

Adaptive Agent Seeker Field Of View Management (AASFOVM)

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Abstract:

A technical approach is needed that is capable of integrating Infrared (IR) target discrimination with Field of View (FOV) management to produce divert instructions to the missile platform over time. For Kinetic Weapons, Divert means called-for-lateral acceleration relative to interceptor center-line (up-down and right-left). A successful approach should concurrently optimize fuel reserve while positioning the seeker to maintain best fit of target cloud objects in its FOV. FORELL proposes to address this problem to develop and test an algorithm utilizing an agent based approach that will optimize kinetic kill vehicle's divert resources while enhancing discrimination and end game kill results. To optimize divert and field of view management perspective in order to discriminate the target cloud correctly, the IR missile seeker must be capable of initial discovery and keeping the "right objects" in its field of view as it approaches the target cloud. The problem domain includes time constrained optimization of intercept and field of view geometry, IR seeker object discrimination and divert fuel conservation. FORELL will develop and demonstrate an algorithm that shows such optimization capability. For commercialization, the AASFOVM approach is extremely flexible and lends itself very well to the areas of Network Centric Warfare and Distributed Robotics.

Anticipated Benefits/Commercial Applications: The Adaptive Agent Seeker Field of View Management (AASFOVM) approach proposed by FORELL is sufficiently flexible to address needs in three areas of importance to the Missile Defense Agency community. These areas are (1) the ability to optimize fusion of data from an on-board suite of heterogeneous sensors, (2) in the area of sensor scheduling and sensor allocation where both on-board and off-board heterogeneous sensors are considered along with other sources of prior information and, (3) the ability to optimize performance adaptively, because anticipated engagements are now largely expected to come from threats where there is little or no measured data. Additionally, ASSFOVM lends itself very well

to the areas of Network Centric Warfare (NCW) and Distributed Robotics (DR). Major NCW programs, such as Future Combat Systems (FCS) and NetFires, that rely heavily on the ability to fuse information from netted multiple heterogeneous sensors and organic real time data can benefit from AASFOVM. These netted sensors generates the need for fusion of measured data with greatly differing quality and timelines. AASFOVM will benefit distributed robots concepts that use hundreds or even thousands of low-power, low-capability sensors that interact locally. These networks will be extremely dynamic, with sensor nodes being added or deleted continually. Within the overall context of both NCW and DR the idea of sensor scheduling that will allocate resources to achieve a required level of performance given system constraints is becoming of great interest to the defense community. AASFOVM concept and technology will benefit these and many other areas of military and commercial application. Reasons that the AASFOVM agent-based approach potentially yields a solution to the integration of Missile Divert and Seeker FOV management régimes are as follows: 1) The agents enable learning between the divert régimes and IR Seeker discrimination regimes. 2) Agent based discrimination can contribute to optimal target set selection out of the target cloud. 3) The IR Seeker FOV management can be optimized to keep the optimal target set in the FOV. 4) The agent-based approach is easily adapted to changing threat characteristics and expandable to incorporate new sensor technology as it becomes available. 5) Agent based modeling can demonstrate performance of candidate approach and validate the AASFOVMM algorithm.

Keywords: Kinetic weapon, kill vehicle, infrared, target discrimination, evolutionary algorithm, missile seeker, seeker field of view, reinforcement learning

Start Date: ~Nov 02 **End Date:** ~May 03

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