Mobile System Development: Amputation by Antenna (Almost)…

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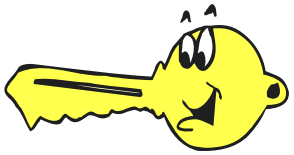
THE AEROSPACE CORPORATION

Agenda

- Introduction
- Mobile Ground Systems
  - Program Overview, Key Requirements
  - Case Study
    - Antenna Crush Zone

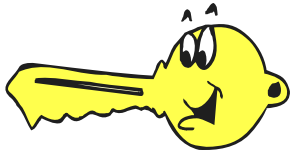


<u>Key:</u> If anything can go wrong, it will.

Acquisition Processes

- Getting more "bang for the buck" -

- Acquisition Reform
  - Competitive/parallel procurements
  - Abbreviated Statements of Work
  - Limitations on Standards
  - Contractor as Systems Engineer
  - Cost as an Independent Variable (CAIV)



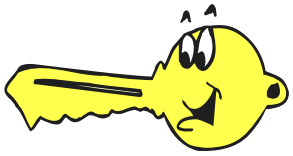
<u>Key:</u> There is never time to do it right, but always time to do it over.

<u>Key:</u> Cheaper, better, faster = rework, rework, rework

<u>Key</u>: Cheaper, better, faster = choose any 2 of the 3

Acquisition Reform: Challenges for Human Factors

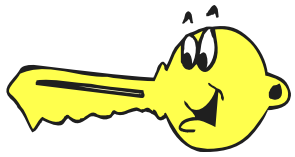
- Concerns
  - HSI not adequately specified as need or contractual requirement
  - Government oversight changed to “insight”
  - Contractor has TSPR (Total System Performance Responsibility)
  - “Design by discovery”
  - Lack of stable review team
  - Contractor has limited expertise in HSI.
  - HSI success often relies on enlightened individual(s) on design team



Key: ***Technology is dominated by those who manage what they do not understand.***

Program Overview

- System Design
  - Next generation Mobile Ground System
  - Maximize use of COTS and equipment from existing program
- Program Structure
  - Joint Product Office
  - Joint Prime Contractors
  - Multiple Key Subcontractors



<u>Key:</u> Success is defined by the customer, not by the architect/contractor

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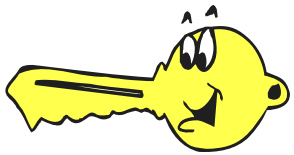
Requirements of Interest

- Total Crew Size = 12
- No piece of equipment requires more than 3 person lift/carry (requirement became a goal)
- Specified setup/teardown timeline must be met to accomplish mission requirements
- MIL-STD-810 imposed (environmental)
- Must present no significant safety hazards

