The Human in the System:
Integrating the Human into the system
Integrating HSI Tools into Systems Engineering

Jennifer McGovern Narkevicius, PhD

Jenius LLC

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The entire world is built for human manipulation

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Systems Thinking

- Look at the needed outcome and solutions as a whole
- Look at a system as a dynamic and complex whole
- Have all the contributors participate in the design and implementation of the solution
- Bring *all* the required perspectives together

PROGRAMS

- Unprecedented number of high value, high visibility programs
- Increased attention to the part of humans in all programs
- Cross-program integration becoming significant issue

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What is HSI?

- HSI is a multi-disciplinary strategy for the design and life-cycle support of systems
  - Based on human-centric issues
  - Executed as a systems engineering activity
  - Requires unique mind-set to system design
- HSI is a concurrent engineering process
- Main concerns:
  - Maximize Total System Performance
  - Minimize Life Cycle Cost

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TOTAL SYSTEM ENGINEERING

Hardware

Probability of success

Software

Operational Availability

People

Readiness to perform

TOTAL SYSTEM PERFORMANCE

Measurable and Certifiable

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HSI Domain Considerations

Human Factors Engineering

Manpower, Personnel, & Training

Habitability & Personnel Survivability

Safety, Enviro & Occ Health

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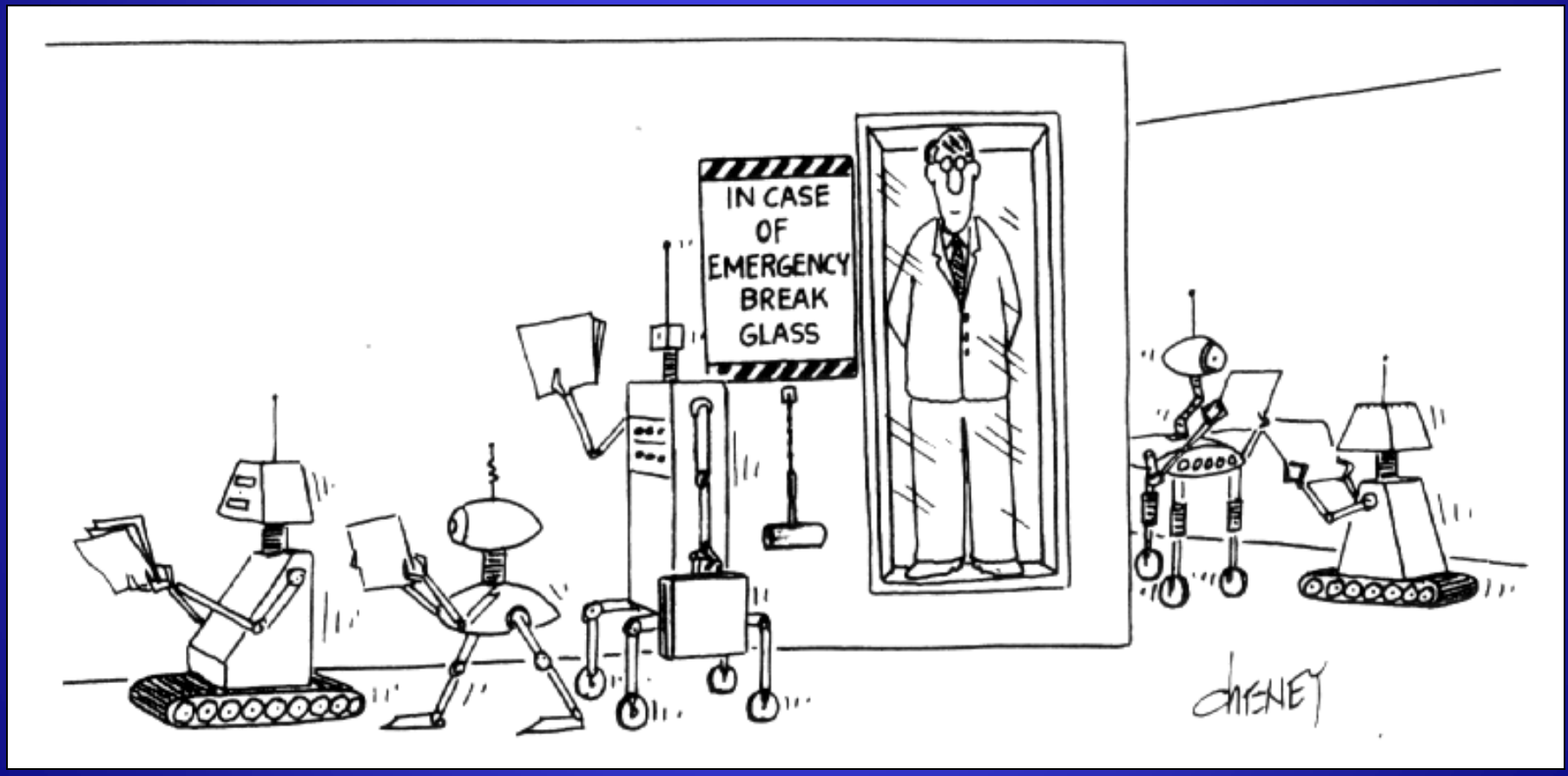
There is no such thing as an Unmanned System



