The Human Viewpoint: Facilitating Human System Integration with Architecture Frameworks

Dr. Holly A. H. Handley

Assistant Professor, Old Dominion University, Norfolk, VA

Dr. Beverly G. Knapp

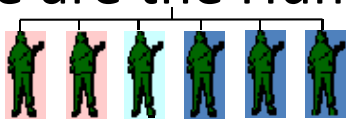
Deputy Director, MANPRINT, HQ Army G-1, Washington , DC

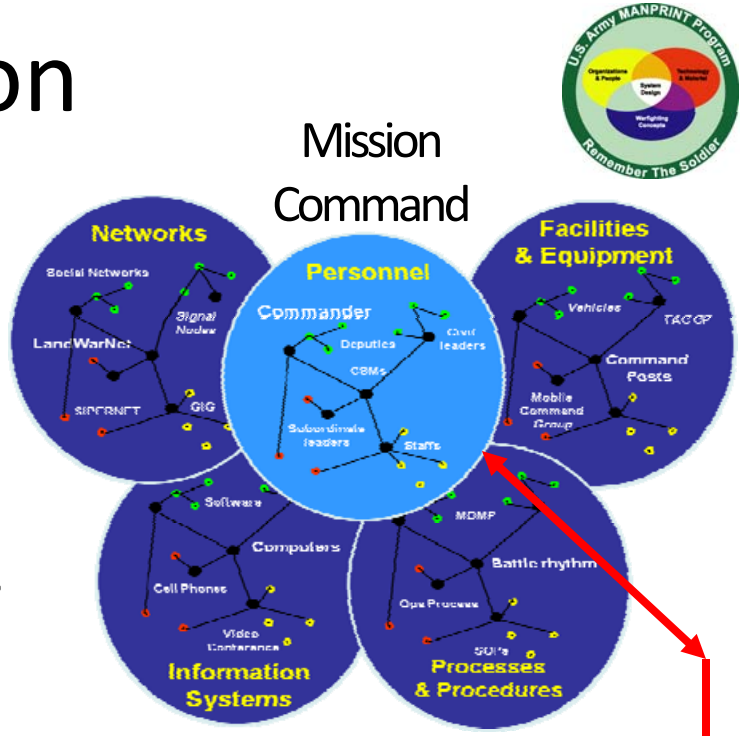
Introduction

- Complex systems require the Human Systems Integration (HSI) community to increase collaboration with Systems Engineering (SE) community.

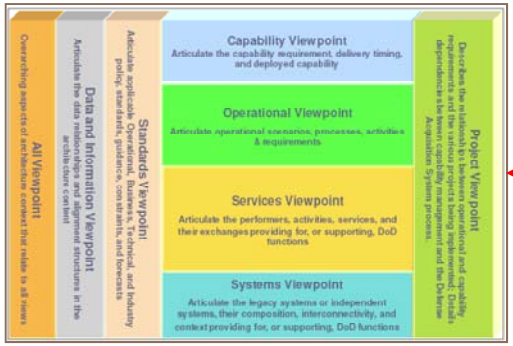
- Architecture Frameworks are an enabler to define elements, relationships, and standards within a complex system.

- Current frameworks have limited representation of the human as a critical element in system design and performance: [Where are the Humans?]

