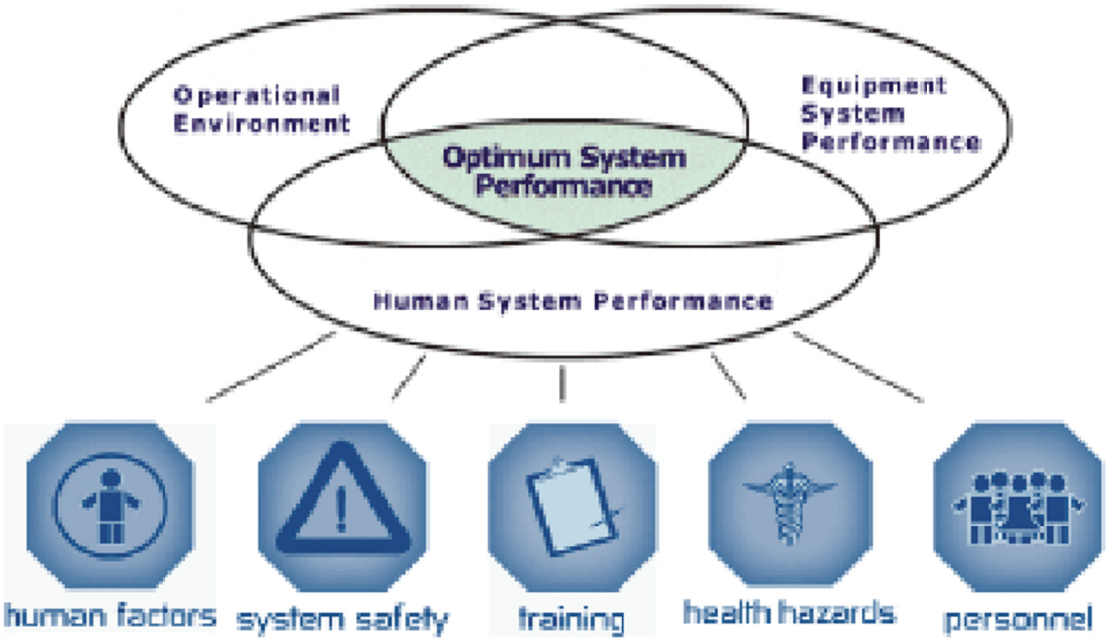

Figure 1: Conceptual illustration of Canadian HSI

The NATO HV is the most mature set of Human Views and as such and will be used as the basis for the Canadian DNDAF HV.

Table 2 illustrates the grouping of the DNDAF HV within each of the HSI domains and also shows the most relevant NATO HV. NATO denotes each of its views with the abbreviation HV, for Human View, followed by a letter (A – H) acting as a uniquely identifier of the view. If sub views are noted they receive a numerical value post unique identifier (HV-B2).

Through discussions with DEA, the group within Canada responsible for implementing DNDAF, this project has elected to rename the NATO Human Views to line up with the naming conventions already in place within the Canadian architecture framework. It was also decided to flatten the hierarchy and to avoid sub-views.

Table 2 provides a reference chart between the five HSI domains, the proposed DNDAF HV and the NATO HV.

Table 2: Human View Reference Chart

HSI Domain	DNDAF HV	NATO HV with Category
Overview	HV-1	HV-A Concept
Manpower		
Force structure	HV-2 Crewing/staffing	HV-D Roles
	HV-3 Rank structure	
	HV-4 Organizational chart	HV-E Human Network
Availability	HV-5 Manpower projection	HV-B1 Manpower Projections
Previous experience and training		HV-B2 Career Progression
Human/Human Interaction	HV-6 Communications	HV-E Human Network
Manpower Workload	Dynamic Human View	HV-H Human Dynamics
Personnel		
Cognitive personnel factors	HV-7 Cognitive requirements	HV-D Roles and HV-B6 Human Characteristics
Physical personnel factors	HV-8 Physical Requirements	HV-B6 Human Characteristics
Phasing		
Recruitment, retention, advancement		HV-B4 Personnel Policy
	HV-9 Target Audience Description	
Training		
Type of training	HV-10 Needs Analysis	HV-F Training
Legacy transfer		
Frequency of training		
Availability of training		
System Safety and Health Hazards		
	HV-11 Health Hazards	HV-B5 Health Hazards
HFE Engineering		
Operator roles, functions, and tasks	HV-12 Human Tasks / Activities	HV-C Tasks
User system interface		
Workspace		
Environment		
	HV-13 Verification and Validation Requirements	HV-G Metrics
		HV-B6 Human Characteristics
	Dynamic Human View	HV-H Human Dynamics

Where a DNDAF HV is not listed, the research team considered this facet of the HSI domain did not warrant its own view, or was already adequately addressed by another view, however they may still be a corresponding NATO HV that is closely related to the HSI domain; for example the Career Progression View under the section of phasing in the Personnel domain.

Where a NATO HV is not listed the DNDAF HV represents a view that was not considered or recorded during the NATO HV development and is considered relevant and useful to DND; for example HV-3, and HV-6.

NATO HVs not included in the DNDAF HV are discussed in Section 4.3.7.3.

4.3.2 Human Component Overview

Within the DNDAF construct each main category of view, such as the system or operational views, has a high level overview or concept view; the HV is not an exception to this. Under the HSI domain a single view represents the human components of the system.

The following sections regarding Purpose, Prerequisites, Instructions, and Representation for each of Canadian Human Views will be updated accordingly during Phase 2 of this project which will be completed by 31 March 2013.

4.3.2.1 HV-1 Human Concept Graphic

The NATO intent for their Concept View (HV-A) was aimed at providing a visual to facilitate understanding of the human dimension in relation to operational demands and system components. They believed the visual could serve as a single point of reference and departure to depict the human impact on system performance as well as the impact of the system and operational context on the person. They propose that, in addition to the above, the view may include indications of human system interactions, supplemental textual descriptions, or even inferences to particular use cases.

This seems to be a lot to expect from a single visual of a complex system-of-systems environment. The sections below describe an interpretation of the intent based on a practical attempt to produce an HV-A at the early stages of system acquisition.

4.3.2.1.1 Introduction

The Human View 1 (HV-1) is a conceptual, high-level representation of the human component of the enterprise architecture framework. Its purpose is to visualize and facilitate understanding of the human dimension in relation to operational demands and system components. It serves as both the single point of reference and departure to depict how the human will impact performance (mission success, survivability, supportability, and cost) and how the human will be impacted by the system design and operational context (personnel availability, skill demands, training requirements, workload, and wellbeing).

The elements of the HV-1 may include:

- Pictorial depictions of the system and its human component;
- High level indicators of where human system interactions may occur; and
- A textual description of the overall human component of the system.

4.3.2.1.2 Purpose

The purpose is to visualize and facilitate understanding of the human dimension in relation to the operational demands and system components. It will be used for briefings throughout the life of a project and may have many audiences. It will be used by the Project Director and Project Manager and by senior leadership when briefing the project.

4.3.2.1.3 Prerequisites

The OV-1 is the prerequisite for this view.

Prerequisite	Rationale
OV-1	The OV-1 provides the scope of the HV-1. As the OV-1 is developed the personnel requirement will be more fully understood and will affect changes to the HV-1.

4.3.2.1.4 Instructions

During the course of developing the architecture, the HV-1 may be updated several times. An initial version of HV-1 will serve to focus and illustrate the effort and scope of the architecture and associated mission. As other sub-views are developed and verified, changes may be introduced. Consequently, the HV-1 may be updated to reflect these changes to the scope and other architecture details.

To create an HV-1:

1. Go to OV-1;
2. Identify the environment in which the architecture resides (e.g., reference to missions or operations, geographic distribution of assets and recognition of boundaries).
3. Identify the direct personnel that will be required to operate the system.
4. Identify the indirect personnel that will be required to operate the system (e.g., support staff, instructors).

4.3.2.1.5 Representation

An example visual representation of this view, developed in support of another tasking related to this ARP, is shown in Figure 2 however; the specific content of this view should be determined by the critical HSI issues of the particular project. In the case of a naval ship manning study, the issue being considered was, given a specific number of each Military Occupational Structure Identification Code (MOSID), would the ship have any operational limitations and would the designated crew be overloaded during specific scenarios. Figure 2 depicts categories of MOSIDs relevant to provide a visual to facilitate an understanding of the human dimension in relation to the operational demands and system components.

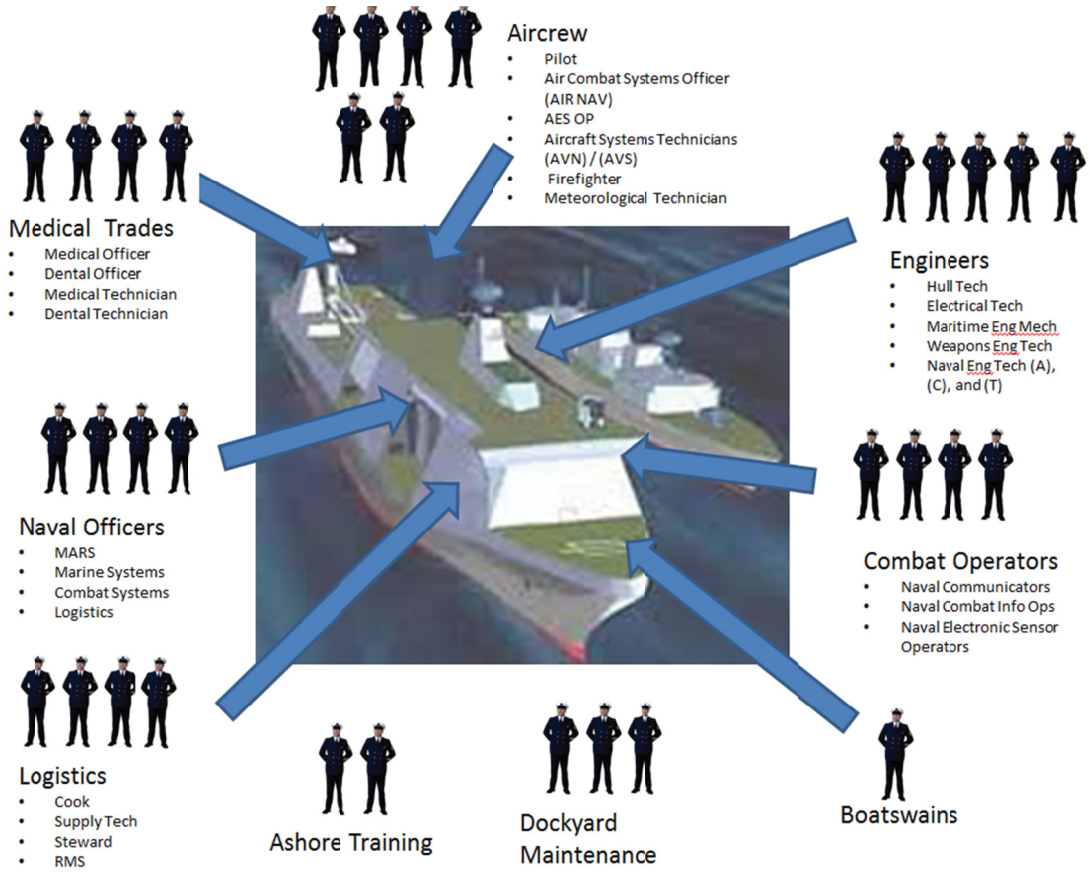

Figure 2: Example HV-1

4.3.2.1.6 DADM Support for HV-1

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.3 Manpower Domain

Within the HSI construct the Manpower Domain looks at numbers of spaces and people. It addresses the number of military and civilian personnel required, and potentially available, to operate, maintain, sustain, and provide training for systems. It is the number of personnel spaces (required or authorized positions) and available people (operating strength). It considers these requirements for peacetime, conflict, and low intensity operations. Current and projected constraints on the total size of the CF/organization/unit are also considered. The HSI practitioner evaluates the manpower required and/or available to support a new system and subsequently

considers these constraints to ensure that the human resource demands of the system do not exceed the projected supply.

