The UCAV Ascendancy: What are the Problem Issues?

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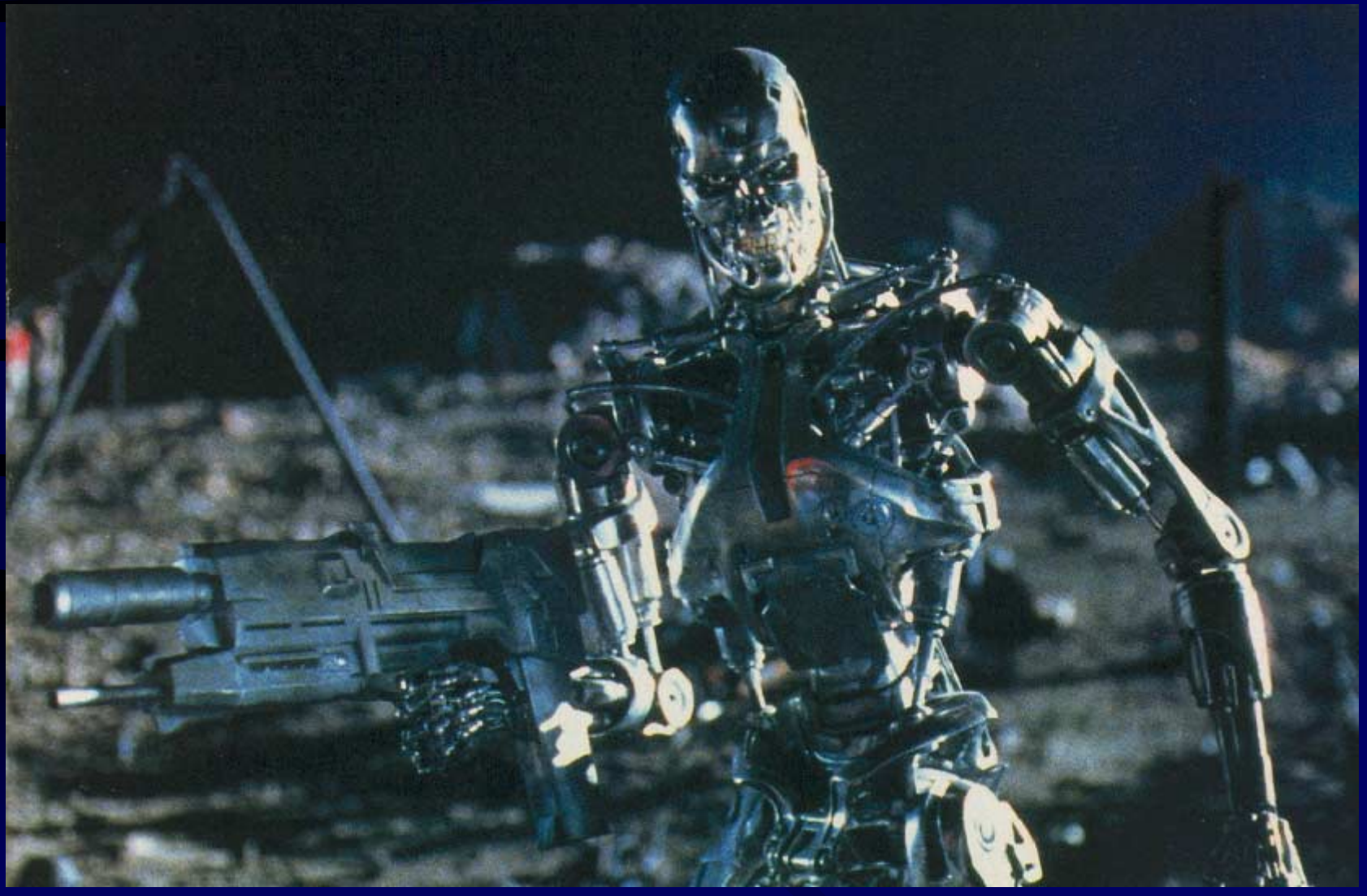
Autonomous Robot Warriors?



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/A-18A Air Superiority Fighter - OCA, DCA, Fighter Escort for F/RF-111C/G, Maritime Strike, CAS/BAI, SEAD/DEAD, Interdiction, Strategic Strike.
  - F/RF-111C/G Tactical Fighter - Maritime Strike, CAS/BAI, SEAD/DEAD, Interdiction, Strategic Strike, LRMP Intercept.

