



Human Factors in the Aerospace and Defence Industry: Is there anything the offshore industry can learn?

30th November 2006

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Topics

- Background
- Similarities between aerospace and defence, and offshore
- The current situation
- Common HF techniques in aerospace and defence industry
- Lessons learned
- HMI carry-over
- Aerospace and defence standards
- What aerospace and defence industry can learn from offshore industry



My background

- M.Eng Systems Engineering
- Lockheed Martin and BAE Systems
- Five years working in design of fast jet and helicopter cockpits/cabins
- Two to three years as lead HMI designer on a helicopter programme
- Less than one year in offshore industry





Background to Merlin CSP

- Upgrade to the Merlin Mk.1 helicopter
 - 44 in use by Royal Navy
 - 4 crewmembers
 - Anti-submarine
- £750 million, 10 year contract
- Replacing old with new
- HMI *key* to the programme
 - Existing HMI has issues
 - New sensors = more data = potential for overload





Roles and responsibilities

- Design of HMI for:
 - HMI prototypes
 - Actual HMI
- Testing of HMI
- Creating HMI requirements
- Interfacing with:
 - System architect
 - Systems engineers
 - Software engineers
 - Hardware engineers
 - Other HF engineers
 - Customer, inc. SMEs



- HMI documentation
 - Philosophy
 - Style guide
 - Detailed definition



Similarities between offshore and aerospace

- Complex system of systems
- High reliability, safety critical
 - Responding to alarms in timely manner
 - Errors can lead to disaster
- Information-rich tasks
- Remote operation
- Non face-to-face communication
- Long periods spent at workstations
- Parallel tasks
 - Communication
 - Perception
 - Interpreting information
 - Controlling
- High competence operators



Driller's cabin vs. helicopter cockpit





HF in the offshore industry

- HF often not done for the right reasons:
 - PSA regulatory control *instead of* to increase efficiency, reduce error etc.
 - HF often seen as a 'tick in the box' task by project management
- HF work performed too late
- Need for HF growing as system becomes more complex





HF in the aerospace/defence industry

- HF in aerospace started in 1940s
- HF realised as being crucial in reducing accidents
- Customer driven
- HF work starts early in programme
- HF *integrated* into engineering process
- Systematic involvement of users



- BUT... Long way from being perfect



Offshore industry in near/medium future

- Offshore industry will develop more:
 - Remote operation
 - Distributed control
 - Networked systems
- Remote operation been performed by ATC, space exploration, military for decades
- Distributed control currently performed by ATC, military
- Networked systems employed by ATC, space exploration, military





Common techniques

- Close user involvement
- Continuous prototyping



User involvement

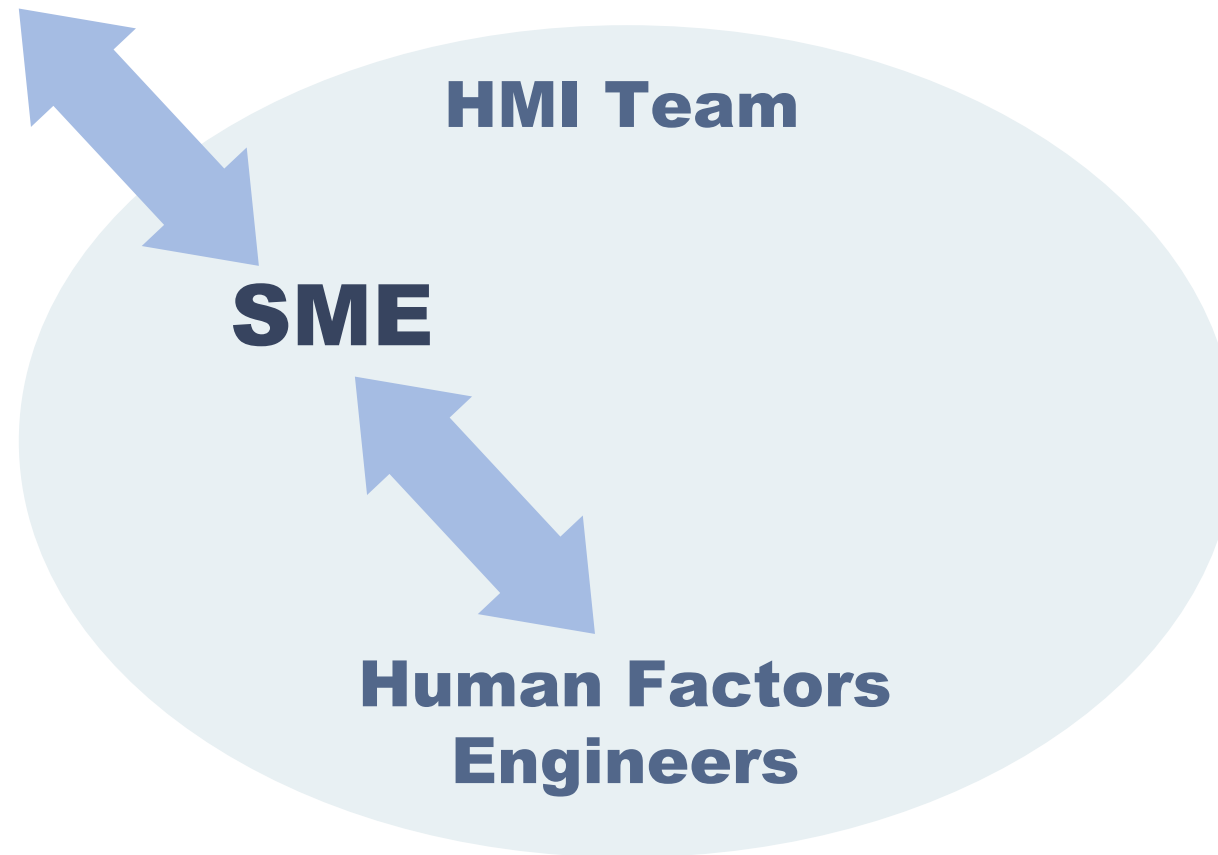
- Defined roles
- Embedded SME
 - Full-time
 - Part of HMI team
 - Interface between end-users and HMI developers
 - Long term contract
- Not a substitute for HF techniques
 - Should not do design
 - SME *supports* task analysis, control selection etc.





