











Toward a Framework for Assessing Human Systems Integration Efficacy

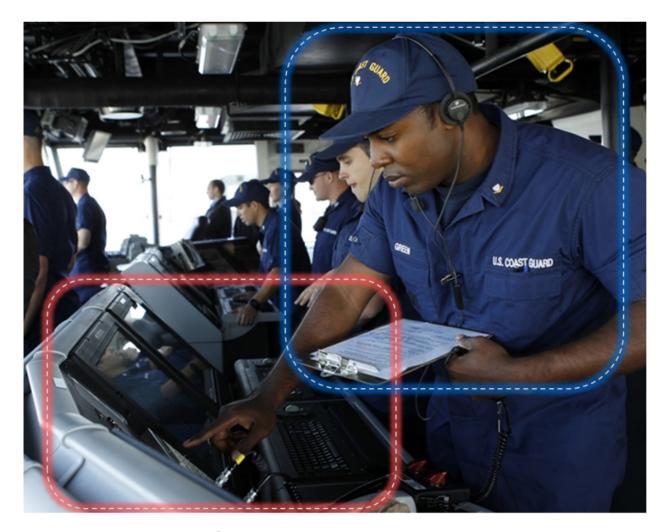
NDIA Human Systems 2016 Springfield, VA

> CDR Mike O'Neil U.S. Coast Guard HSI Division (CG-1B3)



HSI balances human capabilities and limitations with the affordances and constraints presented by system technology to accomplish system goals.

(Shattuck, O'Neil & Sciarini 2014)



How do we place humans on par tech during system development?



Program Executive

Lead System Engineer,

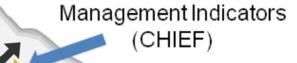
Senior HSI Practitioner

Systems Engineer, HSI Practitioner

Engineer, Programmer HSI Domain Practitioner

Domain SME

Analyst, Researcher



Measures of HSI Performance

Human-Technology Interaction Characteristics (specific HSI domain performance)

Manifested System Attributes

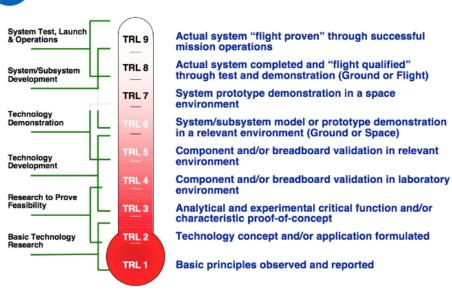
HSI Policies & Standards

Underlying Science



Selective borrowing from TRL

NASA/DOD Technology Readiness Level









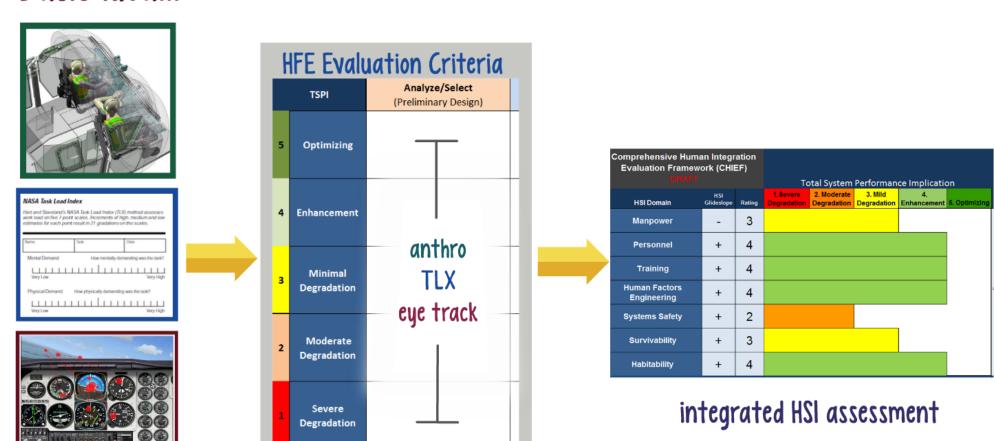
Re-framing the discussion...



This is how HSI is effecting your system.



