Nano/Micro Uninhabited Aerial Vehicle Technologies: State-of-the-Art Overview

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March 2010

Defence Research and Development Canada

Recherche et développement pour la défense Canada

Canada

Airborne Sensor for the Dismounted Soldier

Situation

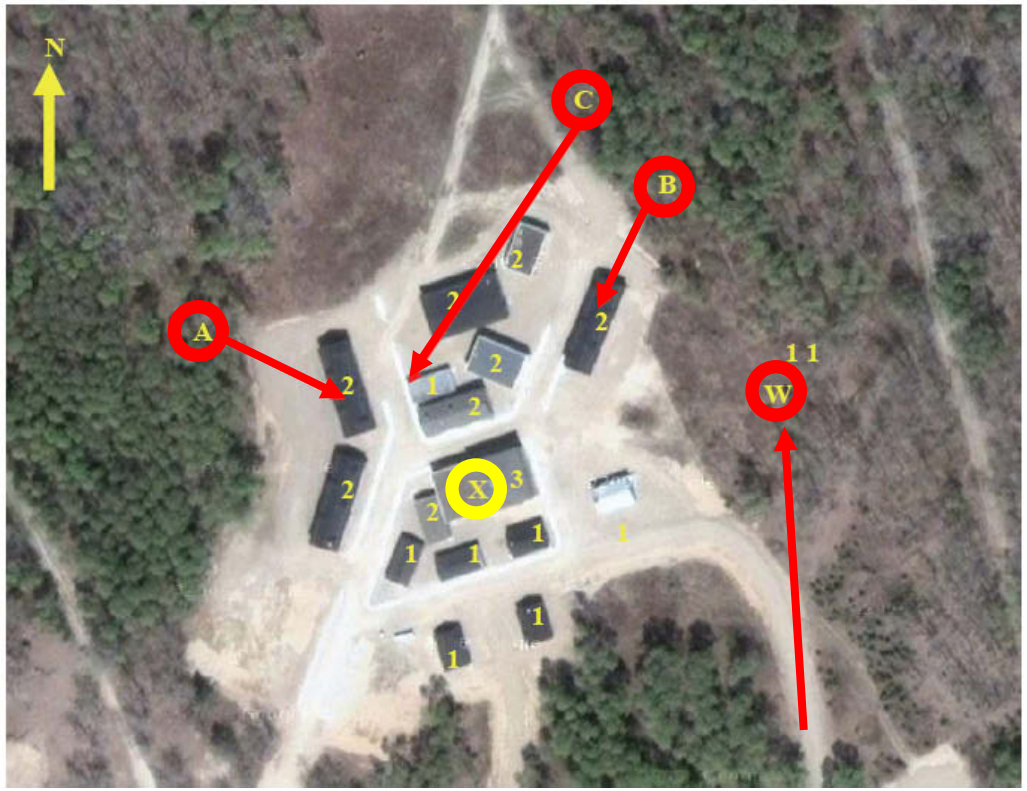
Platoon on morning patrol approaches a village and suddenly takes sniper fire.