SME involvement

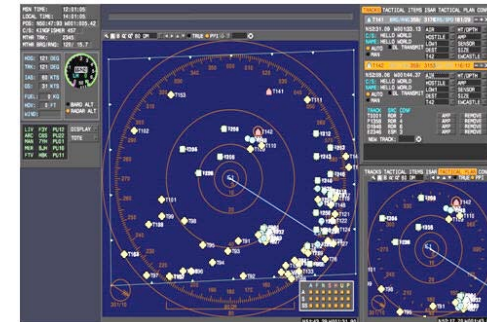
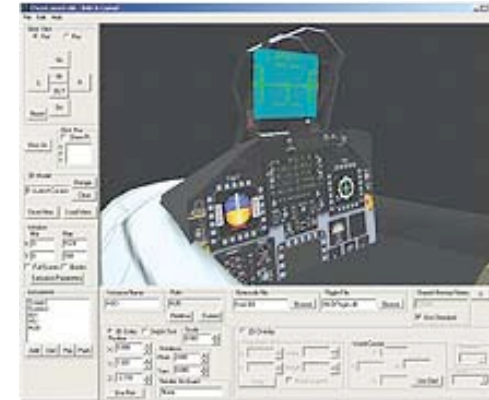
User community





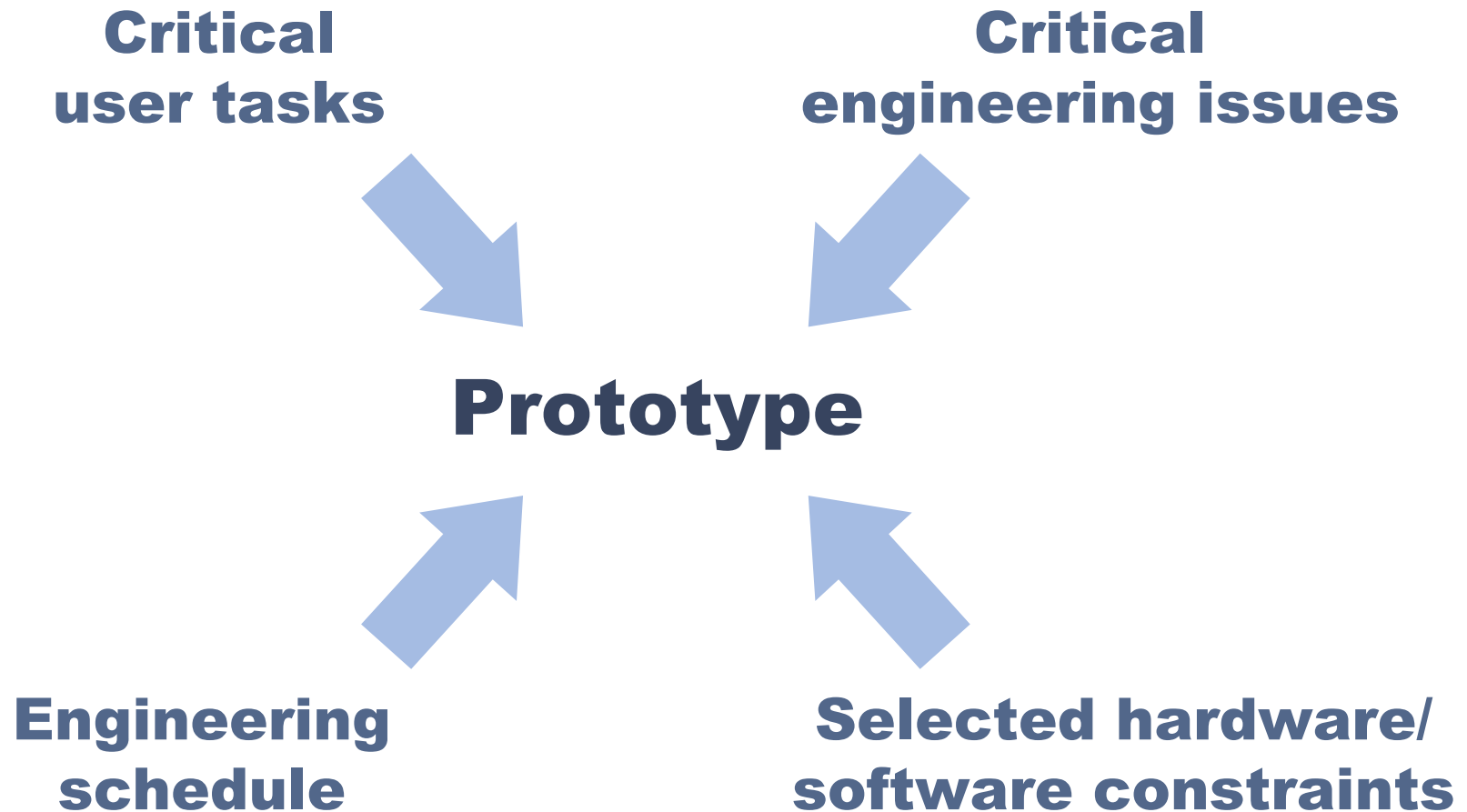
Prototyping

- Continuous, iterative
- Lo-fi: PowerPoint, Visio, Photoshop etc.
- Hi-fi: Java, VAPS, IData etc.
- User involvement:
 - “What are the ‘critical’ tasks?”
 - “What do you have to do during these tasks?”
 - Regular user reviews/tests
- Engineering involvement:
 - “What is possible, what is not?”
 - Programming





Prototype is not an island





Lessons learned 1

- Define SME role clearly and stick to it
 - Prevents SME from doing the design
 - Prevents disputes
- Work *very* closely with engineers
 - Smoother development of solutions
 - Develops trust and teamwork
 - Prevents engineers thinking we are just 'flower arrangers'
- Prevent 'feature creep'
 - Establish SLOC limit early and do not exceed it
- SMEs require reward
 - Provide enough to motivate them
- Keep consistent set of SMEs
 - SMEs are highly opinionated!
 - Reduces flux



Lessons learned 2

- Define detailed prototyping schedule *early on*
 - Complex prototype needs good foundations
- Let people know that design changes *will* happen!
 - Part of concept development
 - Necessary
- Engineers need to know the design solutions too
 - It's not 'them and us'
 - Regular updates necessary



HMI carry-over 1

- KISS - exaggerate the philosophy
 - Design for high stress, high workload - it will happen!

“It doesn’t matter how many times you click, as long as each click is a mindless, unambiguous choice.”

Steve Krug

