Autonomous Systems Design For Combat
UAV Operations

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Combat UAV Autonomy Drivers

• Future combat UAVs are in general expected to be used in particularly dangerous situations.

• Typical examples:
  – Suppression of Enemy Air Defences – SEAD
  – Battle Damage Assessment (BDA)
  – Air-to-air combat
But…….

- It is mandatory that military commanders retain at least the same level of operational effectiveness as with current manned systems.

- There exists a tacit assumption that what we need is…. “Platform Autonomy”
Combat UAV Autonomy

• For highly autonomous vehicles there are numerous issues in:
  – Situational awareness
  – Rules Of Engagement
  – Accountability
  – Flight certification

• These points will need to be resolved if Combat UAVs are to be employed successfully, but are more philosophical than technological
Autonomy Will Also Provide Payoff Where:

• Emission control requirements are in effect
• Jamming/system failure/line of sight communications result in loss of datalink
• An operator is required to command/supervise multiple UAVs
• Operator workload is high
• The operator may have other tasks to perform
  – e.g. as the pilot of another aircraft
Soar/Simulink Interface:

- Self-configuring via Soar rules
- Use of the Real-Time Workshop
- Applicable to any engineering application
- Allows immediate application oriented design to begin
Representative Example

- Searching a network of roads for a vehicle of interest....
Searching a Road Network

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T=0 sec

Target sighted 10 minutes ago
T=30 sec
T=60 sec
$T=90\text{sec}$
T=120 sec
T=150 sec
T=180 sec
T=210 sec
T=240 sec
Real-World Data
Multi-Agent Systems
Upcoming Preliminary Flight Test

• To be carried out over the next 2 months

• Aim:
  – To function Soar in a representative engineering environment
  – To demonstrate some basic functionality

• Platform:
  – A tactical class UAV
  – 2m wingspan
Conclusions

- Autonomy will be required in future UAV systems

- A generally accepted definition of level of autonomy is required

- Typical benefits to be accrued from practical AI techniques will be:
  - Problem solving
  - Planning
  - Anticipation
  - Hypothesis forming
  - Learning

- The Soar AI language:
  - Provides a rich suite of tools for researching functional requirements of advanced autonomous systems
  - Lends itself to the practical demonstration of advanced concepts
• Questions?