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Vision Based Navigation

S&T Campaign: Sciences for Lethality & Protection
Ballistics and Blast

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Research Objective

Develop algorithms for air-borne vehicles that use visual cues as navigation inputs, enabling autonomous solutions for GPS denied environments. Collaborate with mixed platform systems for total situational awareness and robust target detection.

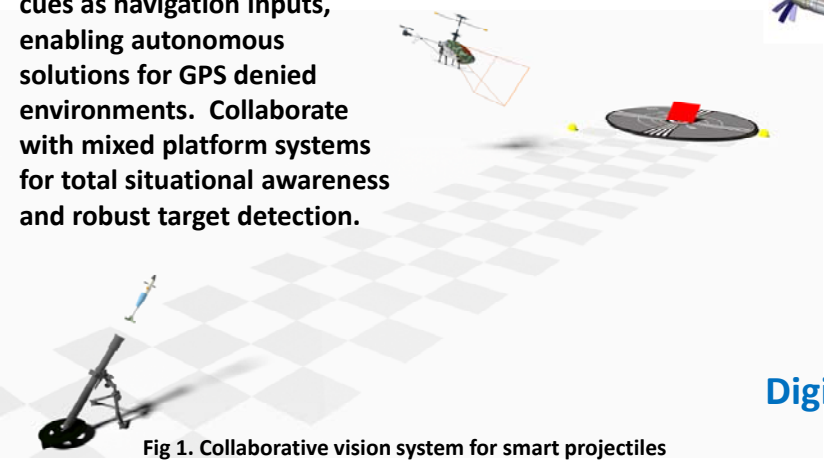


Fig 1. Collaborative vision system for smart projectiles

Challenges

- Inherent computational burden of vision algorithms.
- First frame target detection for smart projectiles is difficult with a dynamic scene.
- Target recognition in complex and evolving scenes
- Technical challenges include low frame rates, blur, latency, gun survivability, dynamic range, resolution, etc.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Expertise sought in surveillance, fast computer vision methods and implementation, IR cameras.
- Innovative new research approaches to address this research objective include biologically inspired methods, compressive sensing, network control, etc.

ARL Facilities and Capabilities Available to Support Collaborative Research

- ARL technical expertise in gun launched embedded processing
- Integrated software / facilities for scene and camera modeling.
- Inertial Measurement Unit (IMU) Calibration and Modeling facilities
- Transonic and air gun facility for small scale data collection and proof of concept demonstrations
- Unmanned aircraft for data gathering and algorithm V&V
- Real-time hardware in the loop facilities including GNSS simulator.

Projectile State Estimation through Optical Flow

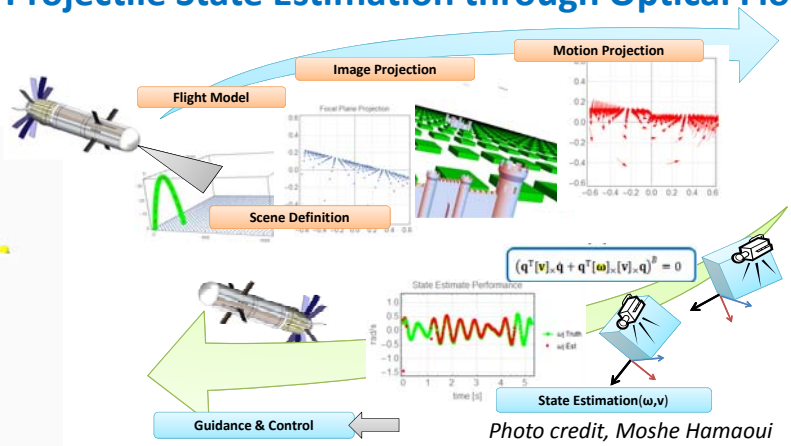


Photo credit, Moshe Hamaoui

Digital View Steering via L.O.S. Estimation

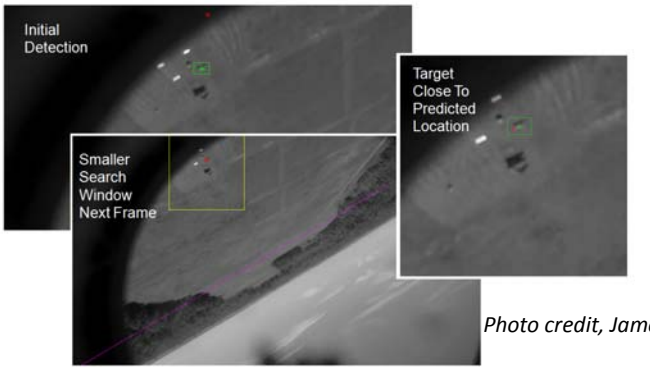
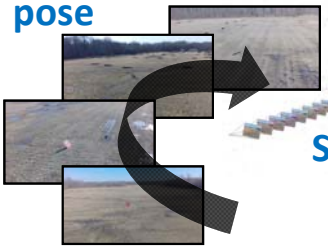
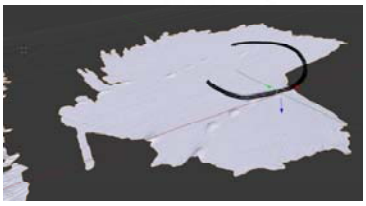


Photo credit, James Maley

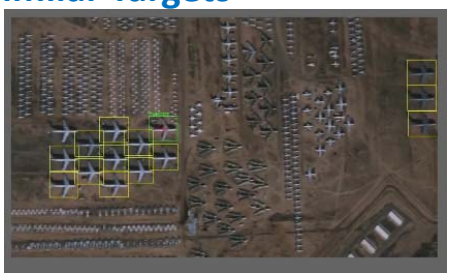
Sparse point cloud generation with camera pose



Solid model reconstruction



Tracking of Multiple Similar Targets through Occlusion



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