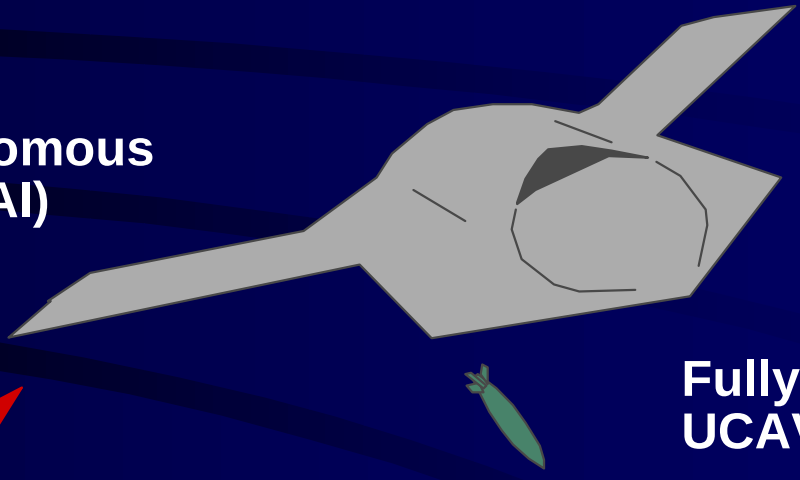
Obstacles to Manned Fighter Replacement?

- 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

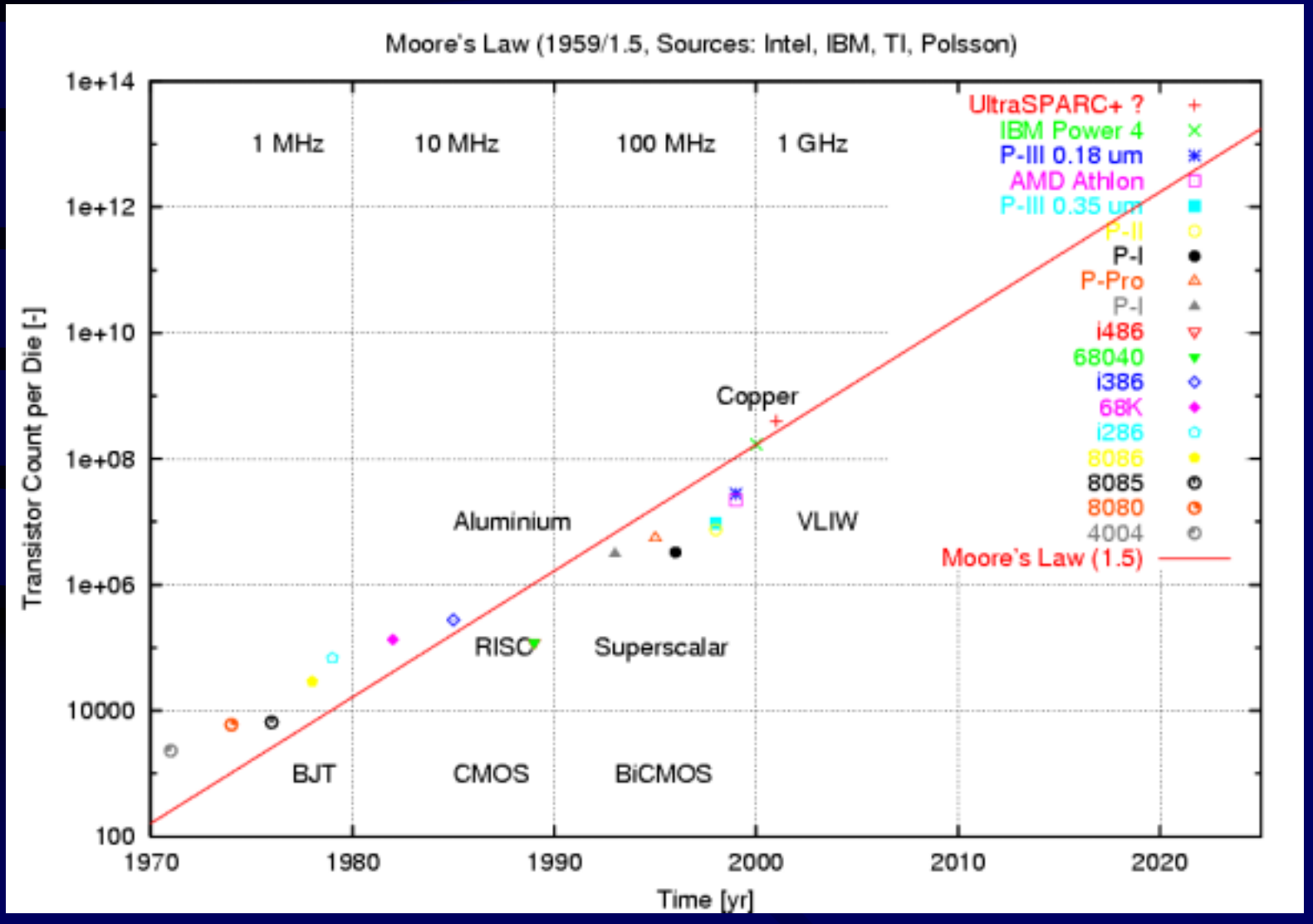
‘Dumb RPV’ Model

- 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!