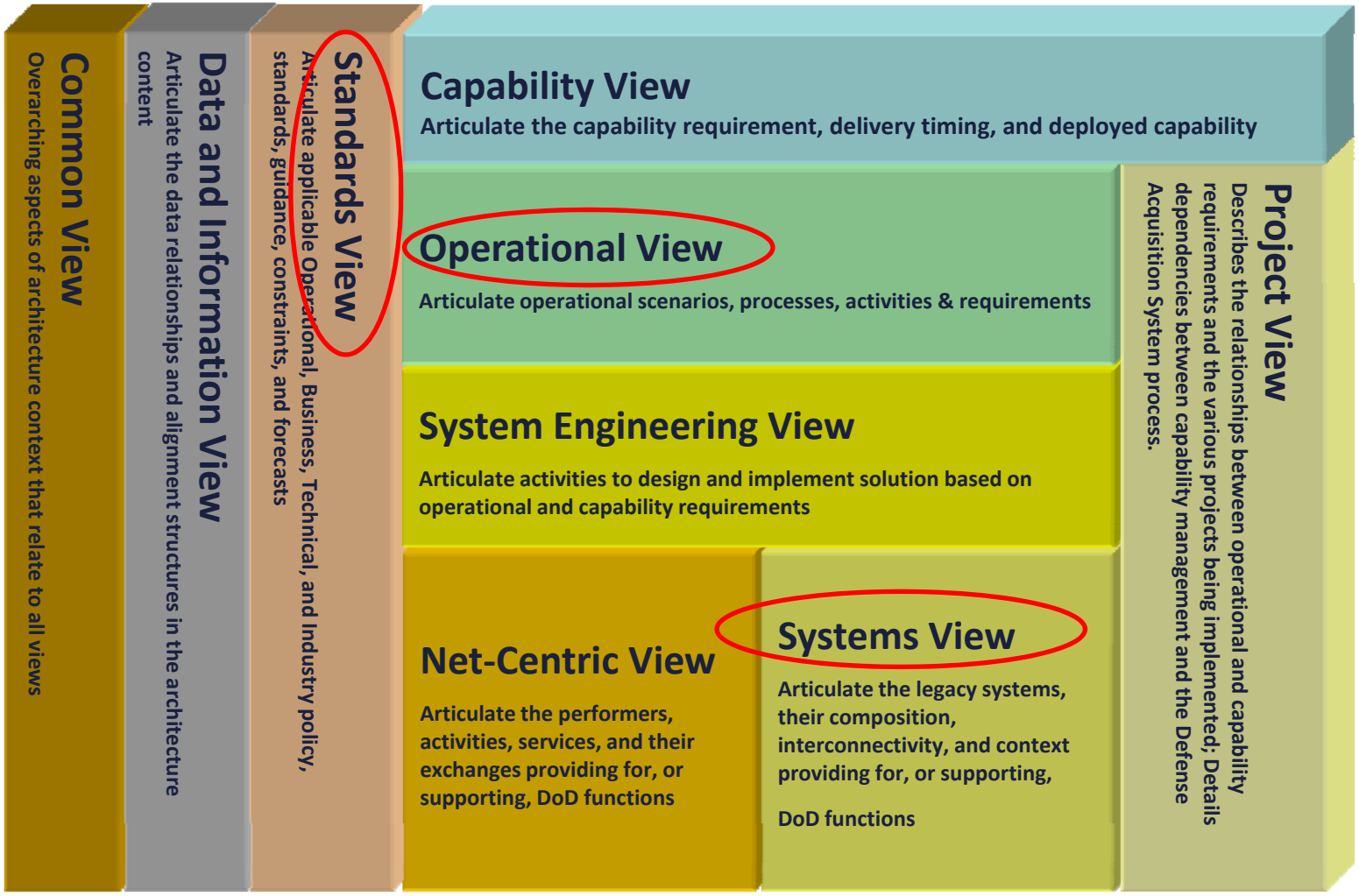




DoDAF 2.0 Architecture



DoDAF 2.0 Architecture Views

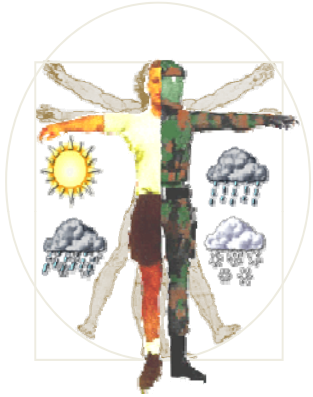


Humans and Systems

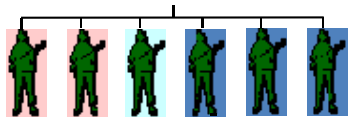
- Humans play a pivotal role in the operation of systems:
  - Systems must be supported by sufficient manpower,
  - Personnel must be adequately trained to operate the system in the context of an operational mission,
  - Equipment must fit the human – not fit the human to the equipment.