As shown in

Table 2 the Manpower domain contains the areas of force structure, availability, previous experience and training, human/human interaction, and manpower workload. These areas are represented by the following views:

- HV-2 Crewing/staffing;
- HV-3 Rank structure;
- HV-4 Organizational chart;
- HV-5 Manpower projection; and
- HV-6 Team communications.

The individual views supporting Manpower will be described in the following subsections.

4.3.3.1 HV-2 Crew/Staffing View

This view is closely related to the NATO HV-D Roles. NATO HV-D provides a description of the roles for each humans interacting with the system. In the NATO context, they defined a role as a representation of a job function (specific behaviour) coupled with information regarding the associated authority and responsibility of the individual performing the role. That being said, there is no explicit definitions provided in the NATO HV literature.

Working with our use case data set (Navy), it became evident that subtly different definitions for the same terms are used by different groups. As such the descriptions/ definitions of the information required became more important than the term used to define it as the requested information is accessible by any user in the context of their organization. This is critical as the appropriate data will need to be populated to ensure analyses are based on similar data among all potential users of Human Views.

A glossary of Terms associated with the Canadian Human Views will be provided at the end of Phase 2 of this project.

4.3.3.1.1 Introduction

The Human View 2 (HV-2) is a tabular view.

The elements of the HV-2 include:

> Crew: A listing of the people who work at a common activity, generally in a structured or hierarchical organization.
>
> Position: The unique name associated with an activity or system used to describe the work to be performed. A position exists whether it is occupied or vacant and is the basic accounting unit for personnel planning and control activities. A number of similar positions may comprise a job. Positions are unique to activity and system and describe the requirements for the work to be performed.
>
> Occupation: The name given to a grouping of personnel that are adequately qualified to perform a job. Each military occupation comprises a grouping of related jobs having similar duties and tasks and requiring similar competencies.

Qualification Level (QL) and Rank: The level of formal training expected to hold the designated position. In the CF the QL and Rank are closely related; as an example a Naval Combat Information Operator (NCIOP) QL5A is a mandatory requirement for promotion to Leading Seaman (LS) and QL6A is required for promotion to Petty Officer Second Class (PO2).

Role – Title specific to the entire system organization (example CBTO).

Job – Defined as a MOSID and QL (attributes of a person).

Organization Chart – overall system and by operational activity (by position information – post HV-C) and by role (later in the analysis-post HV-D2).

4.3.3.1.2 Purpose

The purpose is to provide a complete list of people involved in a system or a program, including operators, maintainers, and other supporting staff (e.g., required at the headquarters), where applicable.

4.3.3.1.3 Prerequisites

The HV-12 is the prerequisite for this view. While HV-12 is listed as the perquisite, the two views may be developed concurrently.

Prerequisite	Rationale
HV-12	The HV-12 provides the basis for HV-2. HV-12 provides a list of all personnel required during the conduct the operational activities for the system being defined. HV-2 can be considered as a specific view of the data required to support HV-12.

4.3.3.1.4 Instructions

During the course of developing the architecture, the HV-2 will need to updated each time a change is proposed to the manning of the 'to-be' system.

To create an HV-2:

1. Review HV-12 to ensure completeness of allocation of personnel to operational activities;
2. Ensure rank, occupation, QL, and all other relevant attributes have been allocated to the personnel; and
3. Filter to ensure areas of specific interest or concern have been completed.

4.3.3.1.5 Representation

HV-2 will be presented as a large table with the personnel listed by row, as shown in Figure 3.

An example of this view, developed in support of work on another tasking related to this ARP, is shown in Figure 4, however, the specific content of this view should be determined by the critical HSI issues of the particular project.

Position ID	Rank	Role	Occupation	Qualification level (optional)	Clearance etc. (optional)	Other attributes

Figure 3: Example HV-2 categories

Position ID (REMAR #)	Rank	Role	Occupation
000001	Cdr	CO	MARS
000002	LCdr	XO	MARS
000003	CPO1	COXN	Any Naval
000004	CPO2	PA	Med Tech-PA
000005	MS	Med Tech	Med Tech
000006	Lt(N)	CCISO	MARS
000007	Lt(N)	2OOW	MARS
000008	SLt	2OOW	MARS
000009	Lt(N)	NAVO	MARS
000010	PO1	Sr NavComm	NavComm
000011	PO2	Track Supervisor	NavComm
000012	MS	Watch Supervisor	NavComm
000013	LS	Tactical Comms	NavComm
000014	LS-OS	Tactical Comms	NavComm
000015	MS	Watch Supervisor	NavComm
000016	LS	Tactical Comms	NavComm
000017	LS	CCR Watchkeeper	NavComm
000018	AB	CCR Watchkeeper	NavComm
000019	AB	Messman	Any Combat

Figure 4: Example of filtered HV-2 for a naval ship manning study.

4.3.3.1.6 DADM Support for HV-2

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.3.2 HV-3 Rank Structure

The NATO Human Views do not have a corresponding view.

4.3.3.2.1 Introduction

The Human View 3 (HV-3) is a tabular view.

- Its representation should be considered a variation of the Roles view;
- This view can be generated from the HV-2 data – no additional data entry should be required; and
- The definition of the rank may need to be extended to accommodate civilian workers.

The elements of the HV-3 include:

- Number of personnel by rank;
- Number of personnel by occupation; and
- Grouping by organization as defined in HV-4.

4.3.3.2.2 Purpose

The purpose of HV-3 is to provide a summary of the distribution of occupational classifications and ranks of personnel involved in a system or a program.

4.3.3.2.3 Prerequisites

The HV-2 is the prerequisite for this view.

Prerequisite	Rationale
HV-2	The HV-2, if complete contains all the data required for HV-3.

4.3.3.2.4 Instructions

HV-3 is a derivation of HV-2.However given the acquisition Programs requirement to capture this information, the incorporation of a dedicated view is important. An initial version of HV-2 will serve to focus and illustrate the effort and scope of the architecture and associated mission. As other views are developed and verified, changes may be introduced. Consequently, the HV-3 may require updating to reflect these changes.

To create an HV-3:

1. Go to HV-2; ensure the required information is filled.
2. Identify the environment in which the architecture resides (reference to missions or operations, geographic distribution of assets and recognition of boundaries).
3. Identify the direct personnel that will be required to operate the system.
4. Identify the indirect personnel that will be required to operate the system (e.g., support staff, instructors).

4.3.3.2.5 Representation

An example visual representation of this view, developed in support of another tasking related to this ARP, is shown in Figure 5. However; the specific content of this view should be determined by the critical HSI issues of the particular project. In the case of a naval ship manning study, the issue being considered was, given a specific number of each MOSID, would the ship have any operational limitations and would the designated crew be overloaded during specific scenarios.

The organizational structure is the same as used in HV-4 as shown in Table 3.

Officers	13															
Senior NCMs	39	**Officers**					**Senior NCOs**					**Enlisted**				
Enlisted	113	**Cdr**	**LCdr**	**Lt(N)**	**SLt**	**Tot**	**CPO1**	**CPO2**	**PO1**	**PO2**	**Tot**	**MS**	**LS**	**AB**	**OS**	**Tot**
Total	**165**	**1**	**2**	**8**	**2**	**13**	**1**	**6**	**14**	**18**	**39**	**32**	**64**	**15**	**2**	**113**
Command/Executive																
MARS	2	1	1			**2**										
Any Naval	1						1				**1**					
Med Tech-PA	1							1			**1**					
Med Tech	1											1				**1**
Totals	**5**	**1**	**1**			**2**	**1**	**1**			**2**	**1**				**1**
Combat																
MARS	6			4	2	**6**										
Any Combat	2							1			**1**			1		**1**
NavComm	9								1	1	**2**	2	4	1		**7**
NCIOp	12								1	2	**3**	4	3	2		**9**
NESOp	7								1	2	**3**	2	2			**4**
Met Tech	1								1		**1**					
Totals	**37**			**4**	**2**	**6**		**1**	**4**	**5**	**10**	**8**	**9**	**4**		**21**
MSE																
MS Eng	1			1		**1**										
Any Eng	3							1			**1**		2			**2**

Mar Eng Tech	17				2	2	**4**	4	9			**13**
E Tech	10				1	1	**2**	2	5	1		**8**
H Tech	15				1	1	**2**	4	6	3		**13**
Totals	**46**	**1**	**1**	**1**	**4**	**4**	**9**	**10**	**22**	**4**		**36**
Deck												
MARS	2	2	**2**									
Bos'n	29			1	1	4	**6**	5	11	5	2	**23**
Totals	**31**	**2**	**2**	**1**	**1**	**4**	**6**	**5**	**11**	**5**	**2**	**23**
CSE												
NCS Eng	1	1	**1**									
Any CSE	1			1			**1**					
W Eng Tech	17				1	2	**3**	4	8	2		**14**
Totals	**19**	**1**	**1**	**1**	**1**	**2**	**4**	**4**	**8**	**2**		**14**
Logistics												
Sea Log	1	1	**1**									
Any Log	1			1			**1**					
Cook	7				1		**1**	1	5			**6**
RMS	5				1	1	**2**		3			**3**
Steward	6				1	1	**2**	1	3			**4**
Sup Tech	7				1	1	**2**	2	3			**5**
Totals	**27**	**1**	**1**	**1**	**4**	**3**	**8**	**4**	**14**			**18**

Figure 5: Example HV-3

4.3.3.2.6 DADM Support for HV-3

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.3.3 HV-4 Organizational Chart

The NATO Human View that most closely relates to HV-4 is HV-E. The intent of HV-E is to capture the existing or expected human to human communication patterns within collocated or distributed teams. They suggest that there are several aspects of communication that may be important; team formation, physical proximity of the roles, type of interaction, and among others, the frequency of interaction between roles.

