DEFENCE R&D DÉFENSE

Ship Recovery

UAV Ship Recovery Challenge

piloted landing
LSO team
visual centerline optics
visual glidepath optics
arresting cables
large landing surface
high-value aircraft

automated landing

precision approach system

multi-purpose capture system
restricted flight deck
high-value payload

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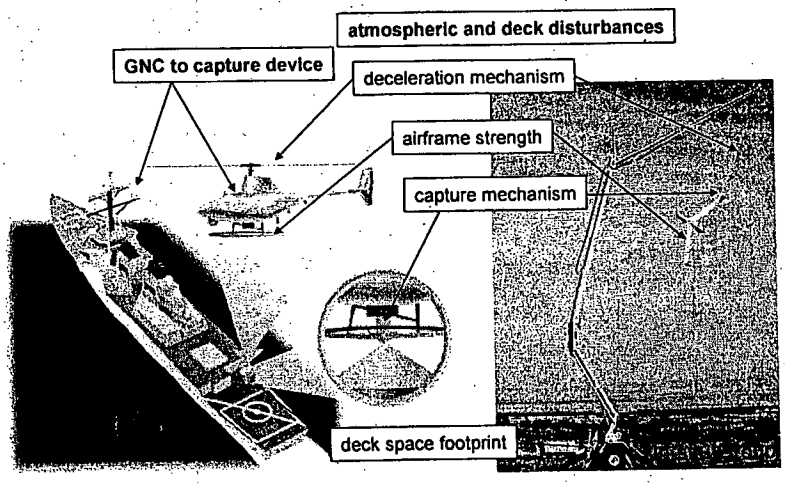
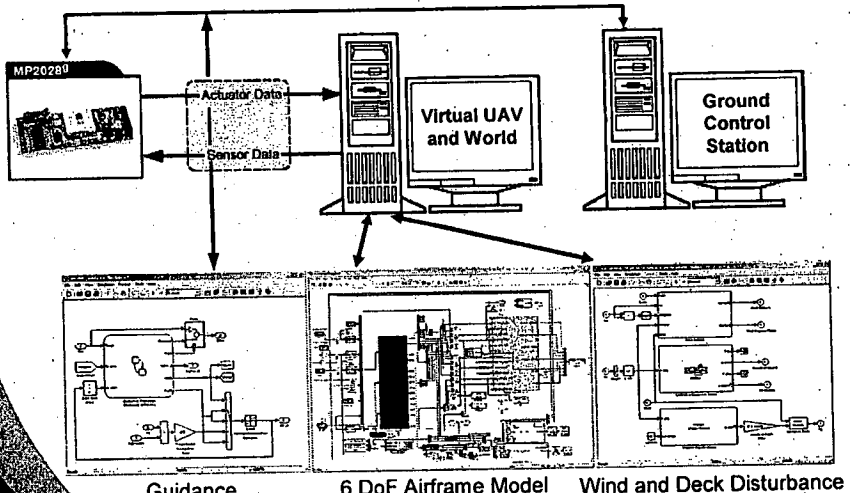
#531904

UAV Ship Recovery Issues and Objective



Objective: To determine the factors affecting successful ship recovery of tactical-sized or smaller fixed wing UAVs.

DRDC Hardware-in-the-Loop Facility



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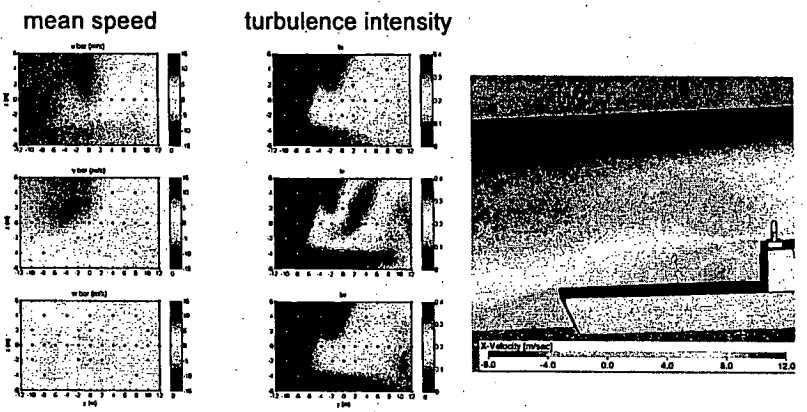
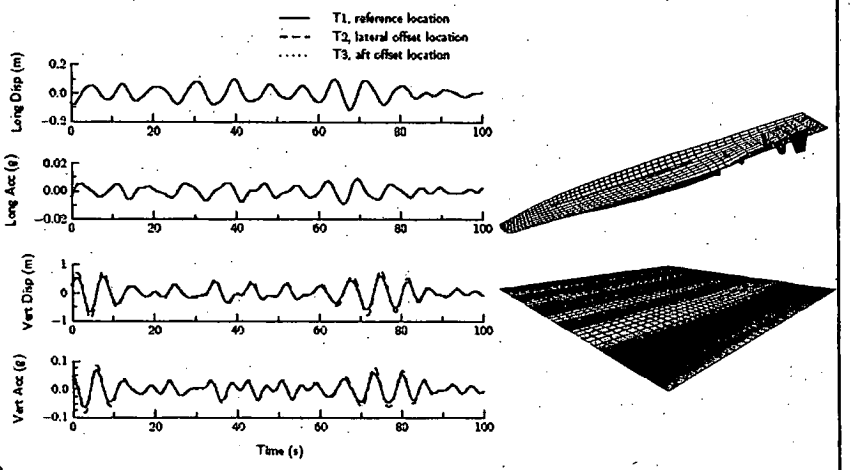
Airwake Modeling