Basic idea...



selected measures

unifying scale for each HSI domain

















Step Two: Anchoring

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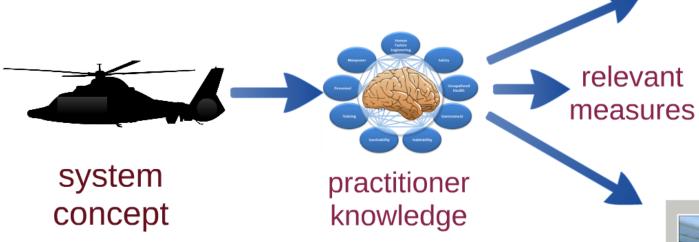
Example question for the practitioner: "What level of anthropometric accommodation would you consider 'minimally acceptable' for this system?"

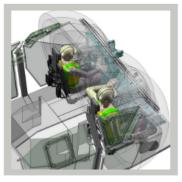


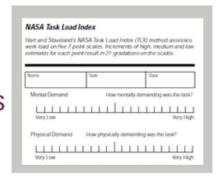


Entering Arguments: Users, Work Context, System Config

Step One: Select Measures









Step Two: Anchoring

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Example question for the practitioner: "What level of anthropometric accommodation would you consider 'minimally acceptable' for this system?"

Minimal Degradation: Impacts on total system performance trend slightly toward degradation. Engineering changes driven by inadequate human system integration may emerge during sustainment to remedy minor system performance deficiencies. Human-system performance (time on task, error rates, availability, etc.) is marginally meeting threshold requirements.

Moderate Degradation: Impacts on total system performance are

degradation of critical/non-critical tasks due to workstation layout, workspace design, system physical configuration. [Human Error] Human error predicted to occur in 5 in 100 critical tasks.	de de to
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Step Three: Calibration



iork load on five 7		dex (TLX) method assesses ints of high, medium and loo lations on the scales.
Same	Task	Date
	How mor	stally domanding was the task
Vory Low Physical Demand	How physically do	Vory Hig omanding was the task?
		Way like



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		Antropometrics: Greater than 99% of users are predicted to be accomodated across critical tasks; less than 1 in 100 users are not accomodated by design. Workload: Critical tasks are predicted to require less than 80% of user capacity (20% reserve capacity) given preliminary system design.	Antropometrics: Gre to be across all critic accomodated by det Workload: Critical ta capacity (20% reserv
5	Optimizing	Time on Task: Time on task are predicted to exceed objective requirement for requisite manpower limitation (reference spec/manpower KPP).	Time on Task: Time requirement (requirement requisite manpower spec/manpower KPI
		Spatial Analysis: Spatial Analysis Link Tool (SALT) scores for preliminary design do not exceed for critical tasks. Human Reliability Rating: HRR score of greater than 96 % or better modelled/predicted for critical systems.	Spatial Analysis: Spa for critical tasks Human Reliability Racritical systems give
		Antropometrics: Greater than 98% of user population acoomodated across critical tasks; less than 2% (1 in 50) is not accomodated given preliminary system design.	Antropometrics: Gre accomodated across accomodated by des
4	Enhancement	Workload: Workload predicted to require less than 90% of user capacity for critical tasks (10% reserve capacity) given preliminary system design. Time on Task: Time on task predicted to meet objective requirements for requisite manpower mix (reference spec/manpower KPP) given preliminary system design.	Workload: Workload tasks (10% reserve of Time on Task: Time of requirements for re- KPP)
	Ē	Spatial Analysis: Spatial Analysis Link Tool (SALT) scores do not exceed for critical tasks, given preliminary system design. Human Reliaibility Rating: The Human Reliability rating of 96 percent	Spatial Analysis: Spa for critical task:
		(objective) Antropometrics: Greater than 95% of user population accomodated across critical tasks; 15% (roughly 1 in every 20 users) are not accomodated by design.	(objective) Antropometrics: Greacross critical tasks; accomodated by des

within HSI domain (e.g. Human Factors Engineering)



across HSI domains

(e.g. HFE, System Safety, Manpower)

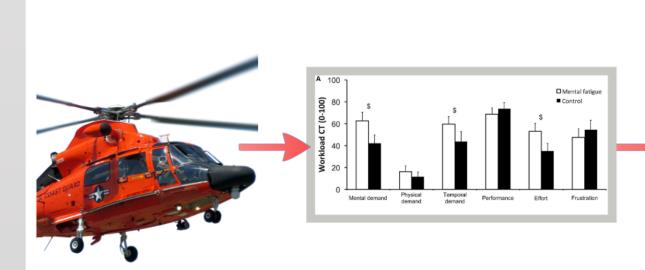
Step Four: Socialization



Awareness & Buy-in:

- ✓ Framework for understanding HSI
- Overview of HSI measures
- Range of acceptable performance