When interacting with our group of stakeholders it became evident that the NATO construct for HV-E required some tweaking to map to a product that they could find useful during acquisition. While an overall Organization Chart or reporting structure could be useful at the Enterprise level, that acquisition project may find sub HV-Es for each activity (sub team organization charts) more useful as it reflects a closer concept to the Navy`s concept of departmental Watch and Station Bills.

HV-4 provides a representation of the organization of individuals required to fulfill each activity of a proposed to be system. This includes both the list of people and their reporting structure within the team associated with the activity; a functional chart and also a formal organizational chart similar to OV-4b.

4.3.3.3.1 Introduction

The HV-4 is a pictorial representation of the organization chart. Similar information can be viewed in a tabular form in HV-3.

The elements of the HV-4 include:

- Functional structure of the system;
- Organizational structure of the system; and
- All personnel required to support the system.

4.3.3.3.2 Purpose

The purpose is to visualize and facilitate understanding of the human dimension in relation to the operational demands and system components.

4.3.3.3.3 Prerequisites

The OV-4a and HV-2 are the prerequisites for this view.

Prerequisite	Rationale
OV-4a and HV-2	OV-4a provides the scope of the roles and reporting structure within the organization. HV-2 supplies a complete list of personnel in the organization.

4.3.3.3.4 Instructions

During the course of developing the architecture the required presentation structure, table, chart, or tree, will need to be determined.

To create an HV-4:

1. Go to HV-2 data;
2. Fill in the additional information with respect to reporting responsibilities of each position for both day-to-day activities (basically who writes their Performance Evaluation Report (PER)) and reporting responsibilities for activities or special parties.
3. Reporting structure will be from dedicated tables that are completed by entry into DNDAF.

4.3.3.3.5 Representation

An example visual representation of this view, developed in support of another tasking related to this ARP, is shown in Table 3. However; the specific content of this view should be determined by the critical HSI issues of the particular project. In the case of a naval ship manning study, the issue being considered was, given a specific number of each MOSID, would the ship have any operational limitations and would the designated crew be overloaded during specific scenarios.

The Functional, and Organizational, reporting structure, as shown in Table 3, must be developed before this view can be completed. This structure can be inferred from HV-3. Figure 6 Figure 7 are examples of potential depictions of this view.

Table 3: Example organization categories

FUNCTIONAL Special Parties	ORGANIZATIONAL Departmental Organization
Forward Section Base Team	Command
After Section Base Team	Executive Department
Cable Party	Combat Department
Force Protection Yellow	Deck Department
Force Protection Red	Marine Systems Engineering Department
Boarding Party	Combat Systems Engineering Department
…	Logistics Department
…	

The special parties view is similar to the Navy's Watch and Station Bill for evolutions.

Forward Section Base Team	After Section Base Team
Position ID #	Position ID #
Position ID #	Position ID #
Position ID #	Position ID #
Cable Party	Force Protection Yellow
Position ID #	Position ID #
Position ID #	Position ID #
Position ID #	Position ID #
Boarding Party	Force Protection Red
Position ID #	Position ID #
Position ID #	Position ID #
Position ID #	Position ID #

Figure 6: Example HV-4 – Special Parties obtained from a naval ship manning study

The example of the unit organization view is shown in Figure 7. This is similar to the OV-4a view.

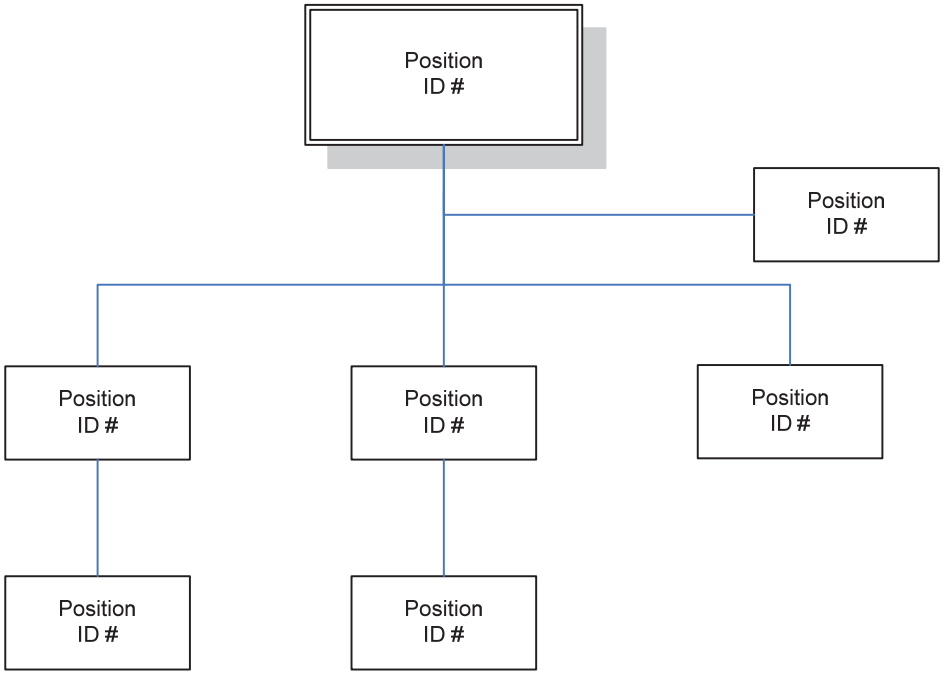

Figure 7: Example HV-4 – Unit organization

4.3.3.3.6 DADM Support for HV-4

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.3.4 HV-5 Manpower projection

The NATO intent of the Manpower projection view (HV-B1) is allow for prediction of manpower requirements for supporting present and future projects that contribute to larger capabilities. Understanding manpower forecasting allows for adjustments in training, recruiting, professional development, assignment and personnel management. It is envisioned that this View will also be able to assist with anticipating the timeframe and impacts related to number(s) of personnel with necessary Knowledge, Skills, and Abilities (KSAs), personnel mix, Military Occupational Structure Identification (MOSIDs), Rank/level distribution, and, postings/relocation(s) of personnel.

In the context of Canadian military acquisition, to implement this View fully, considerable information that is currently held by different groups in different enterprise tools would need to be input into a single database. The discussion below focuses on a practical View of Manpower Projections aimed specifically at providing the essential information to assist projects with manning analysis. This view is temporal in nature and will require knowledge of the Initial Operational Capability (IOC) and Full Operational Capability (FOC) as well as the projected disposal dates.

4.3.3.4.1 Introduction

HV-5 is a representation of the projection of manpower needs during the entire life cycle of the system/program.

The elements of the HV-5 include:

- Personnel by MOSID and rank for the system;
- Projected IOC;
- Project FOC;
- Projected disposal dates; and
- The overall requirement for personnel during the lifespan of the system.

4.3.3.4.2 Purpose

The purpose is to visualize and facilitate understanding of the human dimension in relation to the operational demands and system components.

4.3.3.4.3 Prerequisites

The HV-3 and StratV-1 are the prerequisites for this view.

Prerequisite	Rationale
HV-3 and StratV-1	The HV-3, if complete contains the majority of the under lying personnel data required for HV-5. If HV-3 has not been completed then the architect will have to refer to HV-2. StratV-1 lists the future states of the system including the IOC, FOC and disposal dates.

4.3.3.4.4 Instructions

HV-5 is a tabular representation.

To create an HV-5:

1. Go to OV-1; ensure the information is filled in.
2. Identify the environment in which the architecture resides (reference to missions or operations, geographic distribution of assets and recognition of boundaries).
3. Identify the direct personnel that will be required to operate the system.
4. Identify the indirect personnel that will be required to operate the system (e.g., support staff, instructors).

4.3.3.4.5 Representation

An example HV-5 is provided at Figure 8 below. Note: simplified versions of the following example are also possible. For example, instead of forecasting for each position, it may be sufficient to project only a certain grouping of the personnel (e.g,. based on MOSID/Rank levels).

Timeline (project/system lifecycle) →

Positions ↓

Position#	*2012*	*2013*	*2014*	*2015*	*...*
####	*Vacant*	*Occupied*	*Occupied*	*Vacant*	
####					

Timeline (Timeline (project/system lifecycle) →

Certain grouping of people	Total# required by the system	2012	2013	2014	…
MOSID/rank	5 people	0	3	5	

Figure 8: Example HV-5

4.3.3.4.6 DADM Support for HV-5

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.3.5 HV-6 Communications

The corresponding NATO HVs for Communications is HV-E. The intent of the NATO HV-E is to capture the existing or expected human to human communication patterns within collocated or distributed teams. They suggest that there are several aspects of communication that may be important; team formation, physical proximity of the roles, type of interaction, and among others, the frequency of interaction between roles. This seems to be a lot to expect from a single visual of a complex system-of-systems environment. The sections below describe an interpretation of the intent based on a practical attempt to produce an HV-6 at the early stages of system acquisition.

When interacting with our group of stakeholders it became evident that the NATO construct for HV-E required some tweaking to map to a product that they could find useful during acquisition.

4.3.3.5.1 Introduction

The Human View 6 (HV-6) is a graphical or tabular representation.

The elements of the HV-6 include the communication requirements between operators and the systems required to conduct communications.

Within DNDAF OV-2, OV-3, and SV-2 are closely linked to HV-6. HV-6 captures the human aspect of a communication link whereas the operational and system views describe operational node connectivity, information exchanges, and the system communications required to support the overall system.

4.3.3.5.2 Purpose

The purpose is to visualize and facilitate understanding of the human communication requirements in the system. This view will only be generated if the project has a requirement to investigate the inter-personnel communications. The scope of the view can be contained by identifying the operational activities to be viewed.

HV-6 can be used as the basis for a Dynamic HV that investigates the physical layout of operators and systems in order to optimize the communications defined in this view.

4.3.3.5.3 Prerequisites

The HV-12 is the mandatory prerequisite for this view whereas OV-2, OV-3, and SV-2 are optional prerequisites for HV-6.

Prerequisite	Rationale
HV-12	The requirement to model / view the communications of specific operational activities is driven by the Task View.
OV-2, OV-3, and SV-2.	If these views are available the additional data they provide may be used for the creation of HV-6.

4.3.3.5.4 Instructions

During the course of developing the architecture, the HV-6 could be developed for specific operational activities or for the entire system.

To create an HV-6:

1. Select an activity;
2. Define all COM links/methods required by the activity, and generate table as shown in Figure 9;
3. Create a role matrix and fill the blanks using methods specified in Table 4 and Table 5; and .
4. Create a visual diagram Figure 10

Alternatively:

1. Select an activity;
2. Identify COM needs (like the need lines) in the matrix (Figure 9);
3. Specify the attributes for each COM link (needline) in Table 4 and Table 5; and
4. Create a visual (optional).

