Active Fratricide Avoidance in Net-Centric C3 Systems

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Overview

• Combat ID and Fratricide Avoidance
• Net-centric C3 systems
• Automated aiding of fratricide avoidance
  – Active vs. passive automation
  – Change blindness
• Considerations for the use of automation
  – Situation awareness
  – Mental work load and work flow
  – Decision making
  – User confidence
  – Adaptable automation
  – Automation control trade-offs
• Recommendations for using automation in fratricide avoidance
• Conclusion
Combat ID & Fratricide Avoidance

- Fratricide avoidance is a major goal of combat ID
- Fratricide does more damage than enemy action
  - A “surprise attack” that comes from an unexpected quarter
  - Morale and trust affected
  - Soldiers reluctant to fire until identity is double and triple checked
- Fratricide cannot be prevented entirely; goal is to reduce probability of occurrence
- Many computers and other automated systems on the battlefield
  - Net-centric C3 systems, for example
- Automated alerting systems to aid in fratricide avoidance are a possibility
Net-Centric C3 Systems

- Computerized C3 workstations linked via network
- Network similar to the Internet
- Distribute maps, graphics, orders and similar C3 data
- Shares data vertically (higher/lower echelons)
- And horizontally (across units)
- Often found in both command centers and many vehicles
Automated Aiding of Fratricide Avoidance

- Automated aid would fuse data to aid in decision making
- Correlated data from network and own vehicle
- Would direct user’s attention to potential fratricide situations
Active vs. Passive Automation

- Passive – displays information to user
- Active – involves user (requires user to take additional actions)

"*TARGET IS FRIENDLY*
VERIFY FIRE COMMAND"
“Change Blindness”

- People sometimes miss changes in computer displays
- Durlach & Chen (2003) call this “change blindness”
- More noticeable:
  - Dynamic (blinking, moving) icons
  - Icons which change color
- Less noticeable:
  - Static icons
  - Icons that change shape only
  - Icons near periphery
Considerations for the use of Automation in Fratricide Avoidance

• Automated aid would have same advantages and disadvantages as other forms of automation
  – Situation awareness
  – Mental workload/work flow
  – How automation affects decision making
  – Automation reliability and user confidence
  – Adaptable automation
  – Automation control trade-offs
Automation’s Affect on Situation Awareness

- Situation awareness (Endsley)
  - Perception of elements in the environment
  - Comprehension of their meaning
  - Projection of their status
- Automation can help direct user’s attention to important information
- Can decrease mental workload
- But may also become distracting
Mental Workload and Work Flow

- Automation can reduce mental workload
- However, under certain conditions, automation can be intrusive and interrupt work flow
  - High workload
  - High stress
  - Changing priorities
How Automation Affects Decision Making

• Automation sometimes aids decision making, but sometimes hinders
• When people presented with decisions by automated aids, they rarely question them
User Confidence Continuum

Distrust → Over-reliance
Automation Failure and Failure Recovery

- Systems will fail
- System failure is often not considered in design/training
- User is often surprised
- Difficulty in reverting to manual control
  - User “out-of-the-loop”
- User must decide to either:
  - Try to fix automation
  - Revert to manual control
Adaptable Automation

- Automation used for fratricide avoidance would have to adapt to the user
- Environments and situations change
- Automation should change with changing environments, tasks
Automation Control Trade-Offs

- Automation should reduce user workload
- However, human must retain control
  - Human has final responsibility
- The more the automation controls, the more the human needs to monitor what the automation is doing
- Automation’s actions must be visible

Automation control hierarchy (Billings, 1997):
- Autonomous operation
- Management by exception
- Management by consent
- Management by delegation
- Shared control
- Assisted manual control
- Direct manual control
Recommendations

• Active vs. passive automation
  – “Passive” provides information to user
  – “Active” involves user

• Active mode more appropriate for fratricide avoidance
  – In most cases

• However, ensure active automation does not
  – Reduce situation awareness
  – Increase mental workload
  – Interrupt work flow

• Automation’s usability should be verified
Summary

• Automated aids can help users avoid fratricide
• Same advantages and disadvantages as other forms of automation
• Many factors require consideration
Questions?