“You know you have achieved perfection in design, not when you have nothing more to add, but when you have nothing left to take away.”

Antoine de Saint-Exupery



HMI carry-over 2 - HMI

- Shortcut to emergency displays
 - Only necessary information
 - Shortcut quickly accessible
- Touch screens
 - Very good when designed well
 - Task based
 - Frequent use controls
- Error prevention
 - Data entry
 - Feed forward (e.g. *nnnn*, 6000-6999)





HMI carry-over 3 - Cabins

- Adjustable seats
- Adequate temperature/air-conditioning adjustment
- Desk space
 - Manuals
 - Matpakke
 - Storage
- Importance of seeing other operator's displays
 - Distance
 - Viewing angle



Common standards and guidelines

- UK
 - Def-Stan 00-25, “Human Factors for Designers of Equipment”
- US
 - MIL-STD-1472, “Human Engineering”
 - MIL-HDBK-46855A, “Human Engineering Program Process and Procedures”
 - HF-STD-001, “The Human Factors Design Standard”



What aerospace/defence can learn from offshore

- Structured V&V
 - CRIOP equivalent is missing
 - CRIOP is excellent at identifying shortfalls in design
- Tough regulatory authority
 - Authority checks right work is being done, in right way
 - HFAM is useful for both customer and supplier



Conclusions

- HF in aerospace and defence industry long way from being ideal

But...

- Offshore industry *can* learn from it
 - Aerospace and defence has “been there, done that” (and benefited from it!)
 - No need to reinvent the wheel
- HF in offshore industry will improve *only if*:
 - All parties understand the need
 - Direction comes from the operating companies (not the PSA, nor the suppliers)