The list in step 2 is a matrix with all roles listed along both the x and y axis. An example of this is shown in Figure 9.

	Command	Safety Number	Liquid Cargo Officer	Station Captain	Cage Operator	Dump Worker 1	Dump Worker 2	Dump Worker 3	Dump Worker 4	Cargo Coord	Fork Lift Operator	Fuel Sampler
Command	X	RAS Net		RAS Net								
Safety Number		X		Voice	RAS Net	Voice	Voice	Voice	Voice			
Liquid Cargo Officer			X	RAS Net								RAS Net
Station Captain				X	RAS Net	Voice	Voice	Voice	Voice	Voice		
Cage Operator					X							
Dump Worker 1						X						
Dump Worker 2							X					
Dump Worker 3								X				
Dump Worker 4									X			
Cargo Coord										X	Voice	
Fork Lift Operator											X	
Fuel Sampler												X

Figure 9: Example HV-6 data entry

The intent is then to fill in the appropriate combinations with the communication channels from Table 4. Additional communication attributes and needs can also be captured and shown in HV-6 if required.

In the case of Figure 10 the communication methods are selected from a table of all possible communication categories generated to support this view. An example of the communication method table is shown in Table 4. Table 5 provides a list of additional communication attributes that can be collected as optional fields in support of this view.

Table 4: Example communication methods

Communication Channels	Communication Modes	Communication Type
Voice	Visual	Collaboration
Command Net	Synchronous	Supervision
AAW Net	Asynchronous	Direction
Damage Control Net		Accessibility
RAS Net		
External Net		
…		

Table 5: Example additional communication attributes

Originator	Receiver	Communication characteristics	Frequency	Priority/Criticality

Communication Type	Description		
	Distance component	Angular Component	Function

4.3.3.5.5 Representation

An example visual representation of this view is shown in Figure 10, however the specific content of this view should be determined by the critical HSI issues of the particular project.

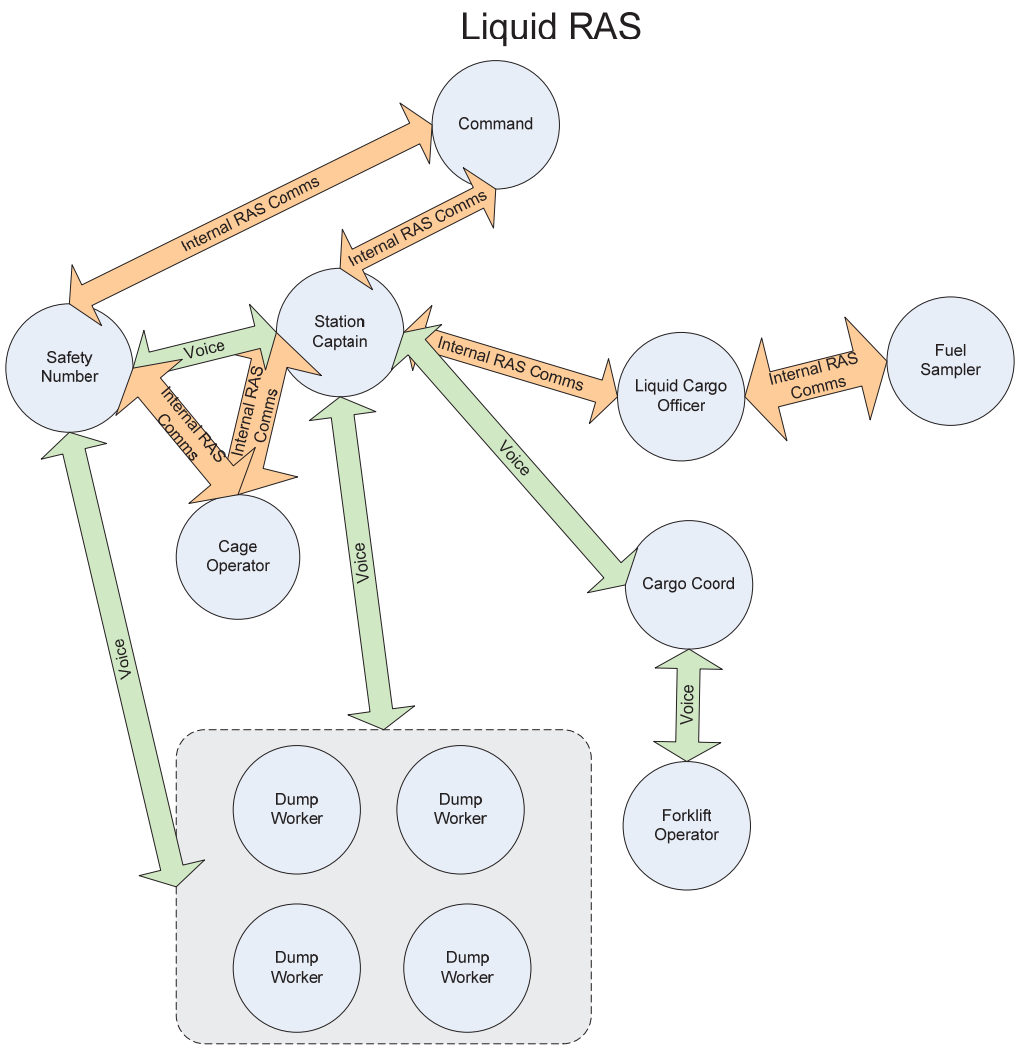

Figure 10: Example HV-6

HV-6 will help identify when individuals may be overwhelmed with communications. In this example, given the communications requirements associated with the Station Captain position, that position may need addition Human Factors study to determine if the level of communications is acceptable or may lead to cognitive overload and potential error.

4.3.3.5.6 DADM Support for HV-6

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.4 Personnel Domain

The intent of the personnel domain is to address the cognitive and physical characteristics and capabilities required to be able to train for, operate, maintain, and sustain materiel and information systems. Personnel capabilities are normally reflected as Knowledge, Skills, Abilities, and Other characteristics (KSAOs).

In the Canadian context, the applicable level of information granularity is best captured in HV-7 (Cognitive Requirements) and HV-8 (Physical Requirements).

4.3.4.1 HV-7 Cognitive requirements

There are no direct corresponding NATO HVs for cognitive requirements. The intent for this view is to describe the specific KSA attributes required to operate the system being defined. The NATO HV of HV-B1 touches KSA requirements and NATO HV-B6 looks at characteristics of operators. Together they can be combined to produce HV-7.

4.3.4.1.1 Introduction

The Human View 7 (HV-7) is a tabular view.

It is expected that HV-7 will only be used for systems that are unique within DND/CF and no existing MOSID conducts similar operations. As an example if the Navy were to operate and control UAVs from a ship they would want to investigate the KSA required to do that in order to find the correct person or training.

The elements of the HV-7 include tasks to be performed and the required KSA.

4.3.4.1.2 Purpose

The purpose is to visualize where the required KSAs, for specific operational activities, are lacking in the current CF allocated MOSID and QL level application.

4.3.4.1.3 Prerequisites

The HV-10 is the prerequisites for this view.

Prerequisite	Rationale
HV-10	The needs assessment identifies the tasks that will require additional analysis and attention afforded by the completion of HV-7.

4.3.4.1.4 Instructions

During the course of developing the architecture, the HV-7 will be updated several times. Detailed instructions will be determined during the user case portion of this project.

4.3.4.1.5 Representation

An example visual representation of this view is shown in Figure 11. However, the specific content of this view should be determined by the critical HSI issues of the particular project.

Operational Activity	Proposed Operator			Required KSA		
	MOSID	QL	Rank	Knowledge	Skill	Abilities
Operate UAV from ship	NCIOP	5b	MS	Yes	No	Yes
	NESOP	5b	MS	No	Yes	Yes
	MARS	D Level	Slt / Lt(N)	No	No	Yes

Figure 11: Example HV-7

In this example, of the three possible MOSID/ QL allocations, all are lacking in one aspect of the required KSA or another. This will help with trade-off analysis to determine which occupation is closest or most appropriate, to undergo further training to be best suited to meet the new requirements.

4.3.4.1.6 DADM Support for HV-7

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.4.2 HV-8 Physical requirements

The NATO HV-B6 looks at human characteristics of operators. In the HV-B6 example NATO examines both the task and role constraints. While this was considered for DNDAF the intent for this view is to describe the specific physical attributes required to operate the system being defined. The view will describe the constraints a system put on the human and the constraints imposed by the human on the system.

4.3.4.2.1 Introduction

The Human View 8 (HV-8) is a tabular or list view.

It is expected that HV-8 will only be used for systems that are unique within DND/CF and no existing MOSID conducting similar operations. As an example if the Navy were to consider new command and control systems with multiple displays they would want to investigate the physical attributes required to do that in order to ensure the design satisfied the current user population's anthropometrics or to define the physical characteristics of the operators needed for the new system.

The elements of the HV-8 are the systems to being employed and the corresponding physical requirements.

4.3.4.2.2 Purpose

The purpose of HV-8 is to capture the assumption/design constraints and the constraints a system put on the human and the constraints imposed by the human on the system.

4.3.4.2.3 Prerequisites

The SV-2 is the prerequisite for this view.

Prerequisite	Rationale
SV-2	The list of subsystem supporting the overall system will be analyzed and annotated for design constraints and limitations.

4.3.4.2.4 Instructions

During the course of developing the architecture, the HV-8 will be updated when new systems are considered for the project.

To create an HV-8:

1. Select the system information contained in SV-2; and
2. Develop a list of assumptions/design constraints and limitations based on the systems.

4.3.4.2.5 Representation

An example representation of this view is shown in Table 6. However, the specific content of this view should be determined by the critical HSI issues of the particular project.

Table 6: Example Physical Requirements

Command and Control system

Assumptions/Design Constraints

- All operators must be able to be accommodated at the design eye line
- All operators must be able to sit with work surface at elbow height (sitting)
- There will be 1 common workstation design
- The workstation will not provide adjustability
- The chair will adjust up, down, forward, and aft in accordance with MIL-STD 1472
- The design must accommodate 5^{th} – 95^{th} percentile of the male and female populations as described in the 1997 Land Forces Anthropometric Survey

· A foot rest will not be incorporated into the workstation

· There is a requirement to reach peripheral equipment from a seated position

· There is a requirement to see over the console from a seated position

· There is a requirement for three 16 x 9 aspect ratio (1920 by 1080 pixel) monitors (96 dpi pitch), with a minimum casement size of 21.3 inch W x 13.9 inch H x 3.8 inch D, incorporated into the workstation in a landscape orientation

· The work surface thickness will not exceed 1 inch

Limitations

· There is 1 common workstation design that must accommodate all potential operators and their job/task requirements

· No analysis has been done to identify workstation requirements on a per operator basis (storage, equipment, etc.)