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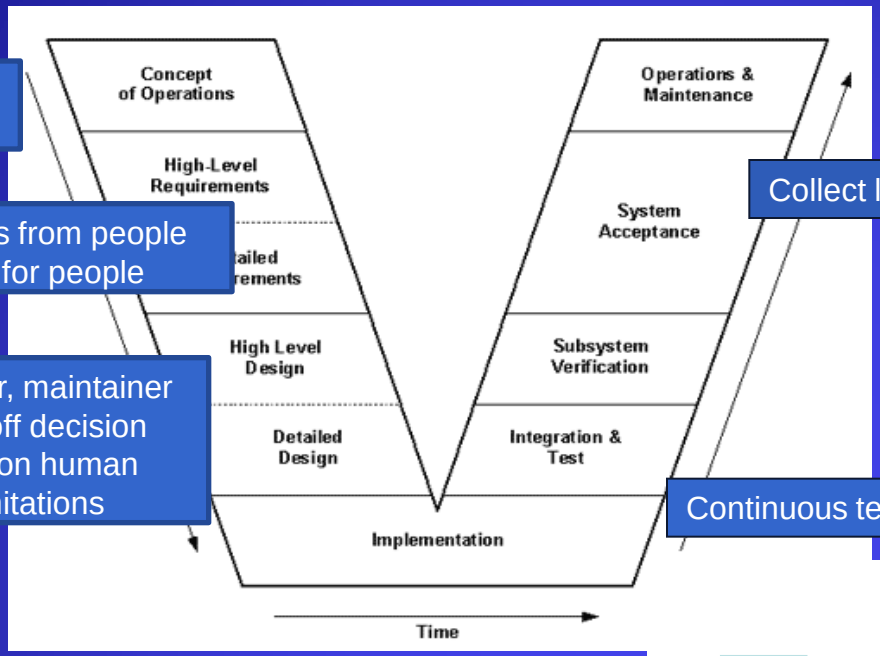
HSI in SE

Define user
Define user intent

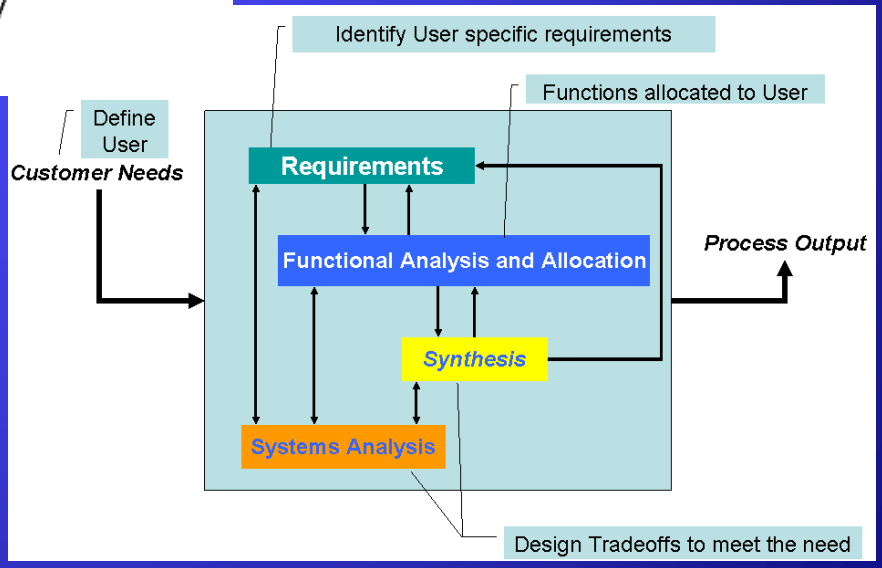
Define requirements from people
Define requirement for people

