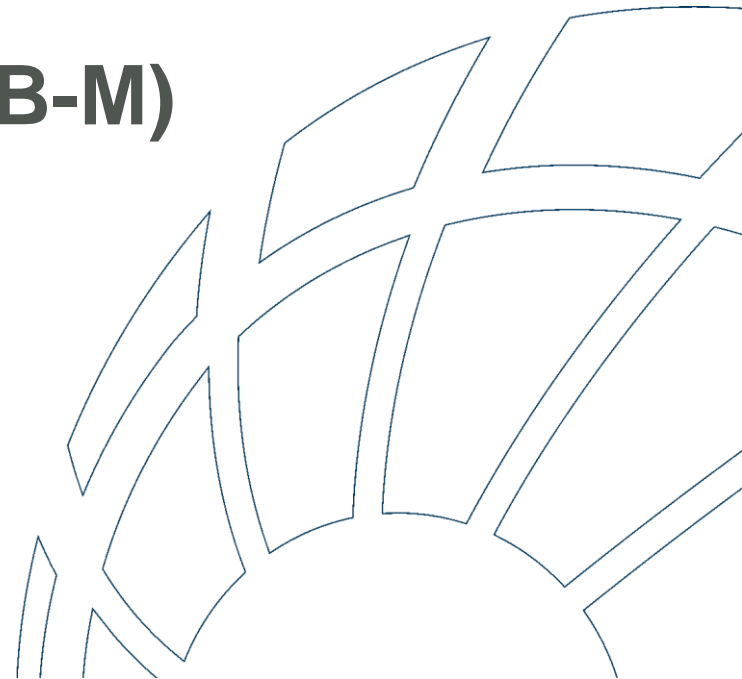


“Where will our knowledge take you?”

HFE Survey and Risk Assessment for Operational Test and Evaluation of the USCG Response Boat, Medium (RB-M)

**Christopher Parker
4 May 2010**



Agenda

1. Introduction
2. Methodology
3. Results
4. Recommendations
5. Conclusions



1. Introduction

USCG Response Boat, Medium

- Replacement for aging USCG 41' Utility Boat (UTB)
- Increased capability including speed and interoperability to meet new DHS requirements
- Acquisition began in 2005
- Little HFE during design, but opportunities for user feedback.
- OT&E Required HFE assessment

Response Boat – Medium (RB-M)



Characteristics:

- Length: 45 ft
- Displacement: 36,500 lbs
- Draft: 3' 4"
- Max Speed: 43+ knots
- Range: 260 nm
- Power: (2) Inboard Diesel
825 BHP each
Water Jet Drive
- Self-Righting
- Towing Cap.: 100 Tons
- 1st Delivery: Dec 2007



1. Introduction

Goals of HFE Assessment

- *The primary purpose of the Human Factors evaluation is to determine if the crews can safely and efficiently operate and maintain the RB-M without any short or long term impacts to the crew's health. (RB-M OT&E Plan)*
- Assess this in terms of test areas derived from the OT&E Plan that included:
 - **Crew Size and Capabilities, Crew Duties, Ergonomics, Shock Mitigation, Noise and Vibration, Lighting, Habitability, Climate Control and Environmental Issues**
- Validate more specific requirements from Operational Requirements Document (ORD)
 - **Not called out as HFE per se, but derived**
- * **Obtain the data necessary to make an informed assessment of whether the design of the RB-M provides the users with the tools and capabilities required to safely and efficiently conduct their tasks, and meet mission requirements.**

2. Methodology

Familiarization

- Review all RB-M acquisition documentation, particularly those with HFE implications
- 41' UTB: Understand the current asset to be replaced as a baseline in terms of:
 - Meeting HFE/ergonomic standards and best practices
 - Context and understanding of demonstrated required missions
- Two stage process
 - **Heuristic assessment:** Using ASTM F1166 and best practices, conduct HFE survey of the vessel.
 - **Usability assessment:** Observe required missions and evolutions to assess the asset's ability to meet the required tasks.