The Human View …

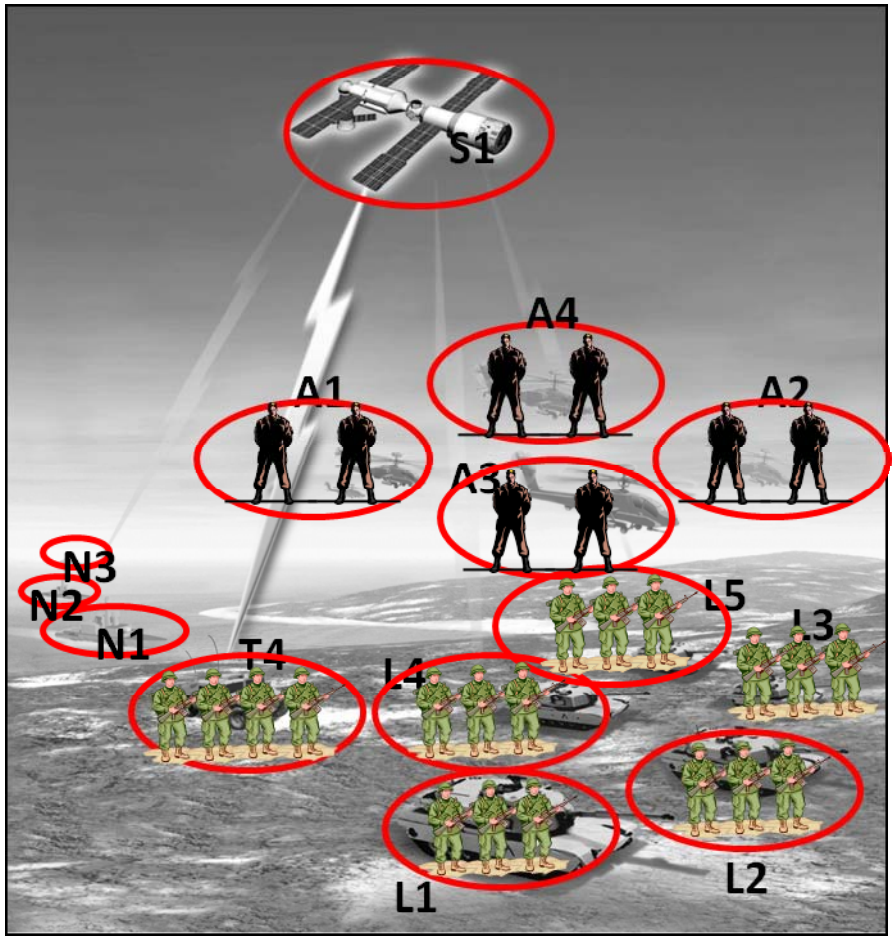
- Is an architectural viewpoint that focuses on the human part of a system.
  - Organizes information about how the human "fits in" or "interacts with" the system.

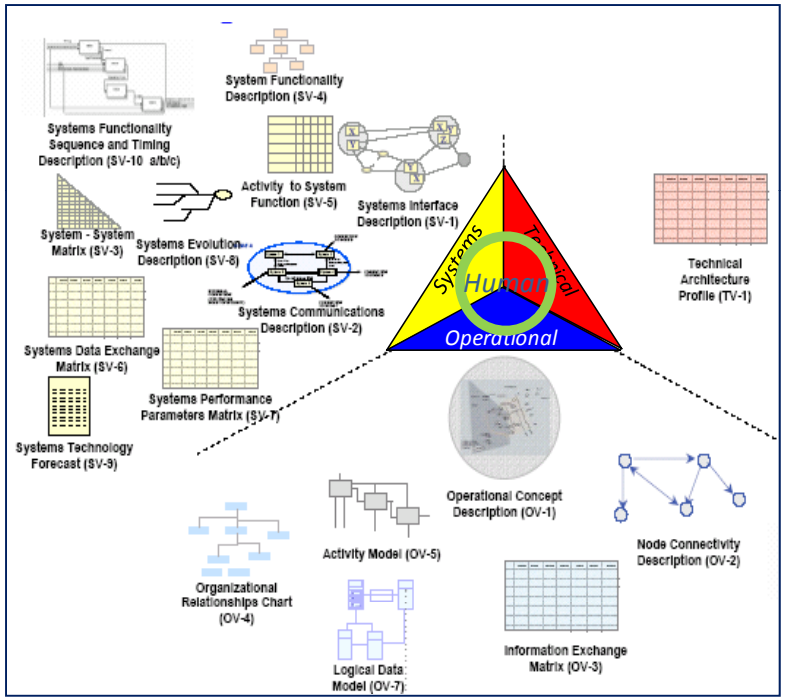


- Adds value by providing a more complete representation by including human capabilities and limitations as an integral part of the system design.
  - It ensures that the human is fully considered in the system enterprise architecture by structurally incorporating them into engineering planning.
  - It provides human-system parameters that can be used to minimize human risk with the overall system.