Design for operator, maintainer
Incorporate trade off decision information based on human capabilities and limitations



Collect lessons learned

Continuous test/validation



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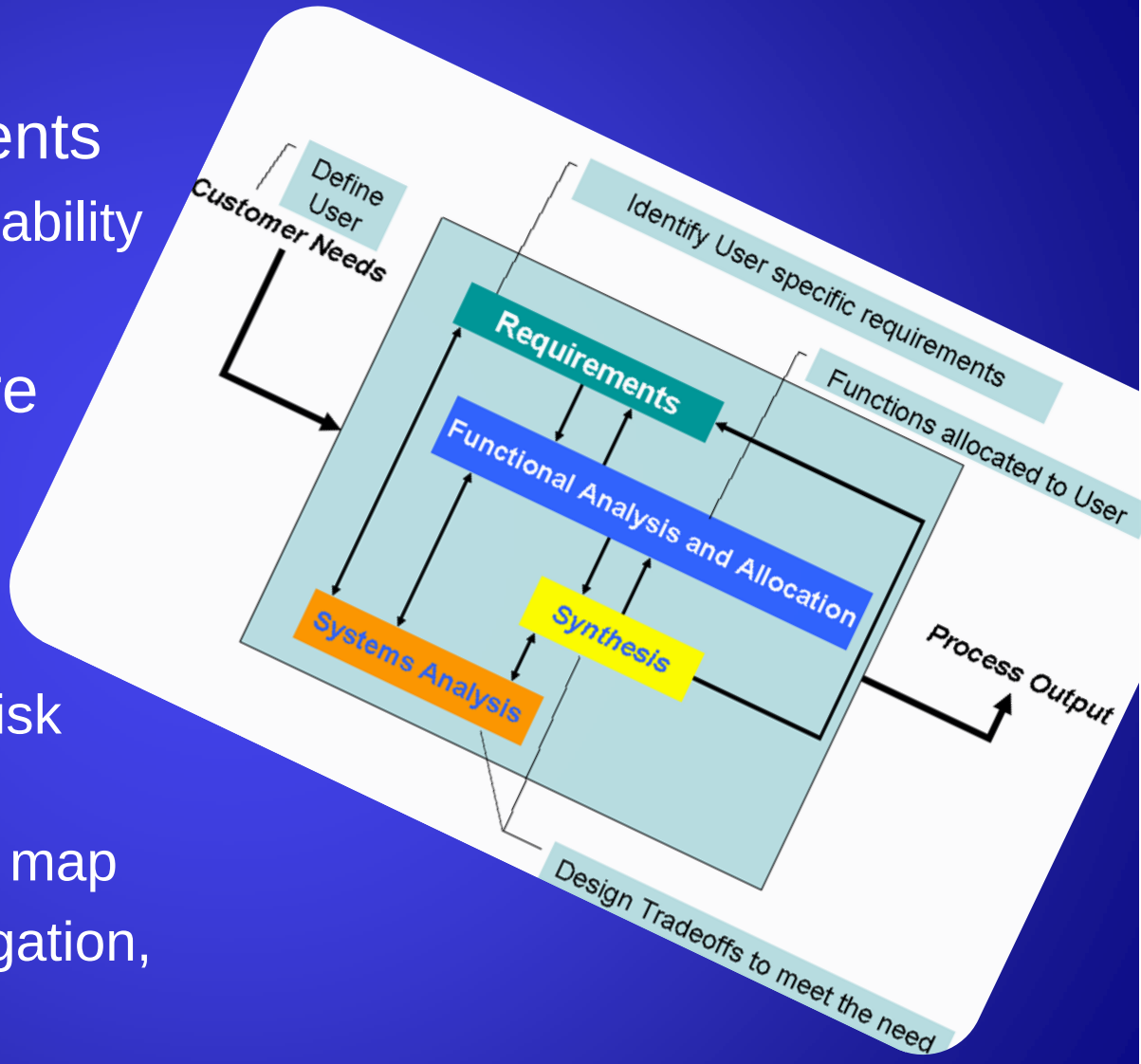
SE Tools