Mission

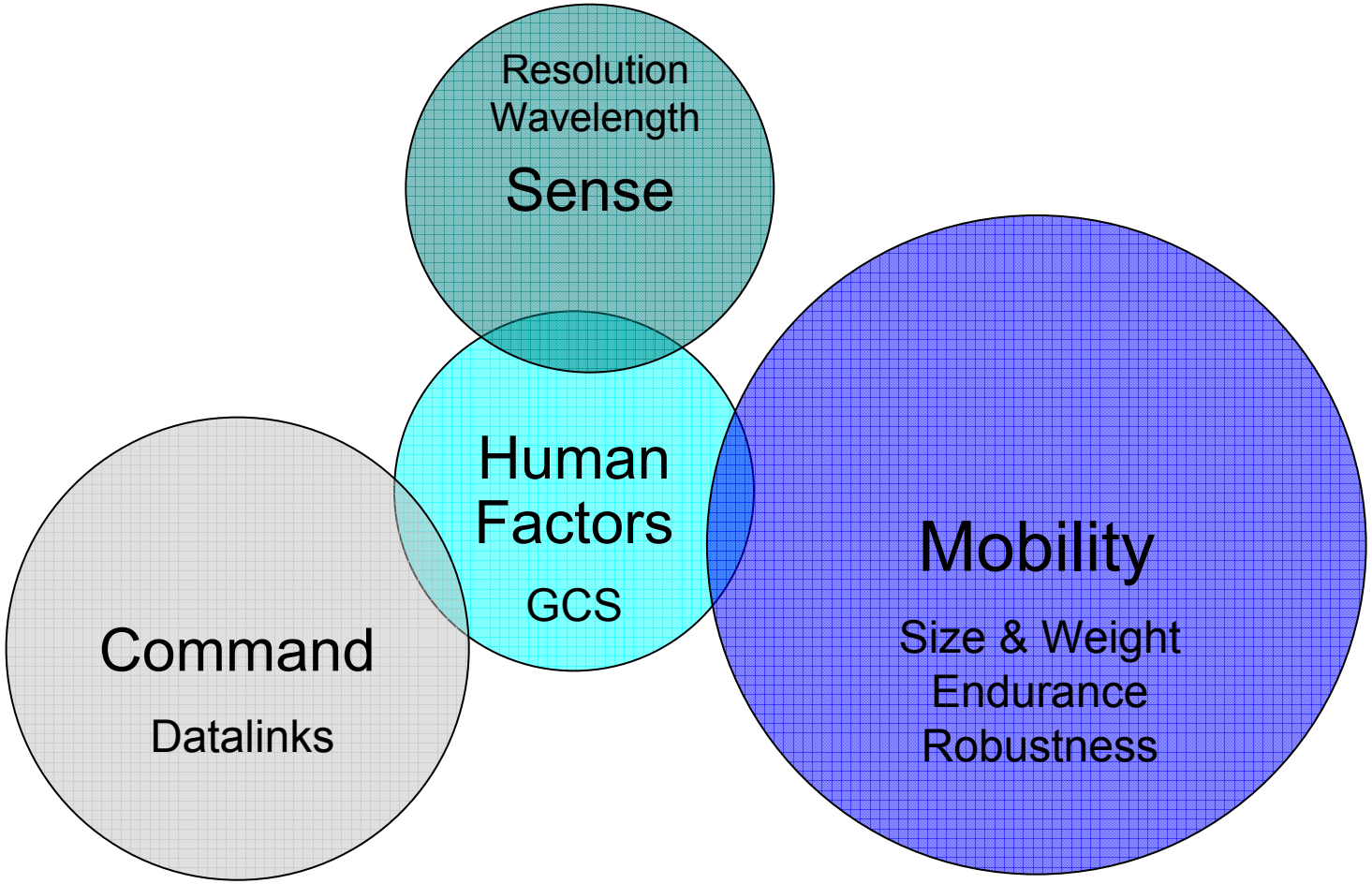
Platoon to locate and eliminate the sniper(s) while minimizing civilian casualties.

Key Question

Would an airborne sensor contribute to successful execution of the mission?



Technology Domains Relevant to the Development of a Mobile Aerial Sensor



Current Options – Fixed Wing

- Size & Weight
  - 72 cm, 430 g
- Endurance
  - 45 min.
- Sensor
  - EO or IR camera
  - forward & side
- GCS
  - IP-based, analog
  - tablet interface
  - waypoint navigation

Current Options – Ducted Fan

T-Hawk
RQ-16

- Size & Weight
  - 33 cm, 7.7 kg
- Endurance
  - 50 min.
- Sensor
  - EO or IR camera
  - forward & down
- GCS
  - analog
  - tablet PC
  - waypoint navigation

Current/Future Options - Rotorcraft

Draganflyer X6

- Size & Weight
  - 99 cm, 1.5 kg
- Endurance
  - 20 min
- Sensor
  - EO still or video
  - forward
- GCS
  - analog
  - laptop telemetry
  - manual navigation

Current/Future Options – Flapping Wing

Cybird

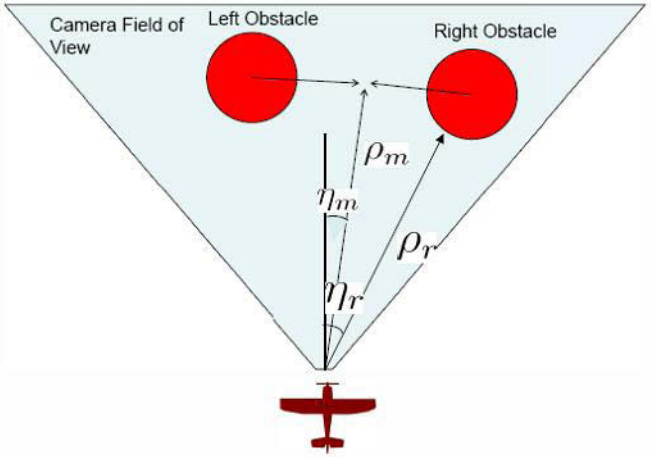
Delfly

- Size & Weight
  - 74 cm, 230 g
  - 28 cm, 16 g
- Endurance
  - 15 min
- Sensor
  - EO camera
- GCS
  - none
  - manual navigation

R&D Challenge -Miniaturization and Power

Component	Current (g) MAV	Future (g) NAV	Reduction
Airframe	180 (40%)	0.50 (17%)	360X
Propulsion	82 (18%)	0.45 (15%)	182X
Control	69 (16%)	0.70 (23%)	99X
Camera	30 (7%)	0.40 (13%)	75X
Battery	83 (19%)	1.00 (33%)	83X
Total	444 g	3.05 g	145X
Duration	20 min.	3 min.	—
GCS	3400 g	?	—

