Tailorable Remote / Unmanned Combat Craft (TRUCC)
Systems Engineering Analysis Cohort 18B
Tailorable Remote / Unmanned Combat Craft (TRUCC)

SEA-18B Capstone Project
CRUSER Brief
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• Provide front-end systems engineering analysis of the future of USVs
  – Outside current programmatic lifecycles
  – Influence future roadmap towards interoperable force structure
    • Manned / unmanned integration
    • Efficiency
    • Combat effectiveness
    • Risk mitigation
    • Joint interoperability
Project Goals

• Develop operational concept(s) for USV
  – Identify key design factors
  – Utilize modular sensors / weapons / comms
    • Leverage future technology upgrades
  – Maximize mission flexibility

• Context of analysis
  – High level strategy
  – Fiscal realities
  – Existing force structure / POM commitments
• Sort missions by high-level function
  – **Find unknowns** (mine warfare, counter piracy, ISR)
  – **Protect knowns** (ATFP, straits transit / convoy escort)
  – **Logistics**
    • Efficient ocean-going logistics already in place
  – **Offensive operations**
    • Air / Ground forces primary offensive vectors
Design Reference Mission

• TRUCCS escort HVUs through Straits of Hormuz
  – USVs refuel / refit in Jebel Ali
• Threat swarms
  – FAC / FIAC
  – Low Slow Fliers
  – ASCM
• “Dumb”; will head straight for HVU
• “Smart”; will maneuver around TRUCCS to get to HVU
• Model-Based Systems Engineering process

• Three modeling groups:
  – Mission Effectiveness
    • Model threat / weapon
  – Mission Vehicle
    • Relate sensor / weapon performance to physical element
    • Regress historical systems for simple future system characteristics (weight, Pk, etc)
  – Operational Availability
    • Project failure rates / maintenance availability
• Map Aware Non-uniform Automata (MANA) modeling software
• Produced by New Zealand’s Defence Technology Agency
  – Alternative to other combat models (CAEn, JANUS, etc)
  – Models Complex Adaptive Systems
  – Operated under NPS license
• MOP: Probability of HVU survival
• Fractional factorial modeling runs / stochastic results
Modeling Plan

• Fully model major threat scenarios
  – FAC / FIAC
  – LSF
  – ASCM

• Integrate three modeling groups for output:
  – Number of ships with baseline capability to defeat given threat
    • 20 x TRUCCS w/ speed XX, endurance YY capable of carry sensor / weapon payload ZZ will be able to counter 150 ASCM with capabilities as given in DRM...
    • 35 x TRUCCS w/ speed XX’, endurance YY’... can accomplish the same level of protection with an alternative physical architecture
• Add modeling complexity:
  – Threat systems attack defenders, not just HVU
  – Model impact of decoys (Advanced Offboard Decoy as reference system)
  – Shouldering tactics (i.e. can TRUCCS use non-kinetic tactics to prevent FAC/FIAC from closing on HVU)
  – Time delays / latency impact modeling (i.e. if man-in-the-loop causes time delays in weapons release authorization, what is the impact?)
• Identify physical TRUCC architecture(s) required to accomplish anti-swarm mission
  – Payload capacity for required weapons / sensors
  – Speed
  – Duration
• Identify sensitivities
• Investigate USV roadmap
  – Identify key technologies to enable TRUCC mission
    • Autonomy / processing speeds / communications
  – Policies
    • Man-in-loop time delay implications
    • Weapons release authorization
• Program Manager:
  – LCDR Loren Jacobi
  – ljacobi@nps.edu
• Lead Systems Engineer:
  – LT Adam Bush
  – arbush@nps.edu
Questions?