- Manage Requirements
  - Requirements traceability
- Maintain control of systems architecture definition
- Measurement
  - Decision Support/Risk bias mitigation
  - Roadmap/Progress map
  - Risk reduction, mitigation, tracking



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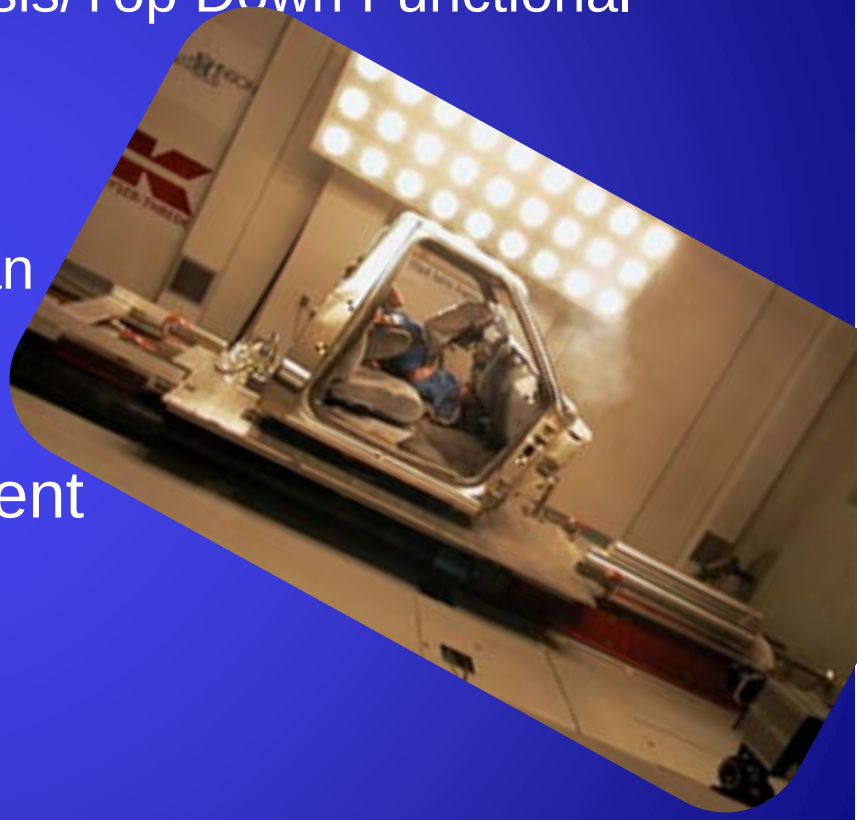
HSI Tools

- Requirements Definition
  - Top Down Requirements Analysis/Top Down Functional Analysis
  - Operation Decomposition
- Management/Planning
  - Human Systems Integration Plan
- Measurement
  - Domain Specific
- Design Definition and Refinement
  - Operational Sequence Diagram
  - Modeling tools
  - Prototyping and simulation
  - Usability Engineering Process