· The depth of the associated computing equipment that will be incorporated into the workstation has not been identified

· The extent to which an operator is required to view another operators displays form their own workstation has not been established

· The off axis viewing angles of the actual displays that will be incorporated into the design are not known

4.3.4.2.6 DADM Support for HV-8

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.4.3 HV-9 Target Audience Description

There is no corresponding NATO HV for the Target Audience Description (TAD). In the Canadian context, a TAD typically describes the characteristics, capabilities, and limitations of the operational and maintenance personnel of a system.

4.3.4.3.1 Introduction

The Human View 9 (HV-9) is a tabular/matrix view.

This view supports the development of the Target Audience Description (TAD). The HV-9 is source material that can be used as guidance by the stakeholders responsible for completion of the TAD.

The Target Audience Description describes the key characteristics of personnel required to perform a job, fill a role or position. The TAD may contain characteristics of the system's operational and maintenance personnel including, but not limited to, the following:

- Physical Characteristics including gender, age range, body size;

- Sensory Characteristics including visual acuity, colour perception, hearing capability;
- Psychological Characteristics including reasoning, decision making;
- Skills and qualifications;
- Training and experience;
- Tasks and responsibilities; and
- Operational environment considerations

4.3.4.3.2 Purpose

This View will provide a means for briefing senior personnel of the most critical components of the Target Audience Description document; the information required to ensure that the system is designed to accommodate the characteristics of the defined population.

4.3.4.3.3 Prerequisites

The HV-2 is the prerequisite for this view.

Prerequisite	Rationale
HV-2	Knowledge of the roles required for the system is essential to develop the TAD document.

4.3.4.3.4 Instructions

During the course of developing the architecture, the HV-9 will be updated each time new roles are added to HV-2.

To create an HV-9:

1. Go to HV-2 and ensure the role information is complete;
2. Complete the entries for the TAD characteristics (in the example in Table 7 the categories: physical characteristics, sensory characteristics, etc have been used);
3. The interface will create a matrix with the roles and TAD characteristics; and
4. Complete the matrix as required.

4.3.4.3.5 Representation

An example visual representation of this view is shown in Table 7. However, the specific content of this view should be determined by the critical HSI issues of the particular project.

Table 7: Example Target Audience Description

Target Audience Description

	Physical Characteristics	Sensory Characteristics	Psychological Characteristics	Skills and Qualifications	Training and Experience	Tasks and Responsibilities	Operational Environment
Flying Pilot	Superior Health	Superior	Leader	high mental, very high physical	very extensive	Flight, Command	mild in, harsh out
Aircraft Commander	Superior Health	Superior	Leader	high mental, very high physical	very extensive	Flight, Command	mild in, harsh out
Non-flying Pilot	Superior Health	Superior	Leader	high mental, very high physical	extensive	Flight, Command	mild in, harsh out
Navigator	Superior Health	Excellent	Technical Expert	very high mental, high physical	extensive	Systems Ops	mild in, harsh out
Weapons System Officer	Superior Health	Excellent	Technical Expert	very high mental, high physical	extensive	Systems Ops	mild in, harsh out
Electronic Warfare Officer	Superior Health	Excellent	Technical Expert	very high mental, high physical	extensive	Systems Ops	mild in, harsh out
Fire Control Officer	Superior Health	Excellent	Technical Expert	very high mental, high physical	extensive	Systems Ops	mild in, harsh out
Flight Engineer	Superior Health	Excellent	Technical Expert	high mental, high physical	lengthy	Systems Ops	harsh out, mild in
Loadmaster	Superior Health	Excellent	Technical Expert	high mental, high physical	lengthy	Systems Ops	harsh out, mild in
Boom Operator	Superior Health	Excellent	Technical Expert	high mental, high physical	lengthy	Systems Ops	mild in, harsh out
Radio Operator	Superior Health	Excellent	Technical Expert	high mental, high physical	lengthy	Systems Ops	mild in, harsh out
Crew Chief	Superior Health	Excellent	Technical Expert	high mental, high physical	lengthy	Systems Ops	harsh out

4.3.4.3.6 DADM Support for HV-9

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.5 Training Domain

The Training domain of HSI includes the instruction or education, and on-the-job or unit training required to provide personnel with their essential job skills, knowledge, values and attitudes, as well as any constraints on such training. The primary sub-areas of training include:

- Legacy transfer;

- Type of training;
- Availability of training; and
- Frequency of training.

Training is defined as the instruction, education, on-the-job, or self-development training required providing all personnel and units with essential job skills, and knowledge. Training is required to bridge the gap between the target audience's existing level of knowledge and that required to effectively operate, deploy/employ, maintain and support the system.

Training is particularly crucial in the acquisition and employment of a new system. New tasks may be introduced into a duty position; current processes may be significantly changed; existing job responsibilities may be redefined, shifted, or eliminated; and/or entirely new positions may be required. It is vital to consider the total training impact of the system on both the individuals and the organization as a whole. Clearly, the cost and considerations of system ownership include initial and sustainment training, that is both unit and institutional.

Training in the CF is managed under the structure of the Canadian Forces Individual Training and Education System (CFITES). CFITES dictates that all requirements for training originate from a Needs Assessment (NA). The requirement for a NA is directed to each project in the Project Approval Directive (PAD).

The Needs Assessment is the only product that will be developed as a HV as part of this HSI domain.

4.3.5.1 HV-10 Needs Assessment

NATO HV-F is described as providing a detailed account of how training requirements, strategy, and implementation will impact the human. It illustrates the instruction or education and on-the-job or unit training required to provide personnel their essential tasks, skills, and knowledge to meet the job requirements.

While this could be extremely useful, in the context of Canadian military acquisition, to implement this View fully, considerable information that is currently held by different groups in different enterprise tools would need to be input into a single database. Again, the Chief of Military Personnel (CMP) and Human Resources Civil (HRCiv) own all training information for the Canadian Forces (CF) and civilian portion of Department of National Defence respectively. These groups are assisted by individual MOSID career managers and occupational advisors.

This view is the capture of the training needs analysis created outside of DNDAF (though possibly supported by its products) with the rest of the product information.

In accordance with the CFITES a Training Needs Analysis shall be conducted in the final stages of producing a Job Based Occupation Specification (JBOS). The JBOS contain a list of tasks expected of an operator within a given MOSID. If new tasks are expected within a MOSID it is necessary to assess and recommend when occupation training should be given and how a JBOS should be segmented to facilitate its analysis by one or more Qualification Standards Board (QSB). The Occupational Specification Validation Board (OSVB) will perform this activity. While the OSVB has their own tools to support this work they will require input and direction

when new systems are being introduced to DND – the intent is to have HV provide a view that triggers the OSVB process. While it is clear that conducting a TNA is not the requirement of the project staff they must provide information, in the form of a needs assessment, to the appropriated people.

4.3.5.1.1 Introduction

The Human View 10 (HV-10) is a tabular view. This view supports the development of the Needs Assessment. The HV-10 is source material that can be used as guidance by the stakeholders responsible for Training Needs Analysis (TNA), required by the Project Charter, and for JBOS development. As such HV-10 will provide a synopsis of the related DNDAF project data to the appropriate stakeholders.

4.3.5.1.2 Purpose

This view will provide a means for training needs gap identification for the training community and serve as a briefing tool for senior staff. This view will provide input to the TNA and JBOS processes.

4.3.5.1.3 Prerequisites

The HV-12 and SV-2 are the prerequisites for this view.

Prerequisite	Rationale
HV-12 and SV 2	The addition of new or unique tasks to an operator or the interaction with new and unique systems will require assessment of a Training Needs Analysis. HV-12 lists the operational activities and SV-2 identifies all systems and sub-systems.

4.3.5.1.4 Instructions

The HV-10 will be very similar to HV-7, however it stops at the identification of operators interacting with new systems or conducting new tasks.

To create an HV-10:

1. Load information from HV-12 and identify new tasks required to conduct operational activities; and
2. Load information from SV-2 and identify new systems or subsystems.

4.3.5.1.5 Representation

An example visual representation of this view is shown in Figure 12 however; the specific content of this view should be determined by the critical HSI issues of the particular project.

Operational Activity	Tasks	New	System	New	Proposed Operator

Replenishment At Sea					
	Winching	No	Single Operator System	Yes	Bos'n
UAV operations					
	Shipborne UAV control	Yes	CCS 330	No	NCIOP
	Shipborne UAV launch	Yes	Catapult	Yes	Bos'n
	Shipborne UAV recovery	Yes	Recovery system Mk 1	Yes	Bos'n

Figure 12: Example HV-10

In the example shown in Figure 12 several tasks are either new or have new systems associated with them and the project staff has proposed operators for these tasks. A full TNA would be based on the new tasks and systems identified by the project and shown in HV-10.

4.3.5.1.6 DADM Support for HV-10

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.6 Systems Safety and Health Hazards Domain

The System Safety and Health Hazards domain identifies safety risks occurring when the system is set-up, used, dismantled, transported or maintained, and identifies short or long term hazards to health occurring as a result of normal operation of the system. These assessments also determine the requirement for protective clothing and/or equipment.

System Safety is the design features and operating characteristics of a system that serve to minimize the potential for human or machine errors/failures that cause injurious accidents. The requirements associated with system safety are extremely specific with the input from safety experts – the intent of the HV is to inform where specialized system safety is required and not to prescribe solutions.

Health Hazards addresses the design features and operating characteristics of a system that create significant risks of bodily injury or death. Along with safety hazards, an assessment of health hazards is necessary to determine risk reduction or mitigation. The goal of the Health Hazard Assessment (HHA) is to incorporate biomedical knowledge and principles early in the design of a system to eliminate or control health hazards. Health Hazard categories include acoustic energy, biological substances, chemical substances, oxygen deficiency, radiation energy, shock, temperature extremes and humidity, trauma, vibration, and other hazards. Health hazards include those areas that could cause death, injury, illness, disability, or a reduction in job performance.

Within the System Safety and Health Hazards domain the following sub-areas are listed:

- Error source;
- User behaviour;
- Environmental surroundings;
- Noise and vibration;
- Hazards substances (contact, inhalants etc.) ;
- Electrical equipment;
- Mechanical equipment;
- Nuclear, biological, or chemical hazards;
- Musculoskeletal hazards;
- Heat or cold stress;
- Optical hazards; and
- Electromagnetic sources.

While this appears to be a vast amount of information the entire list could be displayed within a single health hazards view.

4.3.6.1 HV-11 Health Hazards View

The intent of the NATO Health Hazards View, HV-B5, was to ensure design features and operating characteristics of a system that can create significant risks of illness, injury or death are considered. The goal of this View is to minimise, or mitigate, both short- and long-term hazards to health that occur as a result of system operation, maintenance and support.