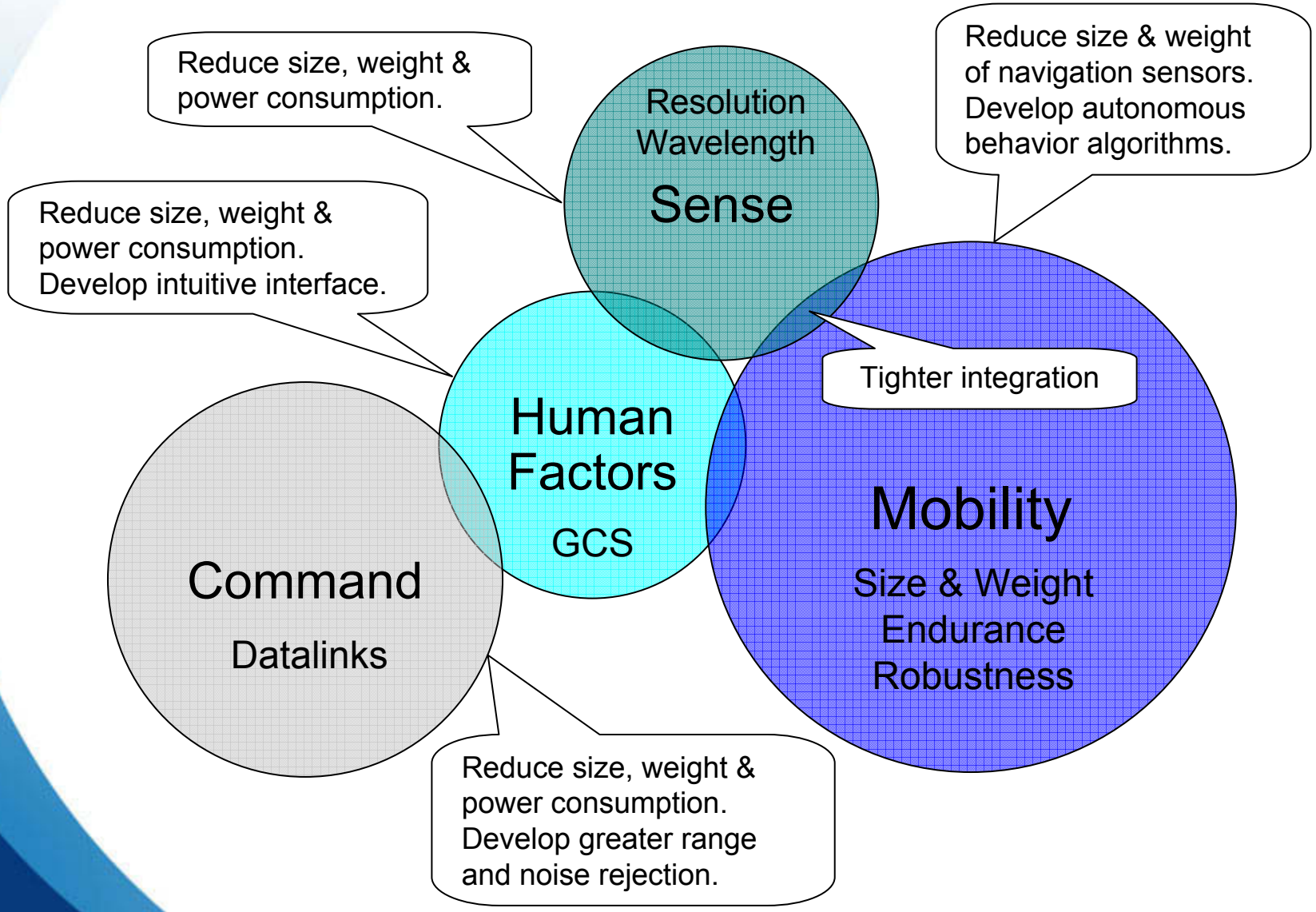
R&D Challenge – Autonomous Navigation



- Positional Sensors (Current)
  - 3-axis accelerometers
  - 3-axis rate gyros
  - 3-axis magnetometers
  - GPS
  - waypoint algorithms
- Optical Sensors (Future)
  - scanning laser
  - cameras
  - motion detection chip
  - optic flow algorithms
  - obstacle avoidance

Airborne sensor must take care of itself so soldier can concentrate on the mission.

R&D Domains for a Mobile Aerial Sensor



Summary

- Man-portable RSTA robots are seen as a means to give the soldier a decisive advantage over the adversary.
- Current military-grade systems are based on fixed-wing and ducted fan platforms with EO/IR sensors connected to a tablet GCS. Future platforms may be based on rotorcraft and flapping wing systems.
- Reduction in overall weight and increase in duration highly desired.
- True usefulness of RSTA robots will come when they possess autonomous technologies that allow the robot to look after itself and leave the soldier to focus entirely on the mission.