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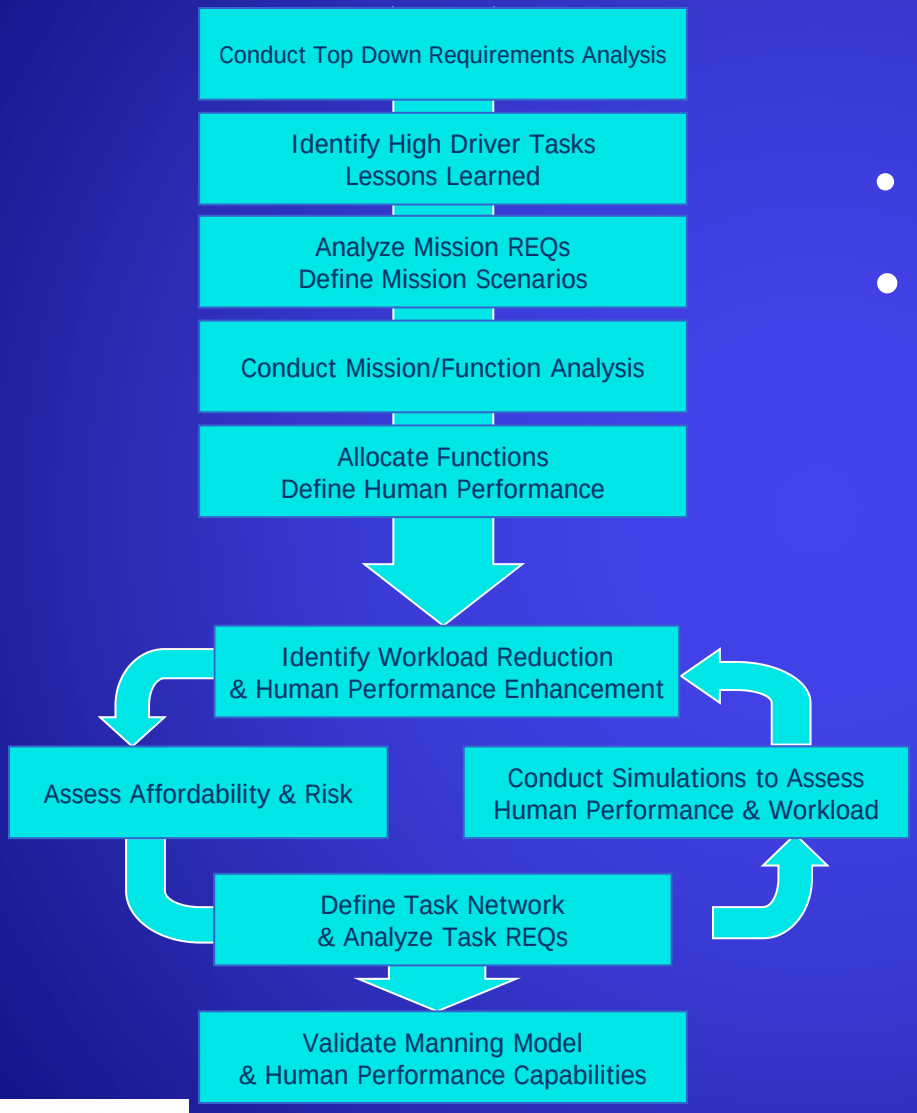
Top-Down Requirements Analysis



- Front-end of HSI Process
- Provides analyzed requirements, allocation concepts, workload estimates, human task models, system metrics, & manning models

