

Multiscan Pre-Filter System for Processing Radar Data

Challenge Being Addressed

Tracking systems associated with Airborne Early Warning (AEW) surveillance radar systems are often challenged by conditions including significant clutter, target maneuvers, noisy measurements, and missed detections. Without robust methods to address these challenges, the tracker will generate a degraded track picture to include track breaks, track swaps, and poorly formed track state estimates. A degraded track picture directly and negatively impacts higher-level command and control decision functions such as combat identification, resource allocation, and related functions that support battle management and mission execution activities. In order to generate the best available information to support these functions, it is essential that the tracker minimize the presence of track breaks and swaps.

Numerica's **Multiscan Pre-Filter System** is specifically designed to filter out clutter reports and enables the tracking system to produce a more accurate track picture. Using a high-fidelity simulator, Numerica has successfully demonstrated that the Multiscan Pre-Filter can significantly improve the tracking system's performance, even for baseline tracking systems, when challenged with significantly cluttered radar data.

Numerica's Innovative Approach

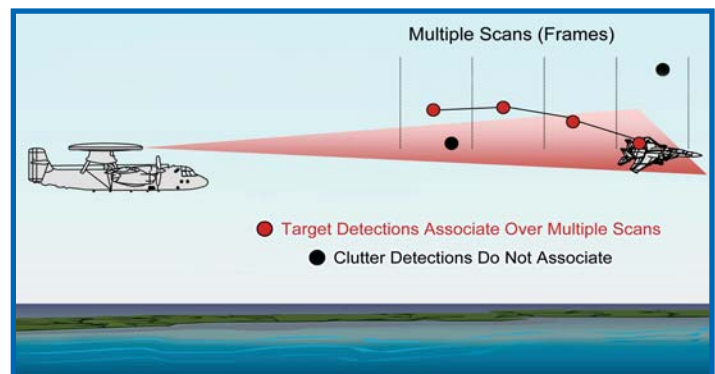
Numerica's **Multiscan Pre-Filter System** is a software-based solution that operates on measurements taken from the radar before being sent to the tracking system. This system eliminates clutter and sends the "filtered" measurements to the tracker, resulting in improved tracker performance. The clutter is eliminated using a hierarchical application of feasibility tests, or measurement-to-measurement "gate tests." The tests are based on the hypothesis that if a radar measurement cannot feasibly associate to other measurements on subsequent scans, it is identified as clutter and suppressed. In addition to improving tracking performance, the pre-filter reduces the computational loading on the tracking system resulting in improved processing efficiency.

Numerica's **Multiscan Pre-Filter System** is being developed in collaboration with the U.S. Navy as a standalone C++ software system for potential integration into an airborne early warning radar system. A pre-filter prototype has been developed and successfully tested in a high-fidelity simulator with representative radar measurement, clutter, and target maneuver conditions. An ongoing program is developing the standalone **Multiscan Pre-Filter System** in C++ with a planned milestone to achieve Technology Readiness Level (TRL) 6 by the end of 2008.

Demonstrated Advantages of Numerica's Approach

Numerica's **Multiscan Pre-Filter System** includes the following discriminators:

- The Pre-Filter System employs very efficient tests called "gates" to identify measurements that could feasibly associate together to form a target track. The gates are "dynamic feasibility tests" that determine acceptable associations.
- The gating tests include pair-wise, triple, and N-frame techniques. The tests increase in sophistication starting with very simple/cheap methods and the pre-filter algorithms employed are specifically tuned to account for target maneuver properties.
- The Pre-Filter System applies the gating algorithms in a hierarchical framework to achieve maximum efficiency.
- An advanced data management system is applied to maintain potential associations and apply the hierarchy of gating tests.
- Numerica's innovative solution is applicable to a variety of tracking systems, including the classical single-frame approaches deployed in most fielded systems, as well as the more modern multi-frame multiple hypothesis tracking (MHT) systems.



Numerica's **Multiscan Pre-Filter System** is a highly efficient surveillance radar clutter rejection software system that enables the associated tracking system to produce a more accurate track picture.

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