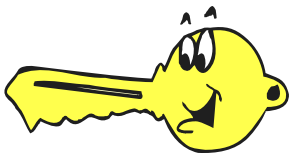


***Key:** No complex system can be optimum to all parties concerned. All parties do not have an equal vote.*

***Key:** It is easier to match a system to the human that supports it, than the reverse*

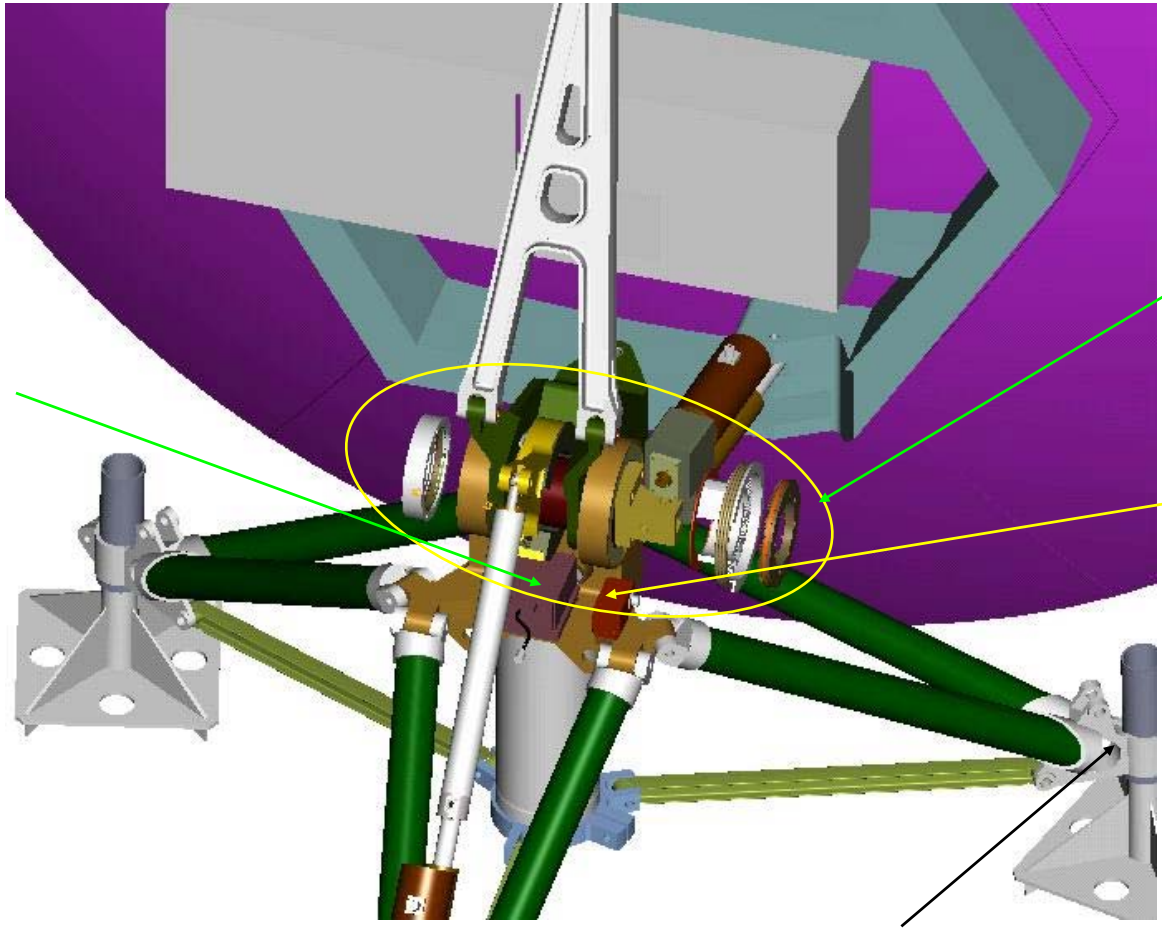
Human Factors Case Study

- Antenna Crush Zone



<u>Key:</u> The primary function of the design engineer is to make things difficult for the manufacturer and impossible for the operators

Pedestal/Positioner Preliminary Design Major Sub-Assembly Breakdown (Con't)