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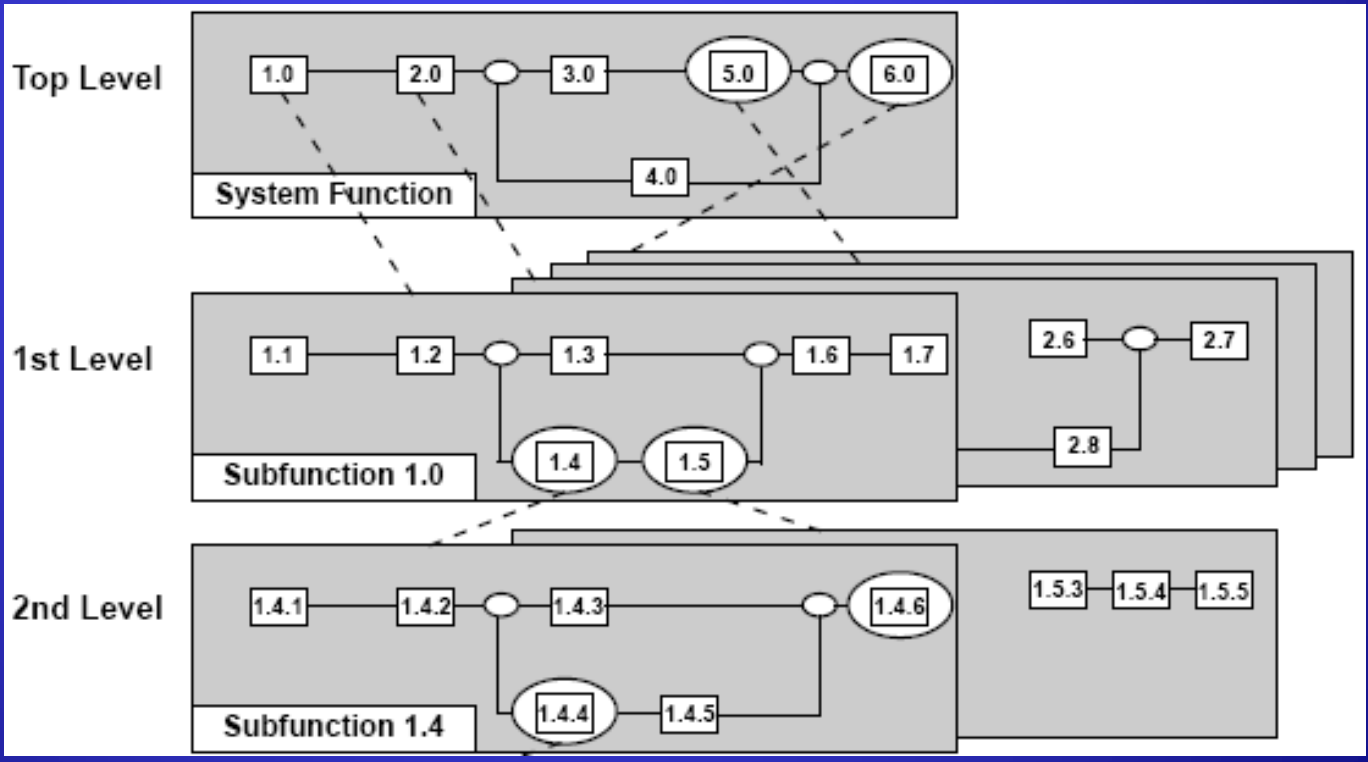
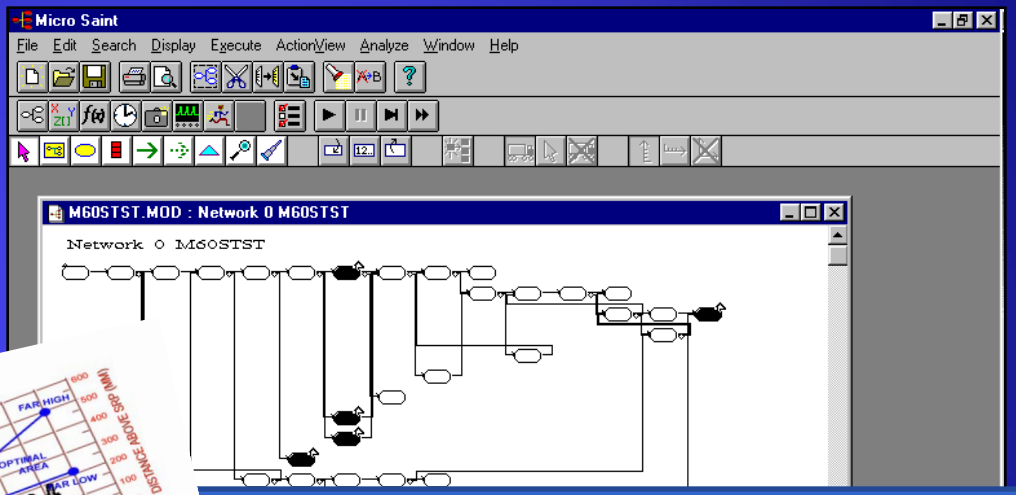
Functional Flow Block Diagram