The Human View Goal

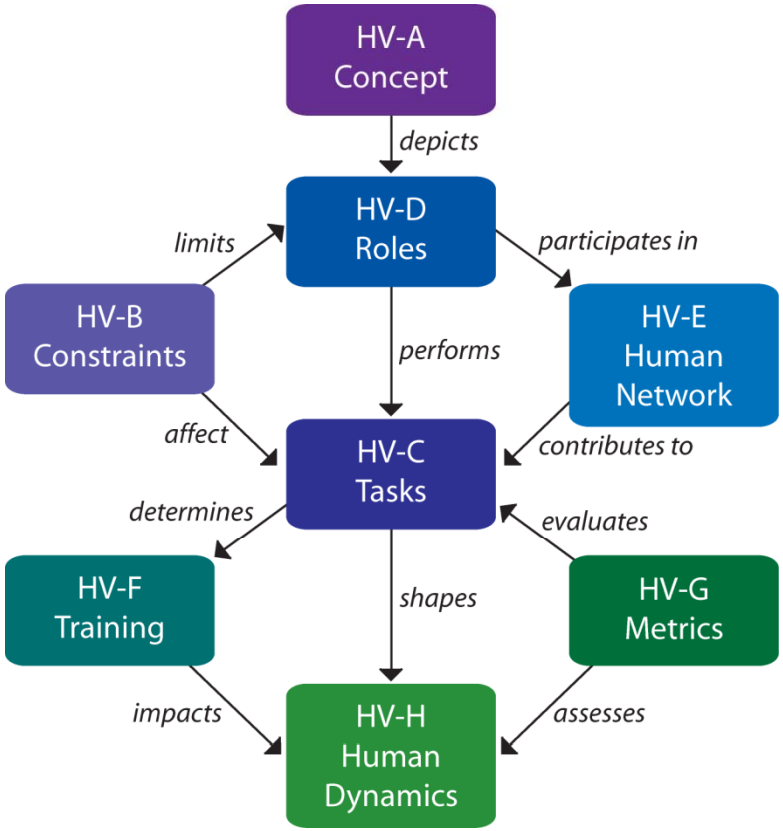




Bring the Human Daily Work Flow into the Picture

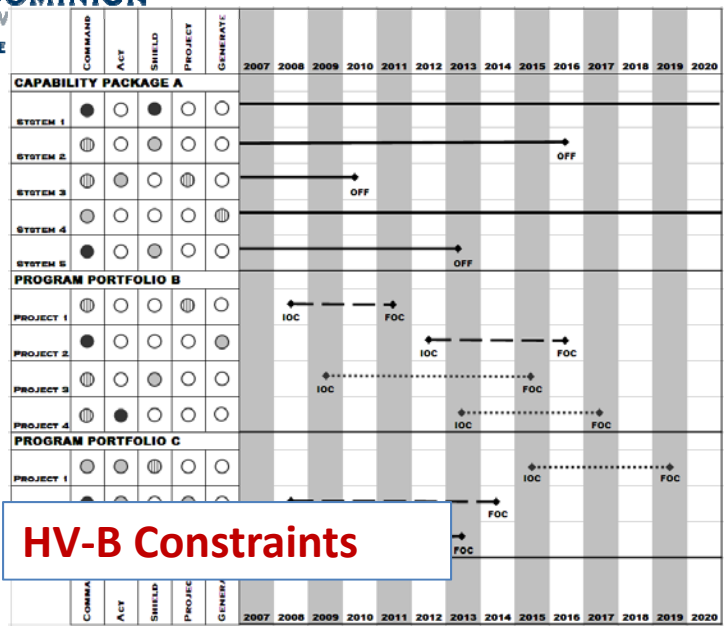
Human View Components

HV-A Concept	a high-level representation of the human component of the system
HV-B Constraints	a repository for different sets of limitations
HV-C Tasks	describes the human-specific activities
HV-D Roles	describes the job functions that have been defined for the humans interacting with the system
HV-E Human Network	captures the human to human communication patterns that occur as a result of team formation
HV-F Training	accounting of training requirements, strategy, and implementation
HV-G Metrics	a repository for human-related values, priorities and performance criteria
HV-H Dynamics	the information necessary to complete a simulation of the human impact on the system

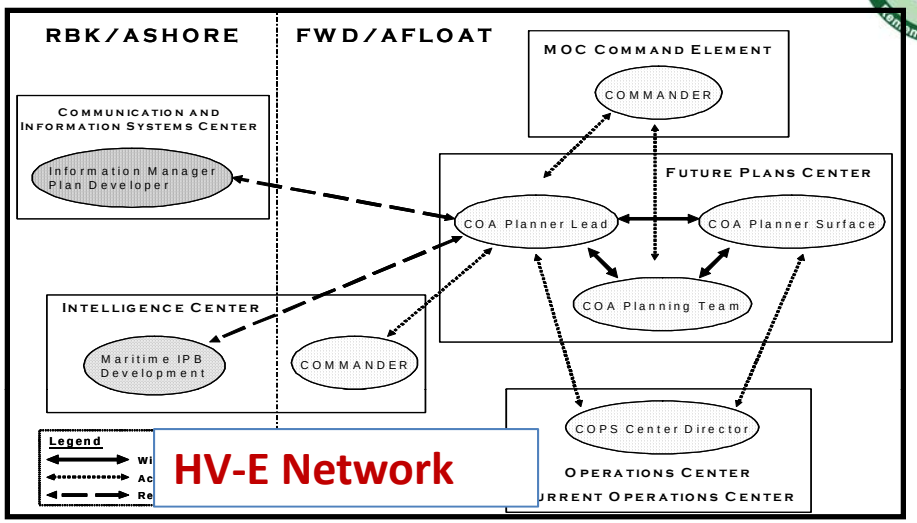


Architecture Framework Human View: The NATO Approach Handley, H.A.H., & Smillie, R.J. (2008). Architecture framework human view: The NATO Approach. *Systems Engineering*, 11(2), 156-164.