In the context of Navy acquisition, much of a ship's system is comprised of a baseline of technology. In order to make this effort feasible for the project, their effort should be focused on any novel or significantly updated systems. Their analysis of health hazards needs to be at a sufficient level to allow for decisions to be made regarding automation/ systems and hazard risk analysis (influencing training needs analysis) (e.g., automated reeling machines versus hand reeling by Bos'n).

4.3.6.1.1 Introduction

The Human View 11 (HV-11) provides an opportunity to identify the tasks associated with the proposed 'to be' system that will place personnel into hazardous situations. This view allows the presentation of this information.

The elements of the HV-11 include:

- Operational activity or task;
- Environmental factors;
- Potential error type or cause;
- Impacts of error;
- Human error probability;
- Error reduction strategy; and
- Error mitigation strategy.

4.3.6.1.2 Purpose

This view can aid in safety assessment, and can allow the validation against the hazards expected for given positions against their job descriptions. The view will highlight the hazards associated with the system that system designers should be made aware of.

It is intended to provide a view or answer to the question; "Are there activities or sub-systems that may harm personnel?"

4.3.6.1.3 Prerequisites

The HV-12 and SV-4 are the prerequisites for this view.

Prerequisite	Rationale
HV-12 and SV-4	The HV-12 provides list of tasks to be analyzed. SV-4 provides a list of equipment in the new system.

4.3.6.1.4 Instructions

During the course of developing the architecture, the HV-11 may be updated several times. An initial version of HV-1 will serve to focus and illustrate the effort and scope of the architecture and associated mission. As other views are developed and verified, changes may be introduced. Consequently, the HV-1 may be updated to reflect these changes to the scope and other architecture details.

To create an HV-11:

1. Go to HV-12; fill in the information in the View Information section about this view.
2. Identify the tasks or operational activities that represent a hazard to the operator; and
3. In consultation with domain and subject matter experts complete the information in the hazard assessment form.

4.3.6.1.5 Representation

HV-11 is best shown in tabular form. An example visual representation of this view was developed as part of a Human Reliability assessment work for another project is shown in Table 8. However, the specific content of this view should be determined by the critical HSI issues of the particular project.

Table 8: Example Health Hazards View

TASK No.	TASK NAME	ENV. FACTORS	ERROR C = COMMISSION O = OMISSION	IMPACTS S = SAFETY E = EFFECTIVENESS	Human Error Probability (HEP)	ERROR REDUCTION STRATEGY	ERROR MITIGATION STRATEGY
1.1.1.b	Confirm preparations to enter winch compartment	Noise, darkness, poor weather	O Miss an item from the checklist	S Possible accident E Re-work to prepare	0.5%	Electronic checklist with check off	

TASK No.	TASK NAME	ENV. FACTORS	ERROR C = COMMISSION O = OMISSION	IMPACTS S = SAFETY E = EFFECTIVENESS	Human Error Probability (HEP)	ERROR REDUCTION STRATEGY	ERROR MITIGATION STRATEGY
		Paper checklist	C Misinterpret an item in checklist	ditto	0.1%	Write checkmarks on paper	
			C Believe false information from other (spoken or written)	ditto	1	Two-person check	
			C Misread a display, indicator or control position	ditto	1	Better display design	
			C Deliberate short cut	ditto	5	Training and discipline	
			C Believe false information from other (spoken or written)	ditto	1	Two-person check	
1.1.1.c	Make detailed report to command	Too busy No check list	O Fail to make a report		0.5	Training	
		Radio comms faulty	O Cannot report (communication fault)			Use of backup comms (e.g. telephone)	
			O Omit an item from the report		1	Training and procedure	
		Noisy space	O Fail to get confirmation from other		1	Training	

4.3.6.1.6 DADM Support for HV-11

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.7 Human Factors Engineering Domain

The Human Factors Engineering Domain is the basis for all HSI related work. Traditional HFE work is based on task analysis; the analyses of what operators do to complete their work. There are several variants of task analysis – mission function task analysis, hierarchical goal analysis, and cognitive task analysis are just a few examples.

The goal of HFE is to maximize the ability of an individual or crew to operate and maintain a system at required levels by eliminating design-induced difficulties and errors. Human Factors engineers work with systems engineers to design and evaluate human-system interfaces to ensure they are compatible with the capabilities and limitations of the potential user population. HFE evaluates habitability, systems and operator tasks, and user needs. This is performed by analyzing and allocating functions, analyzing tasks and associated workload using many methods including interviews, studies, surveys and prototyping.

4.3.7.1 HV-12 Human Tasks / Activities View

The intent of the NATO HV-C is to provide descriptions of human-specific activities (functions, decomposed into tasks) across the life cycle of the system and to provide a link between the activities identified in OV-5a and the roles identified in HV-D. Generally, the NATO description of HV-C is very broad and captures much of what could be considered good Human Factors work. Acknowledging the broad nature of their description, they note that there could be multiple HV-C products representing different aspects of the human tasks in the architecture, thus the discussion below will focus on applicability at the project acquisition level.

4.3.7.1.1 Introduction

The Human View 12 (HV-12) is a representation of the tasks required to be conducted by operators and their allocation to the tasks. It is a critical view to the HSI practitioner. The HV-12 is closely related to the OV-5a, SV-4, SV-5, and HV-2 views.

The elements of the HV-12 include:

- Operational activities;
- Associated systems;
- Allocation of operators;
- Designation of jobs and positions; and
- Optional information such as KSA and Visual, Auditory, Cognitive, and Psychomotor (VACP) ratings.

It is expected that HV-12 will be created by project staff. The view is the first opportunity for the project to allocate personnel to the system. It is expected that KSA may be added if HV-12 is to be used to inform HV-10 which would be an optional field at the Project level. Optional task attributes such as VACP ratings can inform the human dynamic view that is created for workload analysis. While both KSA and VACP are potentially captured in HV-12 there is limited value for Project Staff.

The view will be used by:

- Project staff
- Personnel needs (DMARPERS)
- Future training requirements (DMTE)

HV-12 is expected to provide the following information about the system:

- A complete list of tasks that are performed by human operators;
- The operator assignment for each task;
- The required equipment for each task; and
- Optional task attributes such as KSA requirements and VACP ratings.

HV-12 can be displayed in tabular/matrix or textual form. It will be necessary to define appropriate stopping rules for the task analysis (OV-5a) – how far down to decompose the activities. The activity decomposition must stop at an appropriate point to allow for the desired analysis; in the Navy acquisition context OV-5a may stop where a position can be considered to occupy a person for a particular period of time.

4.3.7.1.2 Purpose

This view presents the decomposition of the system wide activities into tasks performed by individuals. This task hierarchy represents a significant repository of information and provides a framework for a lot of the data which will populate the other human views.

Tasks are allocated to individual operators, who can be described by their 'positions'.

This view allows the review and validation of specific personnel tasks within the 'to be' system. It can also be used to compare different 'to be' systems.

4.3.7.1.3 Prerequisites

The SV-5 is the prerequisite for this view.

Prerequisite	Rationale
SV-5 (Operational activity to system function traceability matrix)	The SV-5, if complete contains the basis for HV-12.

4.3.7.1.4 Instructions

The HV-12 describes the human-specific activities, i.e., the tasks that have been assigned to the humans in a system over its entire life cycle. In the context of this report, the term task refers to a piece or work that can be assigned to a person. The human task view also considers how the functions are decomposed into tasks and the dependencies between tasks.

The HV-12 may also:

- Clarify the human-related functions in a system;
- Provide a justification for the allocation of functions between the humans and machines;
- Decompose these functions into a set of tasks that can be mapped to the roles identified in HV-2;
- Describe these tasks in terms of various attributes such as the KSA requirements;
- Produce a task-role assignment matrix;
- Depict the inter-dependencies between different tasks, particularly across functional groupings;
- The information demands to perform specific tasks;
- The tools required to accomplish a task; or
- Create interface design guideline on the basis of task requirements.

The HV-12 is very broad and can be used to capture all aspects of the human-related tasks in a system, including the allocation of tasks between humans and systems. This product is also closely related to the HV-2 Crewing. There may be some overlap between the definition of tasks, roles and the assignment between them. More often, there may be multiple HV-12 products representing different aspects of the human tasks in the architecture. In this case, the multiple products can be labelled consecutively within the HV-12 context.

The basis for the view is the SV-5 Operational Activity to System Function Traceability Matrix. This matrix must exist to start HV-12. Every Task / System combination will be assessed by SMEs in the consideration of roles title, occupation, QL or rank requirements, and optionally information such as: VACP, KSA requirements, time to complete the task/activity, information requirements, and communication requirements. The optional information will be required if further HFE related studies such as communication flow and workload analyses are needed.

HV-12 is the view that connects the operations and systems to the human operators. HV-12 serves to focus and illustrate the effort and scope of the architecture and associated mission. As other views are developed and verified, changes may be introduced. Consequently, the HV-12 will be updated to reflect these changes to the scope and other architecture details.

To create an HV-12:

1. Allocation of personnel to operational activities based on SV-5;
2. Ensure Rank, Occupation, QL, and all other relevant attributes have been entered;
3. Identify the direct personnel that will be required to operate the system; and
4. Identify the indirect personnel, support staff, instructors, etc.

4.3.7.1.5 Representation

An example of HV-12 is provided below. Note: simplified versions of the following example are also possible.

Table 9: Example Task View

Operational Activity	**Tasks**	**Associated Systems**	**Job** / **Positions**	**MOSID 00105 BOS'N**	**MOSID 00299 NAVCOM**	**MOSID 00121 Mar Eng**	**…**	**MOSID 00207 MARS**
Liquid RAS	Manage / monitor	Internal Comms	Position Title: Dump IC Criteria: KSA: VACP:	QL5				
			Position Title: Safety Number Criteria: KSA: VACP:	QL6				BWK
			Position Title: Senior Engineer Criteria: KSA: VACP:			QL3		
		Distance Line	Position Title: Distance line operator Criteria: KSA: VACP:					
	Pass / return gear	Winch assembly	Position Title: Winch IC Criteria:	QL3				

Operational Activity	Tasks	Associated Systems	Job / Positions	MOSID 00105 BOS'N	MOSID 00299 NAVCOM	MOSID 00121 Mar Eng	…	MOSID 00207 MARS
			KSA: VACP:					
			Position Title: Winch 2IC Criteria: KSA: VACP:	QL2				
		Line handling system	Position Title: Line Handler 1 Criteria: KSA: VACP:	QL2				
			Position Title: Line Handler 2 Criteria: KSA: VACP:	QL1				
		Intership Comms	Position Title: Comms number Criteria: KSA: VACP:					
	Fuel	Fuel Pump system	Position Title: RAS Engineer Criteria: KSA: VACP:			QL3		
		Winch assembly	Position Title: Winch IC Criteria: KSA: VACP:	QL3				
			Position Title: Winch 2IC Criteria: KSA: VACP:	QL2				
		Fueling Comms	Position Title: Engineer Comms Criteria: KSA: VACP:			QL1		
Solid RAS	…							
Watch keeping	Bridge watch Keeping	N/A	OOW					BWK
			2OOW					U/T
			Lookout	QL1			QL1	
			Senior Hand of the Watch	QL3				
			Helmsman	QL1				
			Signalman		QL1			
	Ops		ORO					ORO
			Director					D LEVEL

Operational Activity	Tasks	Associated Systems	Job / Positions	MOSID 00105 BOS'N	MOSID 00299 NAVCOM	MOSID 00121 Mar Eng	…	MOSID 00207 MARS
			ORS					
			CCR IC		QL5			
			CCR operator		QL1			
	Eng.		EOOW			QL6		

4.3.7.1.6 DADM Support for HV-12

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project potential linkages are shown in Figure 13.