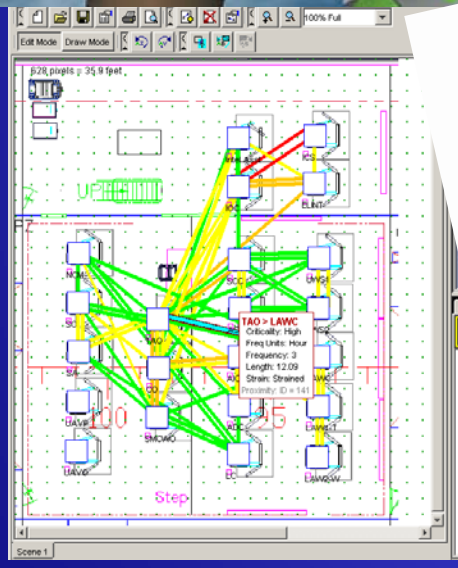
Functional decomposition

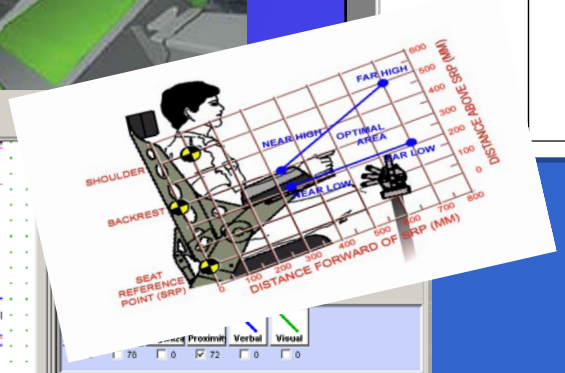
- Traceable to requirements
- Temporal sequences
- Links system level elements to design elements

