The UCAV Ascendancy: What are the Problem Issues?

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Autonomous Robot Warriors?
UCAVS and AIR 6000

• UCAVs frequently advocated in Australian public debate as replacements for manned aircraft in the AIR 6000 project.
• The central argument is ‘cheaper and better’, avoiding expensive and scarce aircrew.
• Rationale assumes that UCAVs can replace manned aircraft in most or all current roles.
• *Is this a reasonable expectation?*
Roles and Missions

• To replace the F/A-18A and F/RF-111C/G the following roles must be performed effectively:
  – F/RF-111C/G Tactical Fighter - Maritime Strike, CAS/BAI, SEAD/DEAD, Interdiction, Strategic Strike, LRMP Intercept.
Obstacles to Manned Fighter Replacement?

- Aerodynamics - No Obstacles.
- Structures - No Obstacles.
- Propulsion - No Obstacles.
- Flight Controls - No Obstacles.
- Low Observables - No Obstacles.
- The central problem is the provision of decision-making intelligence for the UCAV.
Bandwidth vs Intelligence

- Decreasing Bandwidth/Increasing Intelligence
  - Dumb RPV
  - Non-Autonomous UCAV (No AI)

- Fully Autonomous UCAV (Human-like AI)

Increasing Bandwidth/Decreasing Intelligence

UCAV Datalink Needs vs UCAV Autonomy
‘Dumb RPV’ Model

- One ‘extremity' in implementation - remotely piloted UCAV with simple autopilot.
- All information required by human crew is relayed via datalink to remote cockpit.
- Datalink needs are problematic => tens of Megabits/s capacity per UCAV.
- High spreading ratio anti-jam datalinks => tens of GHz bandwidth per UCAV.
- Tropospheric propagation physics preclude reliable long range millimetric band datalinks.
‘Autonomous AI’ Model

• Alternate `extremity' in implementation - autonomous robot fighter with ‘human-like’ Artificial Intelligence (AI).

• UCAV AI has cognitive and reasoning ability similar to a human pilot.

• Datalink needs similar to manned aircraft.

• **TRUE MACHINE ARTIFICIAL INTELLIGENCE REMAINS AS YET AN UNSOLVED PROBLEM IN COMPUTER SCIENCE RESEARCH!**
Moore’s Law - Microprocessors
USAF -SEAD & Fixed Targets

- USAF/DARPA technology demonstration - modest autonomy, modest datalink bandwidth.
- Primary role of SEAD/DEAD is well constrained.
- Growth role of fixed target strike (reusable cruise missile) is well constrained.
- Incremental approach to establish bounds on capability and establish what problems will arise, and how to solve them.
Problems for AIR 6000 UCAVs

- F/A-18A and F/RF-111C/G fulfill very broad role spectrum => flexibility is vital!
- Large geographical footprint mandated by new White Paper strategic doctrine:
  - UCAV AAR is essential to meet endurance and range.
  - Satellites would require very large footprint and high bandwidth for UCAV support.
- No economies in pre/post-strike recce - UCAV vs ALCM vs Manned Fighters.
Conclusions

• Is there a case for an ‘AIR 6000 UCAV solution’?

• UCAV advocates must prove the capability to perform the whole role spectrum now covered by F/A-18A and F/RF-111C/G, with no loss in flexibility or capability.

• Costs, including satellite datalinks, must be competitive against manned aircraft.

• Even with AI technology breakthroughs this may prove difficult to achieve.