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Problem. Solved.

Net Centric Training for Legacy Aircraft

Sly Knight

Georgia Tech Research Institute - Electronic Systems Laboratory

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Virtual Training

- Creates a realistic threat environment in conjunction with or without an open-air range
- Software stimulates on-board systems
  - Based on real threat models
  - Activates when aircraft is in range
  - Helps test operational interfaces among federated systems
- Mission planning currently done pre-flight
  - Not always configurable in flight
  - Each aircraft gets the same experience

Net Centric Aircraft Training Capabilities

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Team Oriented Training with Smart Pseudo-Threats

Remotely Commanded Training

More Realistic Air-to-Air Training

*Images from http://www.defencetalk.com

Requirements

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Capable Mission Computer

- Direct Onboard Systems to Simulate Real Threats in the Cockpit
- Sufficient Control and Resources to Accomplish the Task

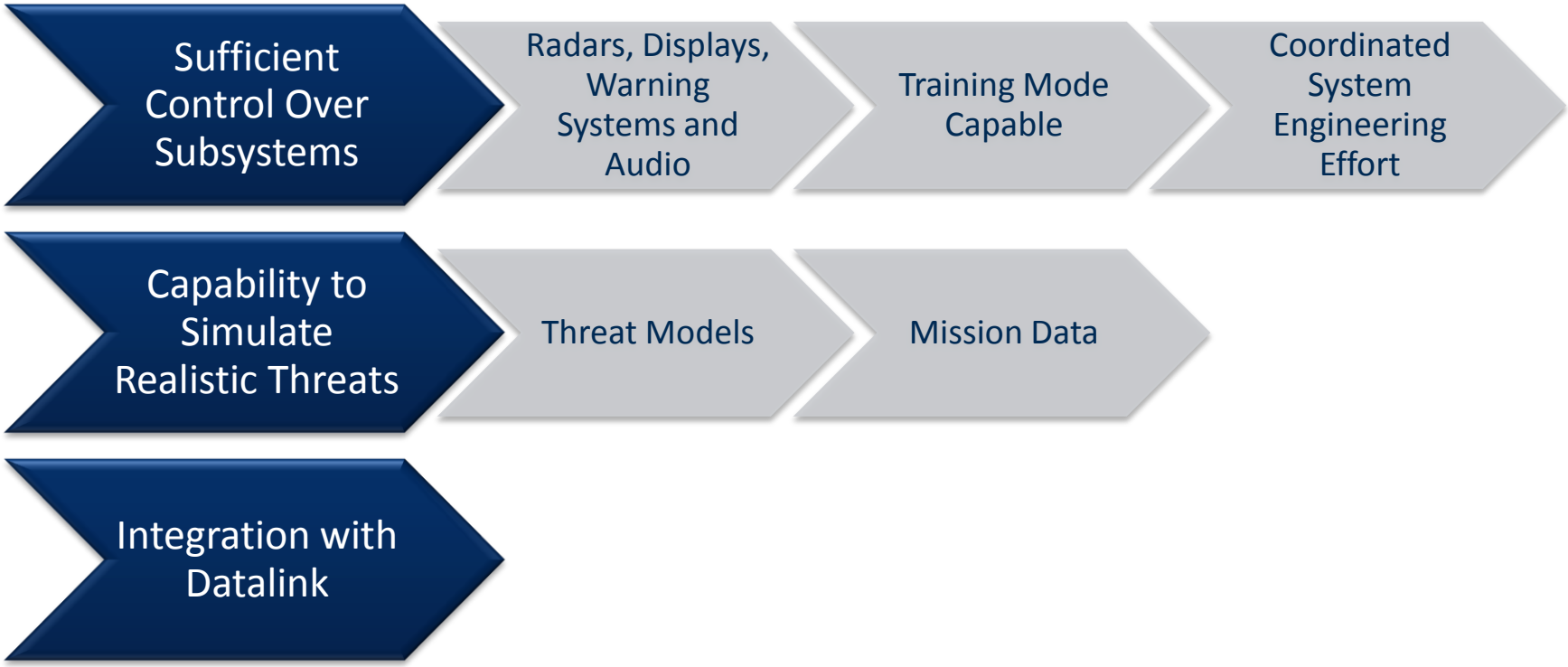
Datalink

- Sufficient Bandwidth for an Additional Message

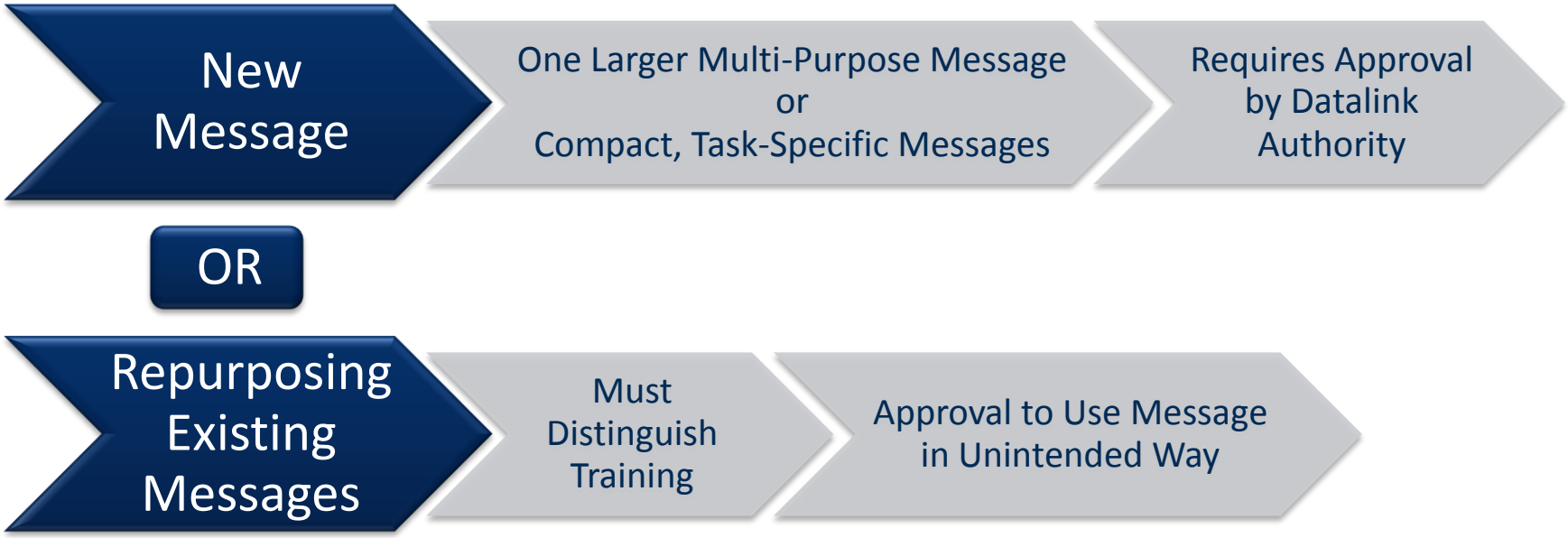
OR

- Messages that can be Repurposed

Mission Computer



Datalink Message



Possibilities

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Team Oriented Training with Smart Pseudo-Threats

Remote Command of Training Scenarios from Ground or Air

Simulated “Red Guy” Air-to-Air Training

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Team Oriented Training

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Team Oriented Training

- Pseudo-threats seemingly coordinate random attacks via datalink communication
  - Smart pseudo-threats
  - Realistic targeting
- Countermeasures reactions
- Susceptible to counter attacks

*Georgia Tech Research Institute published a paper on this concept and presented it at I/ITSEC in 2005. It is titled “Virtual Electronic Combat Training System (VECTS).”