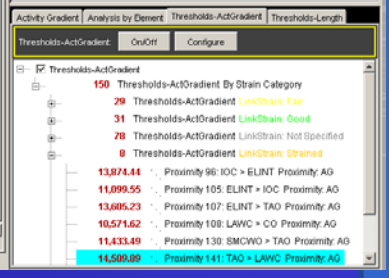


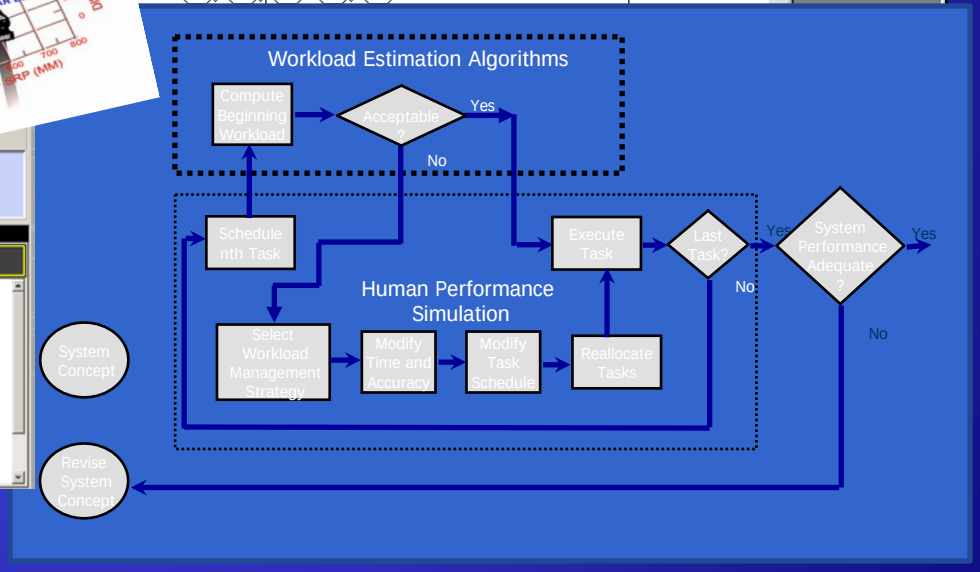
Modeling, Prototyping and Simulation











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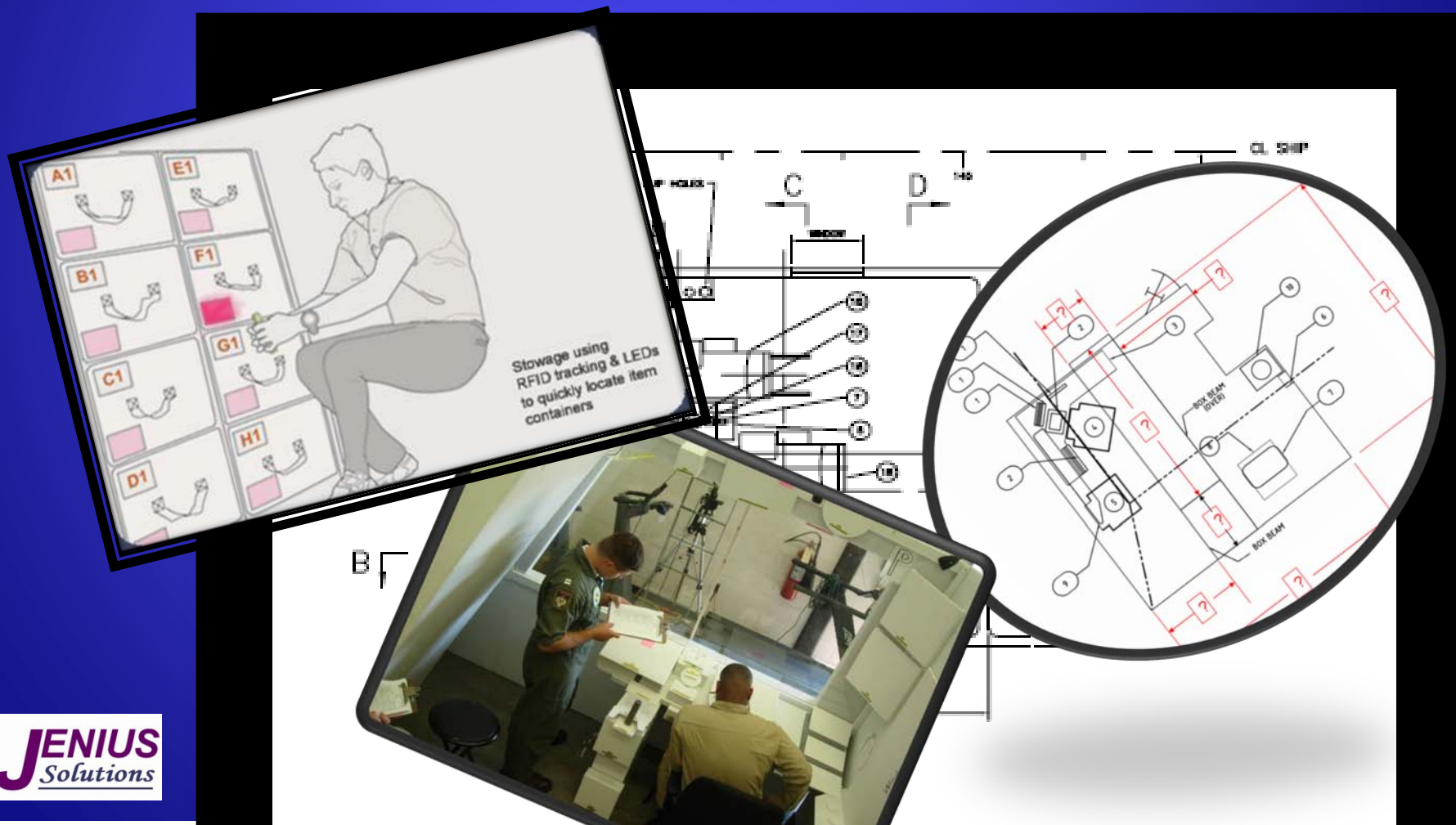
Mockups

Consider all of the design factors to assess the implications and suitability of the design trades made…Use structured, low-fidelity assessments with trained users to identify significant issues that should be addressed early



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Linkage between Tools

HSI TOOLS

- Requirements Definition
- Management/Planning
- Design Definition and Refinement
- Measurement

SE TOOLS

- Requirements Management
- Management Planning
- Maintain control
- Measurement

Challenges

- Linking tools together
  - Actually passing data between tools
  - Without losing functionality, information, clarity, “validity”
- Focusing on the really important stuff
  - Its not the tool
  - The tool is just a tool…it’s what you do with the output that matters
- Maintenance
  - It is not enough just to build a tool
  - Tools should both be maintained and be commercially viable
- Tools must be integrated
  - Across technical disciplines
  - Across questions of technical interest
  - Across phases of development