Supervised Autonomy: A Few Thoughts

Agile Autonomous Flight

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Why Autonomy?

Operation in Close Proximity to Terrain, Structures

Fundamental issues:
- How to find and prosecute targets in hostile, obstacle cluttered environments
- What are appropriate roles for human operators? For aerial robots?
Tactical UAVs

- Large optics, high-quality sensors
- Altitude mitigates threats
- Relatively large timescales
- Centralized, hierarchical control
- Separate task assignment and trajectory design
Munitions & MAVs

• Time critical targets
• Non-typical targets – at best, ATA cues ‘class’ of potential targets → requires human
• Small optics, low-quality sensors
• Decentralized communication, unique objectives → distributed control
• High threat environment
• Robust search
• Small timescales
Supervised Autonomy

Munitions Directorate

Integrating Humans Into Time Critical Autonomous Systems

Time Criticality
• Human supervision – effects of human response latency must be mitigated ➔ stability, robustness, performance
• Insight, not just oversight – humans add value (e.g., situational awareness, judgement)

Context Appropriate Information Processing
• Information conveyed in appropriate context, at level of “cognition” required for decision
  ➔ Operators must appreciate machine state at the “appropriate level” to make insightful decisions – machines supply correct information in context of situation
  ➔ Machines must respond appropriately to operator decision processes in context of current situation and level of operator effectiveness – humans must supply (overtly or not) sufficient and timely information
This is a multi-scale dynamics & control problem:

- Humans are observers, exogenous dynamics, controllers, ...
- Humans impact system / subsystem stability, robustness, fragility,...
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