Team Oriented Training

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Message Considerations

- Pre-planned mission
- Randomized engagements
- Engagement status
- On-board threat modeling

System Engineering Hurdles

- Syncing each aircraft's mission computer
- Message bandwidth

Making Pseudo-Threats Aware

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EXAMPLE IMPLEMENTATION

Requirement

- Random pseudo-threat engagement of one aircraft in range

Solution

- Get aircraft to agree on a random starting number
- Use this number to feed a program that controls the training scenario
- Program feeds number into pseudo-random number generator recursively to generate tables of engagement priorities
- Aircraft constantly report engagement status for each threat
- Resynchronize starting number and restart scenario as needed

Remote Command

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Team Oriented Training with Smart Pseudo-Threats

Remote Command of Training Scenarios from Ground or Air

Simulated “Red Guy” Air-to-Air Training

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Remote Command

- Ground station engages aircraft with pseudo-threats
  - Live, virtual, constructive (LVC) threat simulations
  - Real-time feedback
  - Facilitates drills
  - Relevant combat briefing tool
- Ground station runs models and countermeasures analysis
  - Higher processing power = high fidelity end-game models
  - Less processing required by aircraft systems
  - No pre-planned mission loading required

*Georgia Tech Research Institute and Air Force Research Laboratory published a paper on this concept and presented it at I/ITSEC in 2007. It is titled “Networked Electronic Warfare Training System (NEWTS).”

Remote Command

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Message Considerations

- Detailed threat status
  - Radar modes, operating parametrics
  - Raw data or lookup tables
- Countermeasures timing, accounting for latency

System Engineering Hurdles

- Ground station threat modeling
- Intuitive command software
- Computer to aircraft datalink interface

Remote Command

- Determine the information that will be passed
  - Develop a system level plan based on project requirements
  - Document the details of the datalink message and storyboard use cases
- Development of the command software
  - School the developers on the end use of their product
  - Review the interface from an end user perspective throughout the project
  - Bring in real users to test the software's usability

Air-to-Air Training

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Team Oriented Training with Smart Pseudo-Threats

Remote Command of Training Scenarios from Ground or Air

Simulated “Red Guy” Air-to-Air Training

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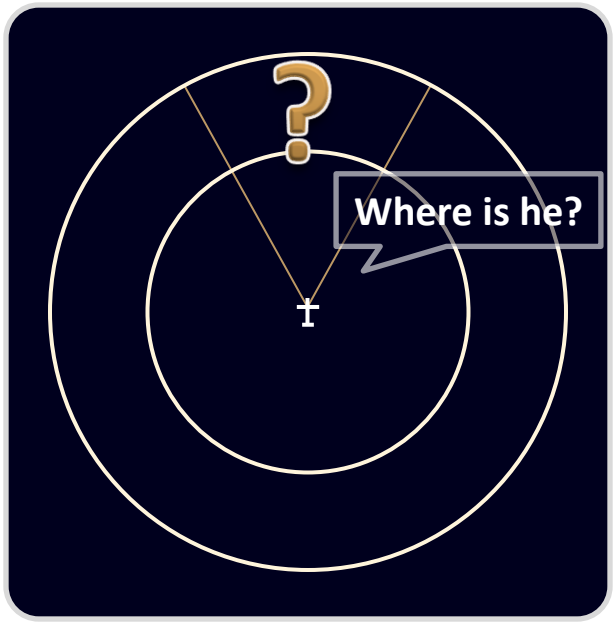
Air-to-Air Training

- Assign squadron pilots to be the enemy
- Convert friendly radar signals to real aggressor radars
- Hide friendly datalink tracks that “red” aircraft would not send
- Simulate weapon effectiveness
  - Calculate missile kills
  - Track gun damage
- Keep score



Air-to-Air Training

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Message Considerations

- Initial team assignment
- Weapon damage
- Countermeasures timing, accounting for latency

System Engineering Hurdles

- Provide safe training environment
- Powerful interface with displays
- On-board end-game analysis

Air-to-Air Training

- Coordination of mission computer developers and display controller developers
  - Maintain a clear description of how the system will perform
  - Make this description accessible to both parties
  - Communicate regularly
- Maintain safety of flight requirements
  - Coordinate with pilots and flight test personnel to ensure system will not pose any flight dangers
  - Build in training mode awareness that does not interfere with the purpose of the training

Summary

- Given the following
  - Mission computer in control of the EW and display systems
  - Datalink connection (Air-to-Air and/or Air-to-Ground)
- These are possible
  - More realistic dog-fight training
  - LVC training orchestration from a command center
  - Pseudo-threats that realistically target aircraft selectively and respond to countermeasures

Thank you

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Questions?

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