View from stern

PowerFLOW based on Lattice-Boltzmann approach used to create time history airwake corridor up to the CPF.

Deck Motion Modeling



DRDC Atlantic ShipMo3D analysis based on Bretschneider spectrum with significant wave height of 1.8 m and peak wave period of 8.8 s.

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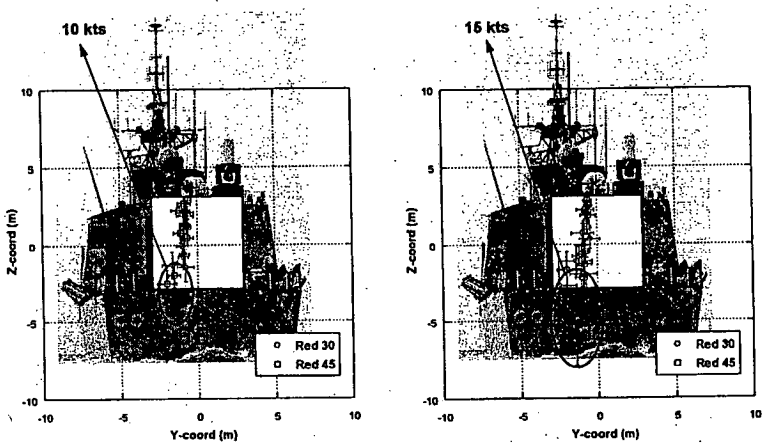
Parametric Study

Parameter	Value
Course of frigate	000 060
Speed of frigate	10 kts 15 kts
Speed of UAV	54 kts 76 kts
Center of capture device	5 m aft of hangar door, centerline, 3.4 m high 14 m aft of door, 4 m starboard offset, 3.4 m high 14 m aft of door, centerline, 3.4 m high
4440 ton CPF operating in Sea State 4 conditions with coincident 1.8 m waves and 15 kt wind	

Effect of Frigate Speed



Notes: White box represents a 6m x 6m capture device placed on centreline only. Each data point represents the mean and standard deviation of the landing coordinates on the capture device based on 50 attempts.

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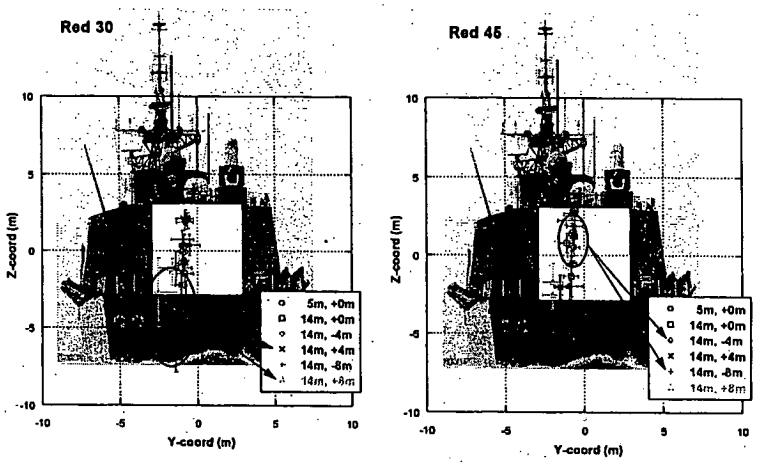
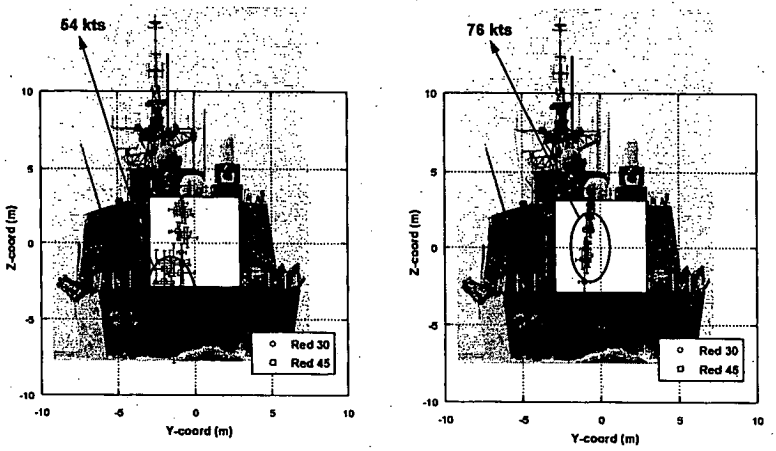
Effect of Recovery Device Position



Notes: White box represents a 6m x 6m capture device placed along centreline only. Each data point represents the mean and standard deviation of the landing coordinates on the capture device based on 50 attempts.

