



# AUTONOMOUS & COGNITIVE SYSTEMS



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Session Chair

# Autonomous & Cognitive Systems Wrap-Up

- Towards a UAS Capability Description Framework: Analysis of Reactive, Adaptive & Cognitive Capabilities in Robotics
- Dr. Castillo-Effen:
  - System Capabilities Technical Reference Model
    - That is Reactive (control = observe & act), Adaptive (perceive & decide), and Cognitive (plan & learn)
    - Use to resolve conflicts & facilitate decision making in UAS (air & ground)
    - Use to formulate key questions for T&E
    - Use to enhance virtual environment for testing cognitive systems

# Autonomous & Cognitive Systems Wrap-Up

- On Detecting Individual Aberrant Behavior in Simulation and Test of Unmanned Autonomous Weapon Group Maneuvers
- Mr. Rick Dove:
  - Complexity & connectivity of systems has increased likelihood & frequency of unexpected occurrences
  - Agile systems can change easily, rapidly, effectively and significantly in a self-organizing manner
    - Such systems are “selfish” by nature
    - Such systems are too complex to test beyond minimal functionality
    - From human social behavior, we surmise that these systems will eventually exhibit unintended “lethal” consequences
  - Who’s fault is the above, and how do we “instill these systems with ethics”
  - We must test for what could, but cannot be allowed to happen by detecting emergent aberrant behavior

# Autonomous & Cognitive Systems Wrap-Up

- On Adding a Fourth “Artificial” Simulation Environment Category to the LVC Environment
- Mr. Arthur Brooks:
  - Fourth ‘artificial’ environment encompassing virtual with a real system with simulated operator
  - A reconfigurable architecture of concepts and capabilities for such an environment has six characteristics;
    - Flexibility, Intelligence, Cognizance, Collaboration, Autonomy, and Artificiality

# Autonomous & Cognitive Systems Wrap-Up

- Weather Routing Tool for Unmanned Aircraft Systems
- Mr. Terry Jameson:
  - Aviation Weather Routing Tool
    - Rules-based and physics-based prediction methods through-out mission area
    - Gridded weather forecast in 4D
    - System operational thresholds
    - Weather effects & risk grid
    - Route optimization scheme to determine lowest weather risk route
  - T&E applications @ WSMR and YPG – weather prediction and graphical route display

# Autonomous & Cognitive Systems Wrap-Up

- Netcentric Systems Test Tools Supporting LVC Environments
- Mr. Rob Heilman:
  - Concepts of Network Centric Warfare
    - Wars are won by Best: Force & Leadership, SA, Technology
    - Must test the above elements
  - Net-Centric LVC environment, tools, and investments
    - Re-create operational battlespace in a test environment
    - Must Build, Manage, Measure
  - Challenges for M&S support of autonomous & cognitive system testing
    - Standards, Focus expertise & federate, VV&A of SoS, Baseline characteristics of Joint Mission Threads

# Autonomous & Cognitive Systems Wrap-Up

- Extensive and Very Different Missions and Environments
- Unique and Miniature Instrumentation
- Operator Overload
- Range Safety Concerns
- Artificial Intelligence
  - Adaptive System Testing
  - Operator Interface
  - Structured System – Structured Test

**Less Smart (Operatorless) Systems That Dictate  
Smarter Testing**