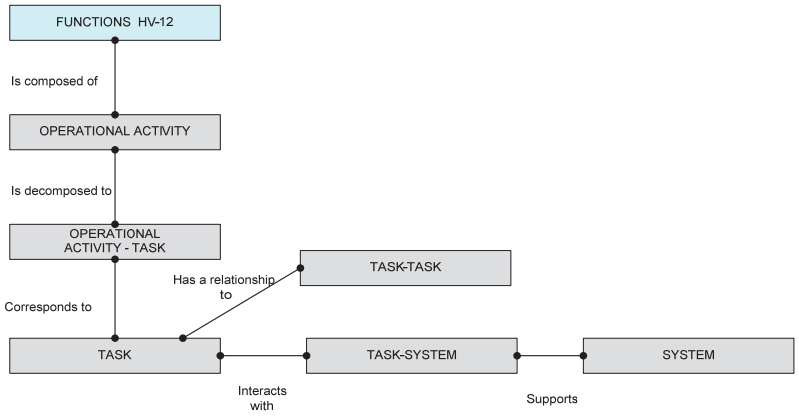

Figure 13: DADM support HV-12

4.3.7.2 Dynamic Human View

The NATO description of HV-H describes the desire to capture the dynamic aspects of human system components identified in other views. They express a desire to capture dynamic aspects of human-system interaction or performance parameters over time to be able to communicate enterprise behaviour through the use of executable models and simulation tools. In this regard, the concept of the Dynamic View is somewhat unique within the HVs in that it is comprised of neither entered data nor a reformatted presentation of data entered in other views; it attempts to perform analysis using data from various views but executed using a tool external to the core data entry mechanism. Thus our fundamental interpretation of the intent of the Dynamic View is that it is used to answer a specific question or set of questions relevant to the user of the view.

The NATO description of the Dynamic View lists a wide variety of possible features (i.e., elements of questions that could be answered) that all describe good elements of Human Factors

work; however, many of these possible features, such as workload or decision speed performance predictions, are at too low a level to be useful to DND stakeholders such as acquisition project staff. The discussion below focuses on a practical implementation of a Dynamic View to support a specific use case: manning analysis (validation) for Navy platform acquisition.

4.3.7.2.1 Introduction

This is a specialized type of view which represents a concrete analysis. The Dynamic HV presents the architecture for the implementation of various analyses to be determined by specific project / organization / enterprise needs.

4.3.7.2.2 Purpose

The purpose of each dynamic view will vary, however, most will support validation and/or augmentation of the data captured for a project to support other views.

4.3.7.2.3 Prerequisites

The prerequisites for this view will be dependent on the analysis required. Typically most HFE work starts with a task analysis or similar base. Each dynamic view has the potential to be unique therefore the prerequisites to develop a dynamic human view will be unique as well.

4.3.7.2.4 Instructions

During the course of developing the architecture, the Dynamic HV may be updated several times. Each dynamic view has the potential to be unique therefore the instructions to develop a dynamic human view will be unique as well.

4.3.7.2.5 Representation

The detailed description of this view will be established and validated during Phase 2 of this project.

4.3.7.2.6 DADM Support for Dynamic HV

The DADM support information and documentation of this view will be established and validated during Phase 2 of this project. However, it is not envisioned that links between the DADM and this view will be strictly required as critical issues will vary by project.

4.3.7.3 Corporate Human Views

During the study of the NATO HV a number of views were found to not be applicable to the acquisition process. These are deemed to be ‘Corporate Views’ as are included in this section for completeness. It may be that at some point these views may be included in DNDAF to allow for a single repository and access point for data – currently the information depicted in the following

views are relevant to organizations such a Chief Military Personnel and the ADM Personnel (Civilian) and are accessible through separate applications.

There are several additional views that record human related data at the corporate level including: career progression view, establishment inventory, personnel policy, human characteristics and metrics. These views are described in the following subsections. Further investigation is needed and they will be fully documented in the project final report.

4.3.7.3.1 Career Progression

NATO's vision for this View was to illustrate career progression as well as the essential tasks, skills, knowledge, and proficiency level required for a given job.

In the Canadian Military context, the Chief of Military Personnel (CMP) and Human Resources Civil (HRCiv) own all career progression information for the Canadian Forces (CF) and civilian portion of Department of National Defence respectively. These groups are assisted by individual MOSID career managers and occupational advisors.

This information is essential at the Enterprise level of the organization and should be collected and entered into DNDAF. However, this would take considerable effort by the individual groups responsible for the information. In addition, there is very little dynamic change in career progression mapping and as such the acquisition project will be able to leverage information such as existing MOSID and QL levels. This type of information seems to be immediately evident to the experts within the projects and is an effective tool in its current form to assist with establishing the crew complement.

4.3.7.3.2 Establishment Inventory

The intent of this View was to define current number of personnel by rank and job within each establishment. The goal of this effort is establish current trained effective strength and assist with forecasting of personnel requirements regarding predicted future demand.

In the Canadian Military context, the Chief of Military Personnel (CMP) and Human Resources Civil (HRCiv) own all personnel information for the Canadian Forces (CF) and civilian portion of Department of National Defence respectively.

This information is essential at the Enterprise level of the organization and should be collected and entered into DNDAF. However, at the acquisition project level they are concerned with establishing personnel requirements rather than identifying gaps between current and future total trained strength.

4.3.7.3.3 Personnel Policy

The intent of this View was to define the various department policies dealing with Human Resource HR issues. This is an effort to capture data regarding the fair treatment of individuals while employed with the department. It was seen as the repository for Human Resource

documents informing on policies, doctrine, laws, benefits, pay, and standard operating procedures, among others.

Again, in the Canadian Military context, the CMP and HRCiv own all personnel policy information for the CF and civilian portion of Department of National Defence respectively.

This information is essential at the Enterprise level of the organization and should be collected and entered into DNDAF. However, this information seems less applicable in the context of an acquisition project as typically the fair treatment of individuals is the responsibility of the operational departments and is consistent throughout the CF.

4.3.7.3.4 Human Characteristics

NATO suggests this View as a means to provide a repository of physical characteristics, movement capabilities and limitations of an operator, under various operating conditions with consideration of system operating requirements. They envisioned this View may include physical characteristic information such as anthropometrical/medical data, reach data, range of motion data, physical strength data, visual and auditory assessment, speed or duration of activity data, cognitive workload, working memory capacity, ability to be security cleared, personality, and motivation among others.

While this is a valuable effort it is important to note that in the context of the Canadian Military, its applicability may be somewhat redundant with the manner in which the military requests personnel for specific tasks. Each person is assigned a MOSID which includes a legal description of the tasks expected, physical and knowledge requirements, and the training required to perform the tasks. For instance, MOSID 00105 identifies a Bos'n; each Bos'n is expected to be able to complete all requirements prior to being classified with that ID. In this regard, the View, as defined, may be more appropriate at an enterprise level of the organization rather than the acquisition project level.

4.3.7.3.5 Metrics

NATO suggests that HV-G could either be its own product or incorporated into another architecture metric view, such as the SV-7 (in MoDAF and DoDAF). The intent is to provide a repository for human-related values, priorities and performance criteria, and maps human factors metrics to any other human view elements. They envision that this view could assist in the mapping of performance metrics and assessment targets. However, similar to the Human Characteristics View (HV-B6), in the Canadian Military context, its applicability may be somewhat redundant with the manner in which the military records such information. Each person is assigned a Military Occupational Speciality Identification (MOSID) which includes a legal description of the tasks expected, physical and knowledge requirements, and the training required to perform the tasks. For instance, MOSID 00105 identifies a Bos'n; each Bos'n is expected to be able to complete all requirements prior to being classified with that ID.

4.4 Application of the HV in the Acquisition Process

Figure 14 illustrates the Project Management phases and the associated key decision points identified in the DND/CF Project Approval Directive (PAD). The recommended minimum set of DNDAF sub-views identified below should provide a baseline for the architectural development progress of new architecture activities through each of the following project management phases.

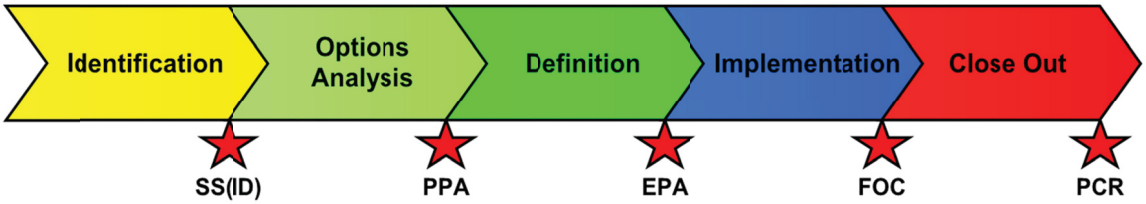

Figure 14: Project management phases

The architecture activity development staff will use following PAD lifecycle phases as a measure to identify the DNDAF View development progress through each of these phases. Table 10 lists the PAD document and associated DNDAF View. The right hand column is the suggested association for the HV described in this report. Both Figure 14 and Table 10 are from DND/CF Architecture Framework Version 1.8 Volume 2 [6].

Table 10: DNDAF View to project phase association

PAD Document	Associated DNDAF View	Suggested HV placement
• SS(ID):	The following sub-views will aid in presenting Key Activity results in the Identification Phase: CV-1, OV-1, and IV-1, StratV-1, CapV-1 and SecV-1.	HV-1
• SS(PPA):	In addition to the sub-views identified in SS(ID) the following sub-views will aid in presenting Key Activity results in the Option Analysis Phase: OV-1, OV-2, OV-4a, OV-5a, CapV-3, SV-1, SV-5, SV-7, and TV-1. Note: more than one set of any sub-view may be used to define various options.	HV-2, HV-9, and HV-12
• SS(EPA):	In addition to the selected sub-views identified in SS(PPA), the following sub-views will aid in presenting Key Activity results in the Definition Phase: CV-2, OV-3, OV4b,OV-5b, OV-6a, OV-6c, SV-2, and TV-2.	HV-3, HV-4, HV-5, HV-6, HV-10, and HV-11
• FOC:	In addition to final updates to the selected sub-views identified in SS(EPA), any additional sub-views developed will aid in presenting the results of the Key Activities results in the Implementation Phase.	
• PCR:	All the completed sub-views with a final updated CV-1will aid in presenting the Key Activity results in the	

PAD Document	Associated DNDAF View	Suggested HV placement
	Close Out Phase. Note: On completion of the Close Out Phase, a copy of all architectural sub-view information must be provided to DEA for integration into the DND/CF Architecture Registry and Repository System (DARRS). This valuable enterprise architecture information will allow the DND/CF to more effectively and efficiently exploit the valuable information resource provided through the integration of all architecture activities.	