2. Methodology

Heuristic Review of 45' RB-M

- Primarily utilized ASTM F1166 as the standard for HF design criteria



2. Methodology

Usability Assessment of 45' RB-M





- Concurrent with Heuristic Reviews
- Observing crew members performing simulated and actual required missions or evolutions including:
 - **Man overboard**
 - **Towing**
 - **Boardings**
 - **Anchoring**
- Data collected included the tasks conducted, areas where design impeded performance, and interviews that followed.



2. Methodology

Data Reduction

- Compile the “opportunities for improvement” as well as the “accomplishments” into a matrix
- Included the observation with pictures, trace to requirements, standards, interest area

RB-M HFE DATA COLLECTION & RISK ASSESSMENT FORM													
Item	Issues and Observations	Location/Area	Picture	Accomplishments / Opportunities for Improvement	Requirement	Source	Standard / Best Practices	Critical Task	Test Area	Potential Human Performance Issue	Cause / Root Cause	Effects of Issue	Exist
42	When attempting to rig up test, the deck is made for the test is not easy.	Little Creek / RB-M		Opportunities for Improvement	The RB-M must be capable of testing other vessels. Tests will be conducted at both normal and emergency.	ORD Section C, Para 1.1 (D)	USNIB is not suitable for some criteria.	At sea/In test	Crew/Doctor	Difficulty in safely operating and maintaining the RBM. Difficulty to come along with in deck made.	The work of the deck to push the test may while attempting to come along with in deck made.	Difficulty and delay in securing tests at sea.	
43	For the COO field of view, there are slight obstructions including primarily the equipment and subsea equipment. Marine walk on rails are also a slight obstruction.	Little Creek / RB-M		Opportunities for Improvement	Does the RB-M allow for safe and efficient operations by its crew... This includes but not limited to layout of the RB-M or ergonomic of controls/critical line of sight....	ORD Section C, Para 4.1 (D)	ASTM 4.4.5.5 (1) visual, auditory, and other communication links between personnel, and between personnel and their equipment, under both normal and emergency conditions.	All capabilities	Crew/Doctor	Inability to see objects in water.	Obstructions including handrails, equipment, and railings.	Reduce visibility of objects around test and in part of test potentially leading to accidents.	Stand up support
44	Access to bilge is not adequate to properly clean and prevent bilge rot. Open areas of bilge blocked by equipment and equipment cannot get a hand through to clean the bilge that build up. Since the fuel tanks are on the centerline, there cannot be access in the forward center section of the main deck. Access needs to be provided.	New York / RB-M		Opportunities for Improvement	Does the RB-M allow for safe and efficient operations by its crew... This includes but not limited to layout of the RB-M or ergonomic of controls/critical line of sight....	ORD Section C, Para 4.1 (D)	ASTM 33.2.10 Design for accessibility to all systems, equipment, and components requiring maintenance, inspection, removal, and replacement.	Preventative maintenance	Crew/Doctor	Inability to thoroughly clean bilge.	Loss of access.	Inability to fully clean the bilge.	
45	Four for covering the well deck cover, railing, and other pieces of equipment contain plastic pieces that fall and break off easily requiring all interior pipe to be replaced within the first year of installation.	New York / RB-M		Opportunities for Improvement	Maintenance on Repair: Does the design and construction of the RB-M allow for it to be efficiently maintained and repaired?	ORD Section C, Para 4.1 (E)	ASTM 14.9 Ruggedness—Systems and equipment shall be sufficiently rugged to withstand handling during operation, maintenance, repair, and transport within the environmental limits specified. If there are conditions in the applicable hardware or system specification.	All capabilities	Engineer	Inability to secure track or gear on bilge pipe well deck plate, and hold the load secure.	Inadequate design for durability and repair.	Inability to secure items requiring repair.	