Effect of UAV Speed



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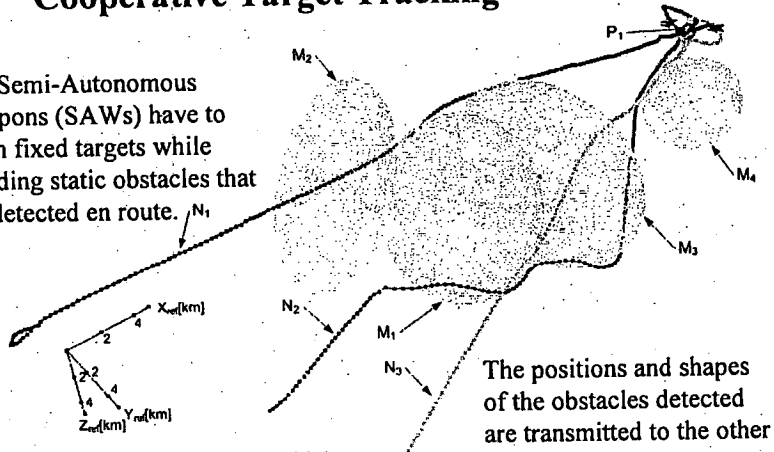
Potential Solutions for Improving Probability of Successful UAV Recovery

1. Reduce airwake disturbance amplitudes
   - a) **strategic placement of spoilers**
   - b) active flow control
   - c) optimization of ship speed and heading
2. Increase resistance of air vehicle to gust disturbances
   - a) **aerodynamic configuration and performance**
   - b) autopilot resolution and bandwidth
   - c) actuator frequency response
   - d) **flight path management**
3. Increase accuracy of UAV guidance system
   - a) differential GPS
   - b) MMW radar
   - c) beam rider
   - d) synthetic vision
4. Reduce deck motion amplitudes
   - a) hull roll stabilization
   - b) quiescent period prediction
   - c) optimization of ship speed and heading

Collision Avoidance of Objects and Cooperative Target Tracking

The Semi-Autonomous Weapons (SAWs) have to reach fixed targets while avoiding static obstacles that are detected en route.



The obstacles are ellipsoid (or included within ellipsoids if they are not).

The positions and shapes of the obstacles detected are transmitted to the other SAWs of the group.

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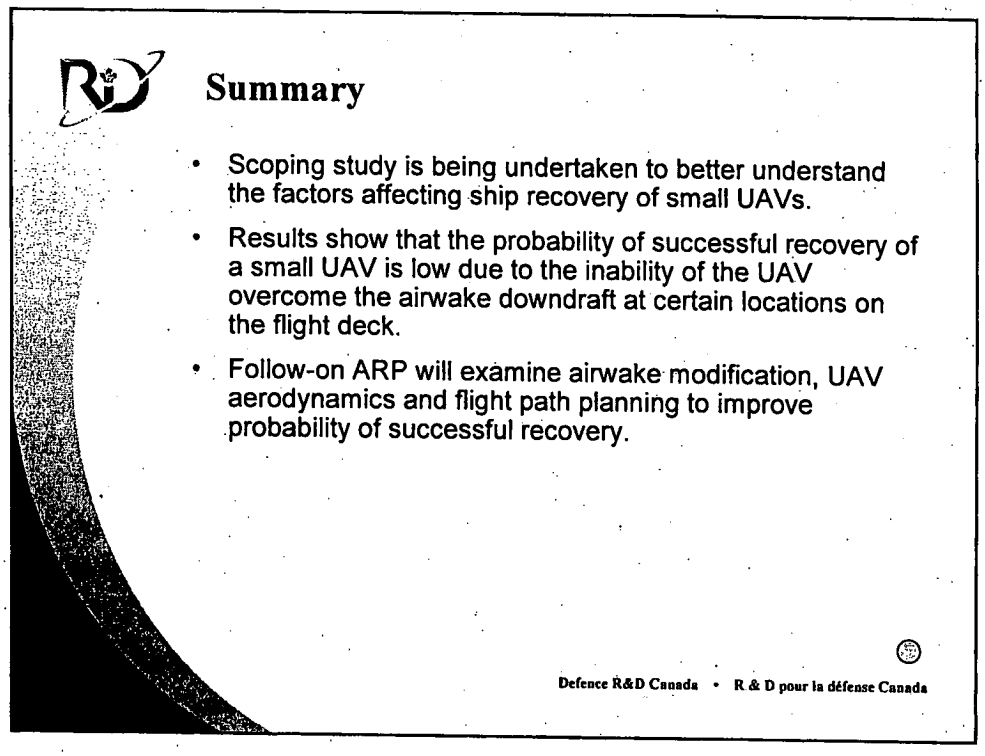

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