Step Five: Collection and Assessment



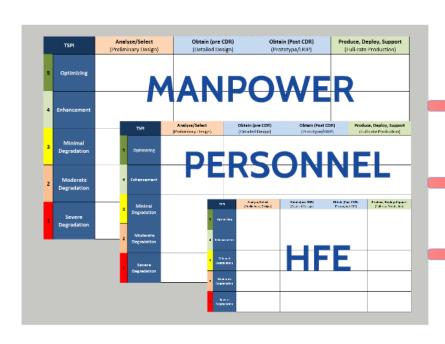
HSI performance

HSI performance data

orkload: Critical tasks are predicted to require less than 80% of user Workload: Critical ta apacity (20% reserve capacity) given preliminary system design. apacity (20% reserv ne on Task: Time on task are predicted to exceed objective equirement for requisite manpower limitation (reference equirement (requi equisite manpower pec/manpower KPI atial Analysis: Spatial Analysis Link Tool (SALT) scores for preliminary esign do not exceed ____ for critical tasks. patial Analysis: Spa man Reliability Rating: HRR score of greater than 96 % or better lelled/predicted for critical systems. ritical systems give metrics: Greater than 98% of user population accomodated comodated across preliminary system design. Workload: Workload predicted to require less than 90% of user capacity r critical tasks (10% reserve capacity) given preliminary system design. sks (10% reserve c or requisite manpower mix (reference spec/manpower KPP) given requirements for rereliminary system design. atial Analysis: Spatial Analysis Link Tool (SALT) scores do not exceed Spatial Analysis: Spa for critical tasks, given preliminary system design. for critical tasks uman Relaibility Rating: The Human Reliability rating of 96 percent objective) Antropometrics: Greater than 95% of user population accomodated cross critical tasks; 15% (roughly 1 in every 20 users) are not across critical tasks;

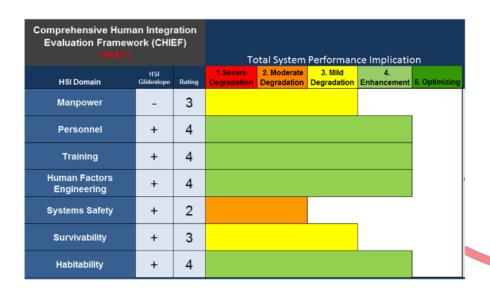
HSI domain rating

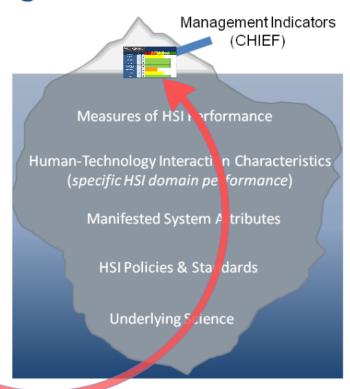
Step Six: Analysis





Step Seven: Briefing





what's next?

- thesis / initial concept (FY 14)
- conceptualize domain scales (FY 15)
- draft domain criteria & TSP scale
- calibration / TTX (FY16)
- brief to program (FY 16) beta test (FY 16) automation / software scaling



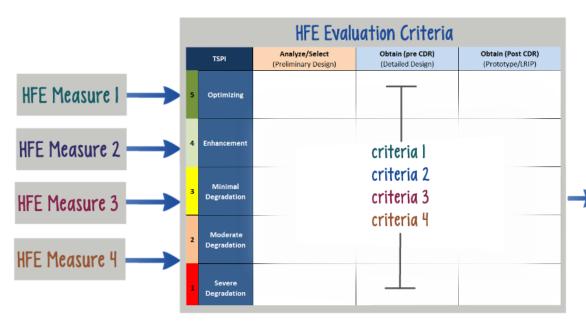
Contact: CDR Mike O'Neil

Human Performance Support & Training Team Lead Human Systems Integration Division (CG-1B3) U.S. Coast Guard Headquarters

Office: 202.475.5096

email: michael.p.o'neil@uscg.mil

web: www.uscg.mil/ff21/HSI/default.asp



	Comprehensive Human Integration Evaluation Framework (CHIEF)			Total System Performance Implication				
	HSI Domain	HSI Glideslope	Rating	1.Severe Degradation	2. Moderate Degradation	3. Mild	4.	
	Manpower	-	3					
	Personnel	+	4					
	Training	+	4					
	Human Factors Engineering	+	4					ľ
	Systems Safety	+	2					
	Survivability	+	3					
	Habitability	+	4					