5 Use Case Selection

Task 3 requires the selection of one user case for the application of Human Views.

To date, there has been no decision made by the project and the Scientific Authority regarding which DND project to use as a case study for the continued development of the core set of Canadian Human Views. Presently there are 2 potential projects being considered: the Joint Support Ship (JSS) and the Virtual Combined Air Operations Center (V-CAOC). Table 11 and Table 12 list the benefits and risks for each project.

Given the end date of Phase 2 is set at 31 March 2013, and the scope of work required is expected to be extensive, a decision must be made by late May (as agreed with the Scientific Authority).

5.1 Joint Support Ship (JSS)

As an active member of the international community, Canada has frequently sent its Navy to every corner of the globe. This ability to operate around the world, however, requires some level of self-sufficiency. For the Navy, that means support ships. The Navy's remaining support ships, known as Auxiliary Oiler Replenishment (AOR) vessels are nearing the end of their operational lives and a replacement vessel is being discussed.

The current concept under development is to replace the aging AORs with at least two Joint Support Ships in the 2017 timeframe. These Joint Support Ships will maintain the core capabilities inherent in the Navy's current support ships, including:

- The provision at sea of fuel, food, spare parts, and ammunition;
- Modern medical and dental care facilities;
- Repair facilities and technical expertise to keep aircraft and other equipment functioning; and
- Basic self-defence.

Support ships are the lifeblood of the Navy, delivering the supplies, spare parts and food necessary to keep ships at sea and support Canadian Forces ashore. The Joint Support Ship will enable a Naval Task Group to remain at sea up to six times longer than is possible without these ships. They will also be capable of providing limited support to Canadian Forces' operations ashore through additional features, including:

- Limited Lift-On Lift-Off ;
    - A capability that facilitates the quick load and off-load of equipment and supplies using standard 20' equivalent containers and Landing Craft - Vehicles and Personnel.
- The operation of up to three Maritime Helicopters (each ship); and
- Work and living space for approximately 85 personnel, over and above the standard crew of up to 165 people.

Joint Support Ships will provide the Canadian Forces with a greater flexibility to conduct a wide range of operations both domestically and internationally. These operations include, but are not limited to:

- Ongoing participation in the international campaign against terrorism;
- International coalition operations;
- Peace Support operations;
- Response to national security incidents;
- Evacuation operations; and
- Assistance during humanitarian crises or natural disasters.

This adaptability will not only help transform the Navy, but will also usher in a new joint capability that will be at the forefront of transformational change within the Canadian Forces.

Table 11: Benefits and Risks of JSS as a Use Case

Benefits	Risks
Project is well known to the research team	Large number of operators – many roles and resultant KSA requirements
Project staff is engaged	Complex system with many operational activities and systems
Some of the data that would be in DNDAF is available	
No new trades or unique job descriptions	

5.2 Virtual - Combined Air Operations Center (V-CAOC)

The CAOC provides operational-level command and control of air and space for Commander 1 Canadian Air Division / Canadian NORAD Region, who is also the Canadian Combined Forces Air Component Commander (CFACC). It is the focal point for planning, directing and assessing air and space operations. It is uniquely structured to meet Canadian Forces' requirements to deliver effects to various commanders in support of strategic, operational and tactical objectives across a full spectrum of operations including domestic and international disaster response, search and rescue, evacuation operations, air mobility operations and NORAD operations.

The Air Force project being proposed is to undertake the development of a deployable CAOC.

Table 12: Benefits and Risks of CAOC as a Use Case

Benefits	Risks
Small project with respect to the scope of personnel and systems	Project does not have approval yet
Project is Air Force therefore the application of HVs will be proven over two environments	Project staff does not know about DNDAF or HVs

6 Phase 2 Future Work

Phase 2 of this project will include:

- Applying the Human Views to a use case, and
- Organize and facilitate a Human Views workshop with DND stakeholders to present the Human Views architecture data products and the results from the user case study.

The next steps of this research project are to develop and apply the Human Views in support of either the JSS project or the CAOC project.

Given that the Human Views extension of the DNDAF is currently only a conceptual framework, there will be a great amount of work to produce a working tool. The work will include the application and refinement of the analysis of work progressed in the United Kingdom and the United States on their Architecture Frameworks. The actual development of the Human Views tool and the population with data from the Use Case project is not without technical and schedule risk. The research aspect of the work must be considered when considering the scope for Phase 2.

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List of symbols/abbreviations/acronyms/initialisms

2OOW	Second Officer of the Watch
AB	Able Seaman
AcV	Acquisition View
ADM(IM)	Associate Deputy Minister Information Management
AES OP	Airborne Electronic Sensor Operator
AIR NAV	Air Combat Systems Officer
AOPS	Arctic Offshore Patrol Ship
AOR	Auxiliary Oil Replenishment
ARP	Applied Research Project
AV	All View
AVN	Avionics Systems Technician
AVS	Avionics Systems Technician
Bosn	Boatswain
BWK	Bridge Watch Keeper
CAOC	Combined Air Operations Center
CCR	Communications Control Room
CapDEM	Collaborative Capability Definition, Engineering and Management
CapV	Capability View
CBTO	Combat Officer
Cdr	Commander
CF	Canadian Forces
CFACC	Canadian Combined Forces Air Component Commander
CFITES	Canadian Forces Individual Training and Education System
CMP	Chief of Military Personnel
CO	Commanding Officer
COM	Communications
Coxn	Coxswain
CPO1	Chief Petty Officer First Class
CPO2	Chief Petty Officer Second Class
CSE	Combat Systems Engineer
CSC	Canadian Surface Combatant

CV	Common View
DADM	Defence Architecture Data Model
DARRS	DND/CF Architecture Registry and Repository System
DEA	Director of Enterprise Architecture
D Level	Director Level
DMARPERS	Director of Maritime Personnel
DMTE	Director of Maritime Training and Education
DND	Department of National Defence
DNDAF	DND Architecture Framework
DODAF	Department of Defence Architecture Framework
DRDC	Defence Research and Development Canada
DRG	Defence Research Group
EOOW	Engineering Officer of the Watch
EPA	Effective Project Approval
E Tech	Electrical Technician
FOC	Full Operational Capability
HFI	Human Factors Integration
HHA	Health Hazard Assessment
HRCiv	Human Resources Civilian
HSI	Human Systems Integration
H Tech	Hull Technician
HV	Human View
HVs	Human Views
HVDA	Human View Dynamic Architect
ID	Identification
IOC	Initial Operational Capability
IPME	Integrated Performance Modelling Environment
IMPRINT	Improved Performance Research Integration Tool
JBOS	Job Based Occupation Specification
JSS	Joint Support Ship
KSA	Knowledge, Skills, and Abilities
KSAOs	Knowledge, Skills, Abilities, and Other characteristics
LCdr	Lieutenant Commander
Log	Logistics
LS	Leading Seaman

Lt(N)	Naval Lieutenant
MARS	Maritime Surface Subsurface Officer
M&S	Modelling and Simulation
MHQwMOC	Maritime Headquarters with Maritime Operations Center
MoDAF	Ministry of Defence Architecture Framework
MOSID	Military Occupational Structure Identification Code
MS	Master Seaman
NA	Needs Assessment
NATO	North Atlantic Treaty Organization
NAVO	Navigating Officer
NCIOP	Naval Combat Information Operator
NCS	Naval Combat System
NESOP	Naval Electronic Sensor Operator
NORAD	North American Air Defence
OA	Options Analysis
OOW	Officer of the Watch
ORO	Operations Room Officer
OS	Ordinary Seaman
OSVB	Occupational Specification Validation Board
OV	Operational View
PA	Physician`s Assistant
PAD	Project Approval Directive
PER	Performance Evaluation Report
PMO	Project Management Offices
PO1	Petty Officer First Class
PO2	Petty Officer Second Class
PPA	Preliminary Project Approval
QL	Qualification Level
R&D	Research and Development
RCN	Royal Canadian Navy
RMS	Records Management Systems
SA	Scientific Authority
SecV	Security View
Slt	Sub-Lieutenant
SME	Subject Matter Expert

SS(ID)	Synopsis Sheet Identification
SV	System View
StratV	Strategic View
TAD	Target Audience Description
TNA	Training Needs Analysis
TV	Technical View
UAV	Unmanned Aerial Vehicle
UK	United Kingdom
UNTL	Universal Naval Task List
U/T	Under Training
VACP	Visual, Auditory, Cognitive, and Psychomotor
V-CAOC	Virtual Combined Air Operations Center
W Eng Tech	Weapons Engineering Technician
XO	Executive Officer

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As a result of information technology and acquisition reform within Allied defence communities architectural approaches have emerged and are evolving as a structure for the development of a systems architecture or enterprise architecture. While international architecture frameworks evolve to include new concepts in System Engineering, the portrayal of the human as a unique part of the system has not been addressed. A Human View is required to explicitly represent the human and to document the unique implications humans bring to and impose on the system design. To that end, the idea of Human Views, which leverages Human System Integration principles, has emerged. The purpose of the Human View is to capture the human requirements and to cater to and inform on how the human interacts in the system. This report defines the Human Views that are applicable to the Department of National Defence / Canadian Forces Architecture Framework (DNDAF).

En raison de la réforme de la technologie de l'information et des acquisitions au sein des communautés de la défense des pays alliés, de nouvelles démarches architecturales émergent et continuent d'évoluer en tant que structure d'élaboration d'architectures de systèmes ou d'entreprise. Bien que les cadres d'architecture internationaux continuent d'évoluer pour prendre en charge de nouveaux concepts en ingénierie des systèmes, la représentation de l'humain en tant que composant unique du système n'a pas été abordée. Une vue humaine est requise pour représenter l'humain de manière explicite et pour rendre compte des aspects uniques des humaines dans la conception de systèmes. Émerge à cette fin le concept de vues humaines, qui s'appuie sur les principes de l'intégration des systèmes humains. L'objet de la vue humaine est de saisir les exigences humaines, ainsi que de refléter les interactions des humains avec le système et d'en rendre compte. Le présent rapport définit les vues humaines qui s'appliquent au cadre d'architecture du ministère de la Défense nationale et des Forces canadiennes (CAMDN).

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

Human Systems Integration, modelling and simulation, manning, crewing, acquisition