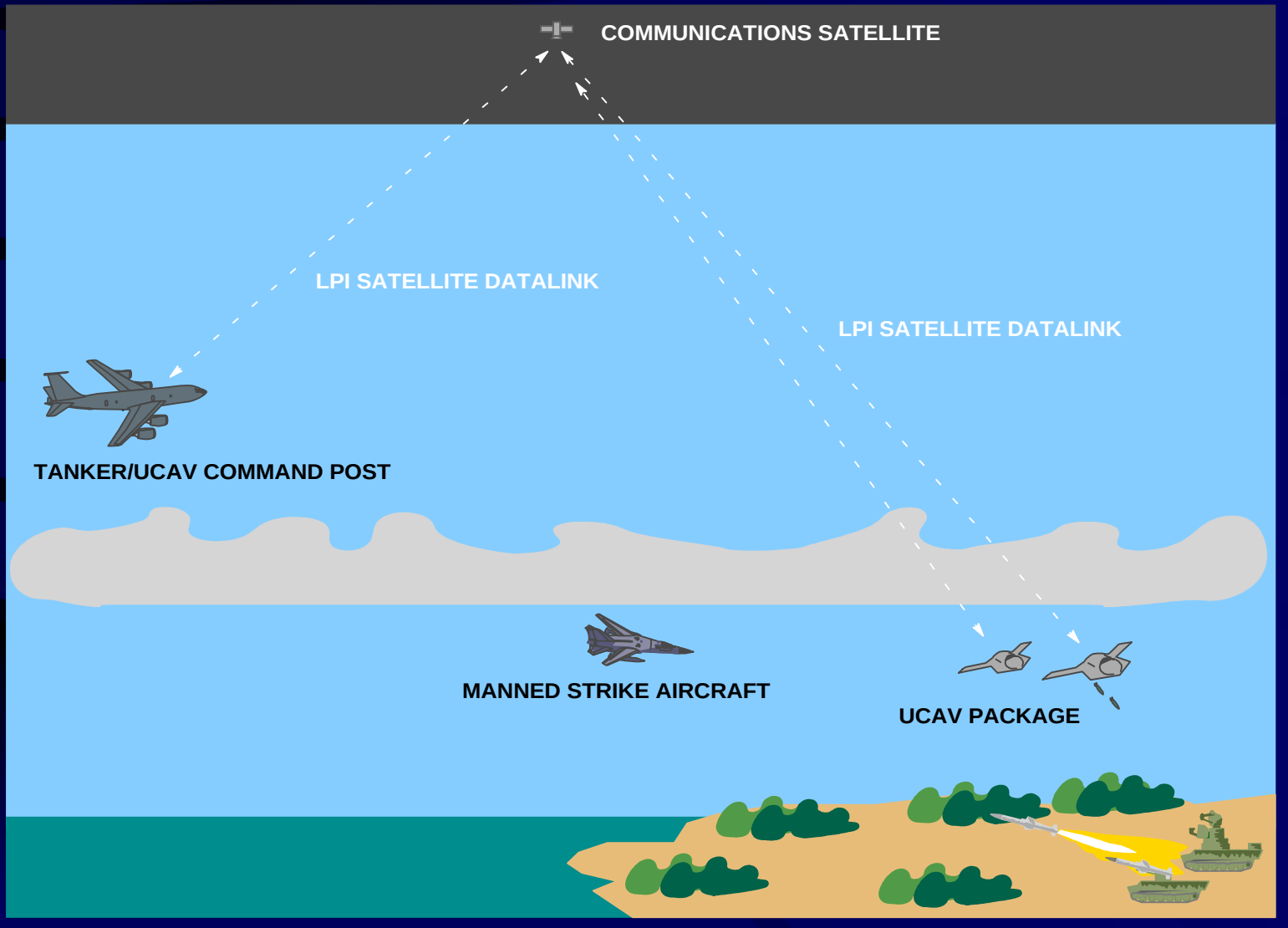
Moore's Law - Microprocessors



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.

DARPA/USAF UCAV CONOPS



Boeing/DARPA Demonstrator

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.