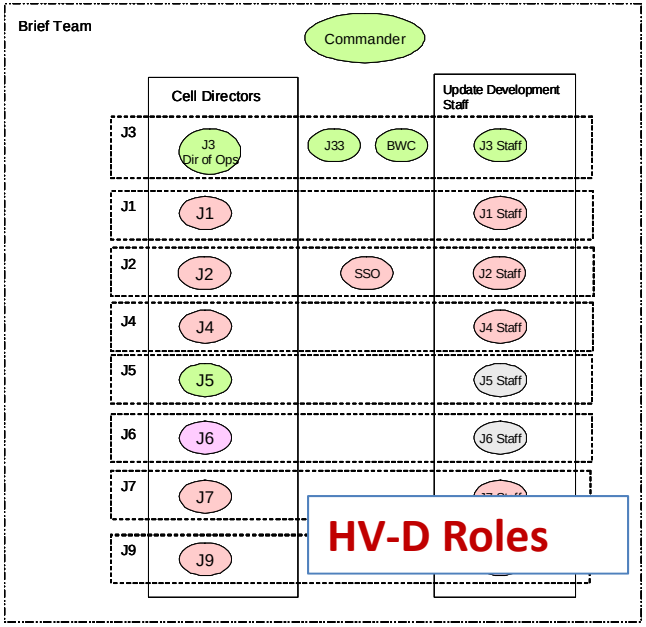
Human View Products



HV-B Constraints



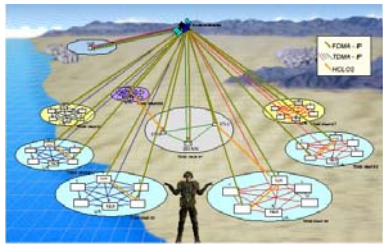
HV-E Network



HV-D Roles

Tasks	Responsibility							
	Director of Operations	CFMCC Staff	Cell Directors	Special Security Officer	Battle Watch Captain	J33	Remote Staff	Commander
1.1 Select topics for briefing content	✔							
1.2 Review previously submitted data		✔						
1.3 Identify data sources for relevent updates		✔						
1.4 Access sources & identify information		✔						
2.1 Obtain templates for briefing		✔						
2.2 Import data		✔						
2.3 Create slide		✔						
2.4 Revise slides and notes		✔						
2.5 Assess currency of information		✔						
2.6 Assess accuracy of fields and spelling		✔						
2.7 Revise slide fields and spelling		✔						
2.8 Assess need to make changes to notes		✔						
2.9 Revise slide notes		✔						
2.10 Assess need for sharing with foreign partners		✔						
2.11 Assess compliance of data with disclosure policies				✔				
2.12 Post completed slide		✔						
3.1 Advise reviewers of readiness		✔						
3.2 Review slides			✔					
3.3 Provide updates and comments			✔					
3.4 Review comments		✔						
3.5 Assess need for more info		✔						
3.6 Access sources & identify new information		✔						
3.7 Import data		✔						
3.8 Assess need to make changes to slides		✔						
3.9 Access and revise slides		✔						
3.10 Post reviewed slides		✔						