2. Methodology

Human Performance Risk Analysis

- Based on MIL-STD-882D
- A systematic application of risk analysis to the analysis of representative tasks and their associated issues

Likelihood Rating	Category	Likelihood of Occurrence
A	Extremely Likely	Likely to be experienced almost continuously
B	Likely	Likely to be experienced frequently
C	Occasional	Likely to occur sporadically
D	Unlikely	Unlikely, but can reasonably be expected to occur
E	Extremely Unlikely	Extremely unlikely but possible to occur

Impact Rating	Category	Impact
I	Catastrophic	Inability to execute the mission which leads to a catastrophic mission failure due to inadequate human performance; death or permanent total disability; program or technology initiative will not meet costs or performance goals due to HSI considerations
II	Critical	Mission and human performance are significantly compromised leading to inability to perform part or all of a mission, permanent partially disabling injury, injuries or occupational illness that may result in hospitalization of at least 3 people; program or technology initiative will experience difficulty meeting cost and performance goals due to HSI considerations
III	Marginal	Mission and human performance are difficult to accomplish leading to some risk to mission success; temporary disabling injury or occupational illness resulting in one or more lost workdays; program or technology initiative will experience minimal to no difficulty meeting cost and performance goals due to HSI considerations
IV	Negligible	Mission and human performance are degraded slightly but can be accomplished without any impact on mission success, minor injury or injury not resulting in a lost workday; program or technology initiative will experience no difficulty meeting cost and performance goals due to HSI considerations

2. Methodology

Human Performance Risk Analysis

- Likelihood and severity yield risk categories
- Provides a scale and categorization for the sponsor

		Impact Levels (S)			
		I Catastrophic	II Critical	III Marginal	IV Negligible
Probability of Occurrence	A – Extremely Likely	1 (High)	3 (High)	7 (Serious)	13 (Medium)
	B – Likely	2 (High)	5 (High)	9 (Serious)	16 (Medium)
	C – Occasional	4 (High)	6 (Serious)	11 (Medium)	18 (Low)
	D – Unlikely	8 (Serious)	10 (Medium)	14 (Medium)	19 (Low)
	E – Extremely Unlikely	12 (Medium)	15 (Medium)	17 (Medium)	20 (Low)

3. Results

Findings

- Many “accomplishments”, mostly revolving around
 - **Aspects of improved habitability**
 - **Boat layout**
 - **Both visual and physical access**
 - **Speed**
- Most HF issues “areas for improvement” included:
 - **COTS equipment not following HFE standards**
 - **Labeling**
 - **Informative alarms**
 - **Speed**
- Vast number of technologies used but with that comes trade-offs

3. Results

Human Performance Risk Assessment

- After the risk analysis utilizing SME's, only one "serious" risk: Speed

Human Factors Risk Category	Human Factors Risk Assessment Value	Total
High	1-5	1
Serious	6-9	9
Medium	10-17	18
Low	18-20	8
Total		35

4. Recommendations

Mitigation Strategy

- Design out the risk
- Design to minimize the likelihood of the risk
- Design to mitigate the consequences of the risk
- Provide warning of potential risk
- Train user to prevent risk
- Write procedures to prevent the risk from occurring

Recommendations

- Speed
 - Provide awareness through design and procedures
- Others:
 - COTS equipment that meets HFE requirements

5. Conclusions

Process

- Combination of heuristic review and usability assessment uncovered a spectrum of issues some significant, some minor.
- Human Performance Risk Assessment provided context and for the issues as well as prioritization for the customer to determine mitigation.

RB-M's Capability to Support the User

- Despite the areas for improvement identified, it was the opinion of the HFE team that the RB-M did in fact meet the needs of the user.
 - **Speed tradeoff**
 - **Technology tradeoff**
- There are multiple ECPs in process to address the issues identified.
- Contract awarded for 30 more boats, up to 250.



Questions/Discussion

Acknowledgements

Chris Kijora, Human Engineering Manager

USCG Human Systems Integration for Acquisitions Division (CG-1B3)

Dave Shepard, RB-M Program Manager

USCG Office of Boat Forces (CG-731)

Contact Information

Christopher Parker

BMT Designers and Planners, Inc.

202.277.8444

cparker@dandp.com

Confidentiality statement

This presentation and all associated material is the sole property of BMT Group. The receiving party shall not, directly or indirectly, as agent or principal, utilise the contents obtained from the presentation, or copy, distribute or re-use the material without the express permission of BMT.