Rear view of the Pedestal Positioner

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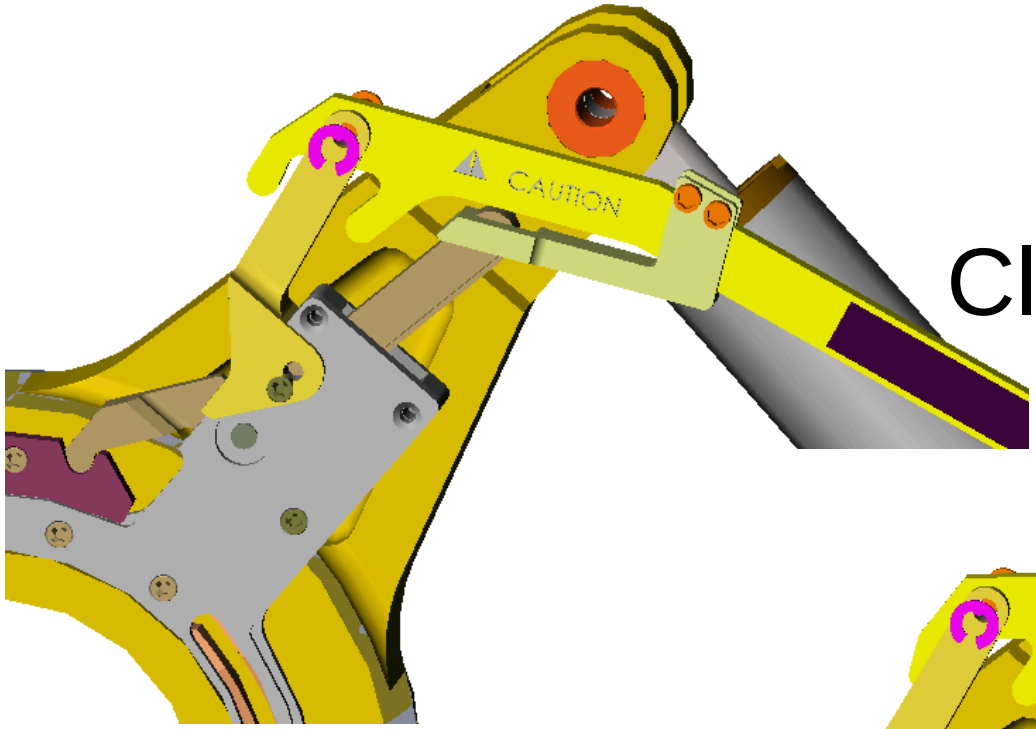
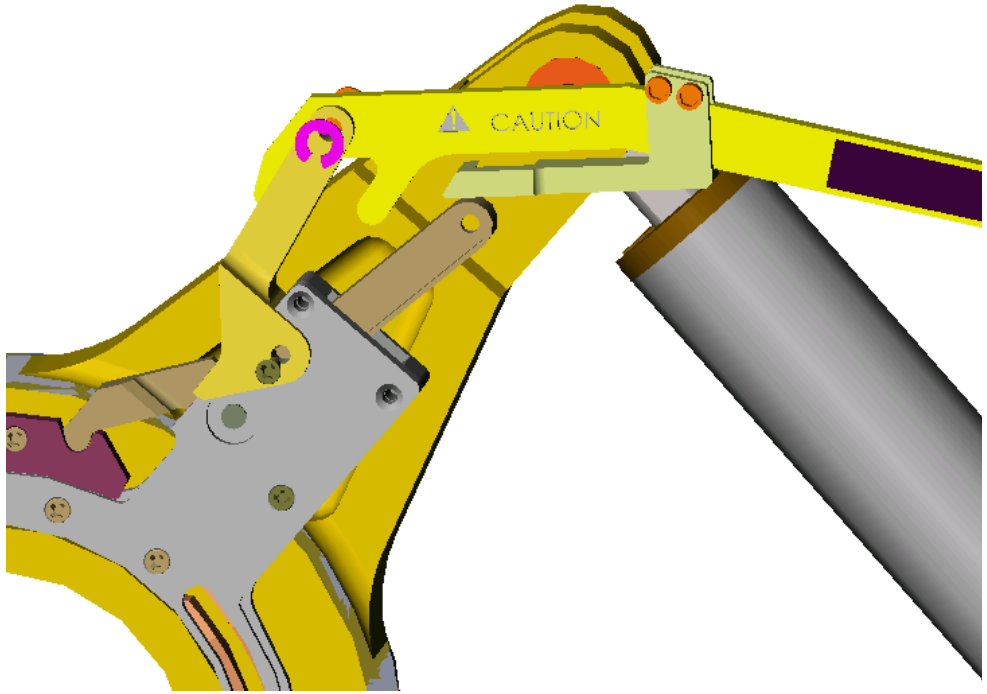
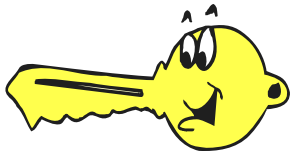
Proposed Clutch Mechanism

Second Modification of Clutch Mechanism





Lessons Learned - Clutch Assembly



***Key:** Experience is the hardest kind of teacher. It gives you the test first and the lesson afterward.*

***Key:** Pause and Reflect!*

***Key:** In correcting system deficiencies and failures, it is important that all the participants know not only what happened and how it happened but why as well*

***Key:** If you think you have a problem, the true magnitude of the problem is probably worse*

***Key:** Safety problems are often found by the "Design by Discovery" approach*

Some Final Thoughts

- Design Trades are an inevitable part of the design process
- Human Factors/Safety personnel must be involved in the design process from the beginning
- The operational implications of a design decision must be taken into account
- Saving a few dollars in design by ignoring safety/human factors will often result in significantly higher lifecycle costs (training, logistics) and degradation of system performance

References

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- Rechtin, Eberhardt and Maier, Mark W (1997). The Art of Systems Architecting. CRC Press, Boca Raton Florida.
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