HV-C Tasks



HV-A Concept

Human View in Design

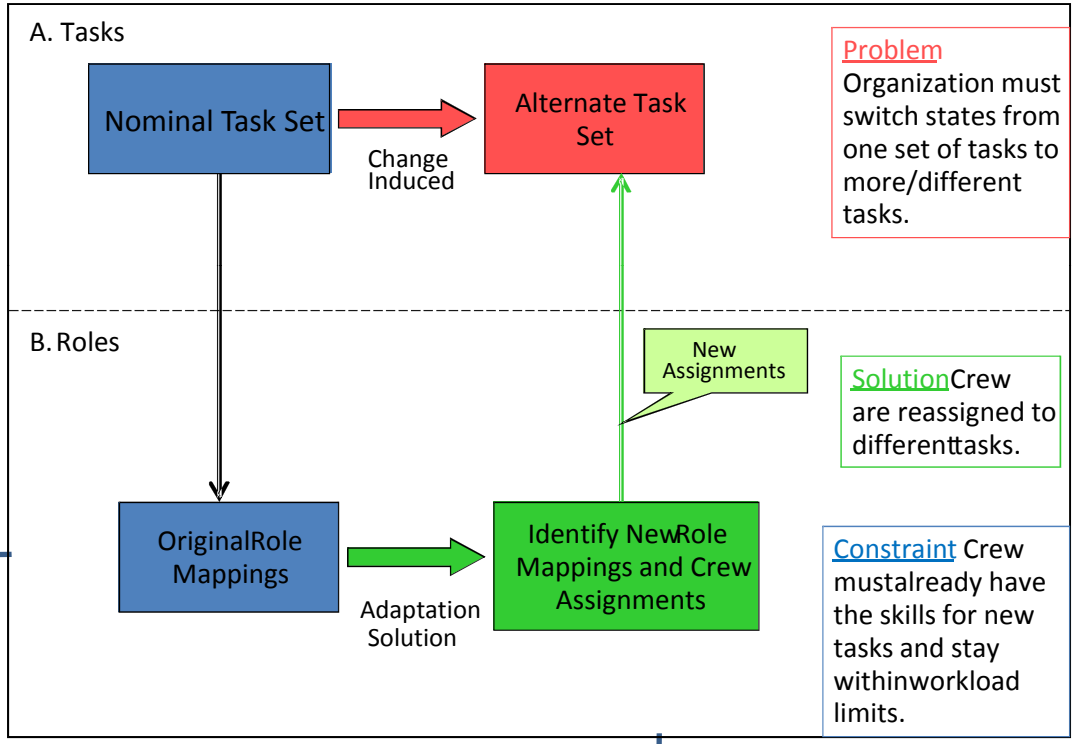
- The inclusion of the human component in the architecture is essential
  - to ensure suitable and acceptable interfaces between technology and users,
  - as well as user fit in to physical environments.

- The Human View integrates manpower, personnel and training considerations by promoting
  - ease of use and error mitigation,
  - decreased stress and user fatigue.

Human View Method

The Human View Visualizes and Compares Human Roles and Workflow

AS-IS Organization

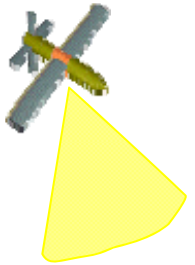


Iterate to the Right Balance Between Design Concepts and Tradeoffs

TO -BE Organization

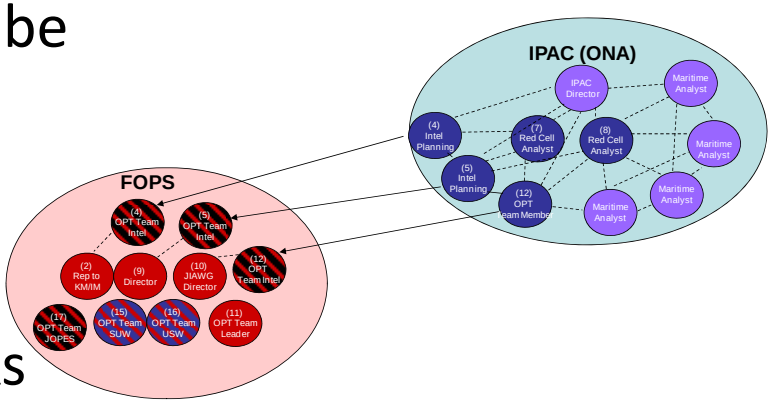
Case Study:

Aerial Reconnaissance Support Team (ARST)

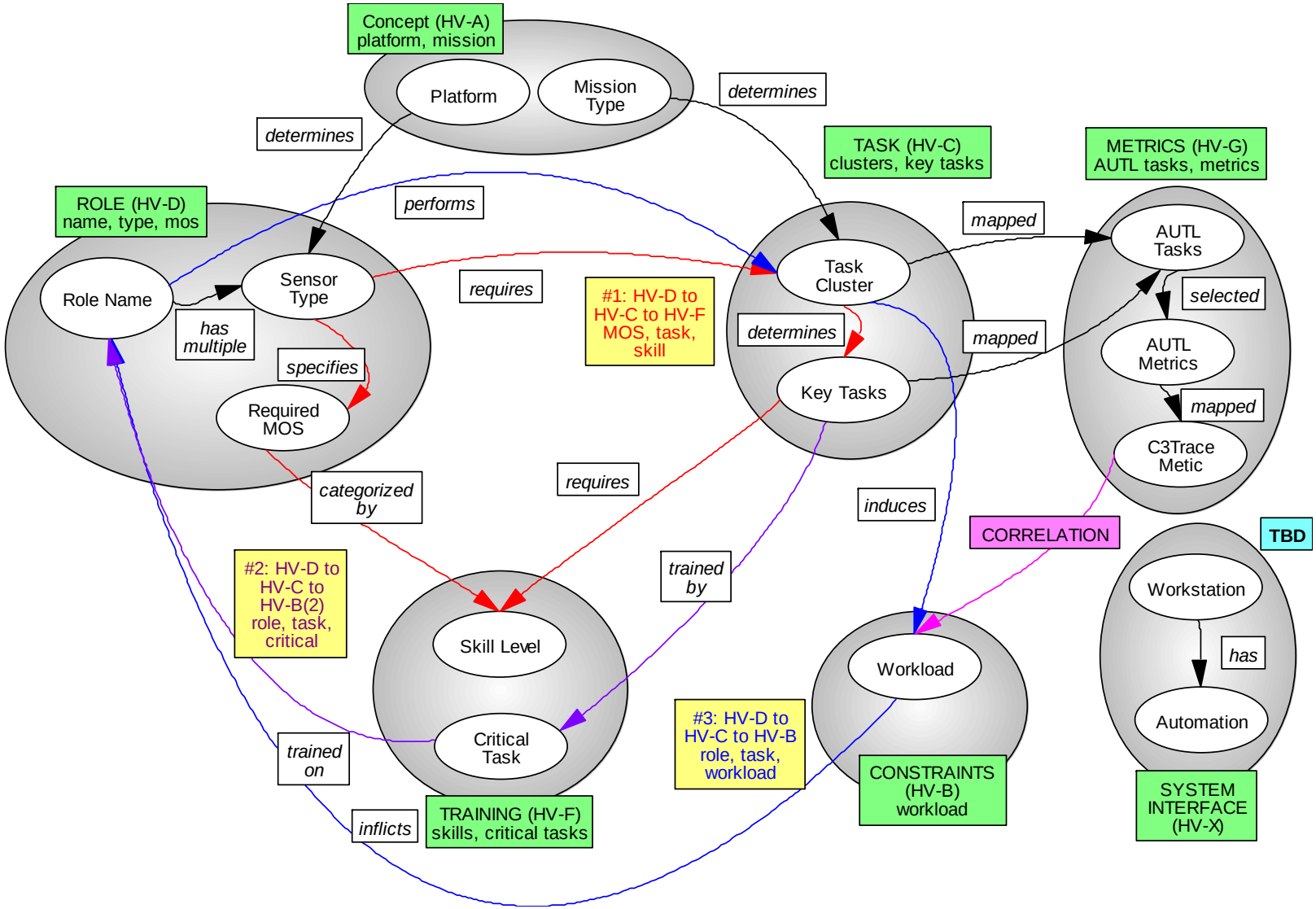


- The ARST supports Intel/Ops Processing, Exploitation & Dissemination (PED) process 21-days on station availability.
  - Monitoring multiple sensors at the same time.
- Human View models represent operator requirements so a baseline and adaptable organizational designs can be defined
  - Monitoring of video and radar combinations of imagery
  - With a minimum of dropped tracks and time to target.

ARST

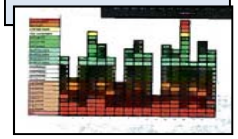


Human View Data Map: Essential Part of the Methodology



Human View Build and Analyze Process

Human Performance Analysis

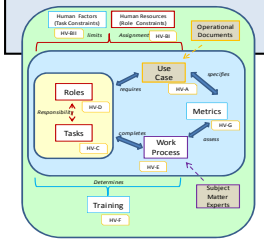


Accept or Reject Changes : New "As-Is" Or Implement different Organizational Change

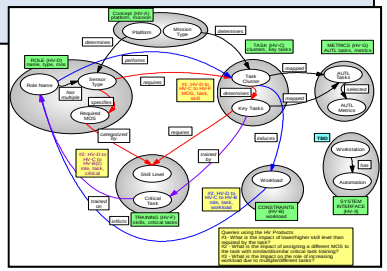
Impact of Organizational Change

Collect Human Data

Develop Human View Products



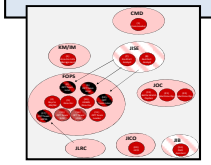
Create Data Map



Execute PED Process

Collect System Data

Process/System Outcome Measures



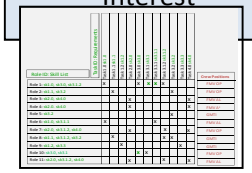
Update Model *"To Be"*

Defines content and format of each product – When populated captures current state "As-is"

Defines inter connections between products and identifies variables of interest

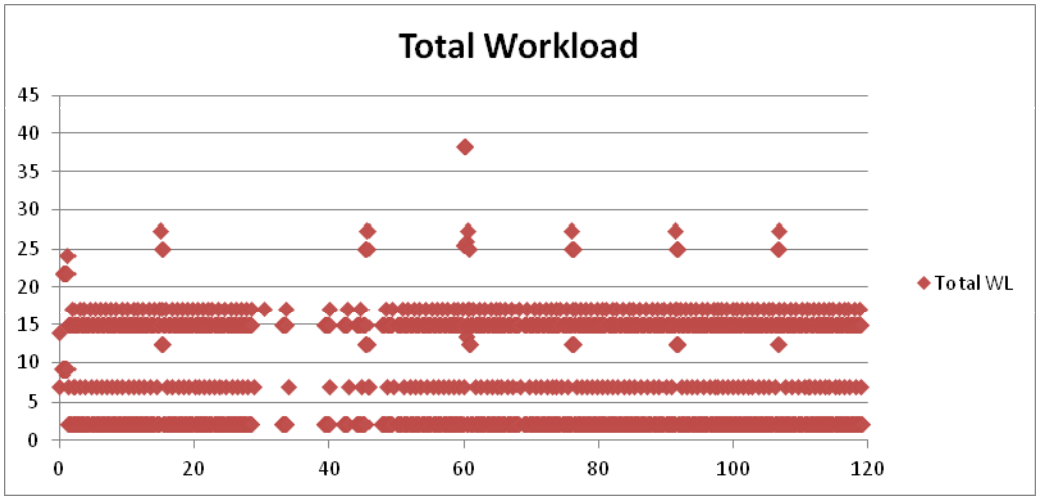
Implement Organizational Change

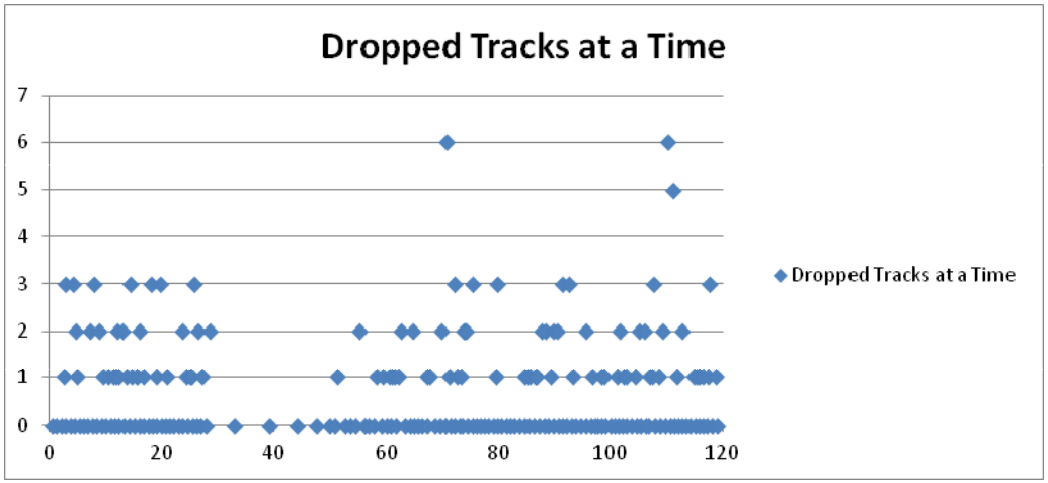
Identify and Adjust Parameters of Interest



For example, change the skill level of roles.

Human Availability Metrics





Correlation Coefficient	Max of average time to target	Avg of average time to target	Last value of average time to target
Process Time	0.645152533	0.359971305	0.641217357
Communication Time	0.319193272	0.670424902	0.381380423
Operation Time	-0.505489744	-0.100702979	-0.399287859
Weighted Process WL	0.752495835	0.527033055	0.759493213
Weighted Communication WL	0.053435927	0.497615925	0.13298175
Weighted Operation WL	-0.502028905	-0.09515456	-0.398242937

Why use the Human View?

- Human View models facilitate a more structured language for communicating with operations and system engineers.
- System engineers and HSI practitioners can use Human View methodology to develop a fully integrated set of products that ensure an effective and efficient design, test, and production process.
- Human Views enable qualitative and quantitative assessment of the human architecture within the system enterprise.

Without Human Views

- Without the Human View there is no basis in the architecture for analysis of human issues that may impact multiple aspects of the system:
- *Performance Analyses*
  - Humans are an essential element of system performance.
- *Cost-Benefit Trade-off Analyses*
  - Human activities with in the system must be weighed against manpower, personnel and training costs.
- *Requirements Analysis*
  - Specifications of human requirements to accomplish a mission (i.e. information, reporting, decision-making).
- *Technology Analysis*
  - Human Factor design criteria applied to enhance human performance which impacts system performance.

Questions & Comments

Dr. Holly A. H. Handley
Assistant Professor,
Old Dominion University,
Norfolk, VA
hhandley@odu.edu

Dr. Beverly G. Knapp
Deputy Director,
MANPRINT, HQ Army G-1,
Washington , DC
beverly.g.knapp.civ@mail.mil