



Using Multi-Sensor Fusion Tracking to Integrate Varied Air Traffic Control Surveillance Systems

Telephonics Electronic Systems Division

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Issue

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- ◆ **Air traffic controllers require a complete and accurate air situation picture to effectively monitor air traffic separations and maintain sector control**
- ◆ **Air Traffic Management (ATM) automation systems must utilize and simultaneously integrate as many position reporting sources as possible, including radar, voice reports and/or ADS (Automated Dependent Surveillance)**
- ◆ **The simultaneous use of multiple sensors is statistically superior to single point of surveillance reporting, and as new surveillance technologies become fielded, automation systems must be able to effectively integrate these systems to provide the most accurate air traffic picture**

Solution

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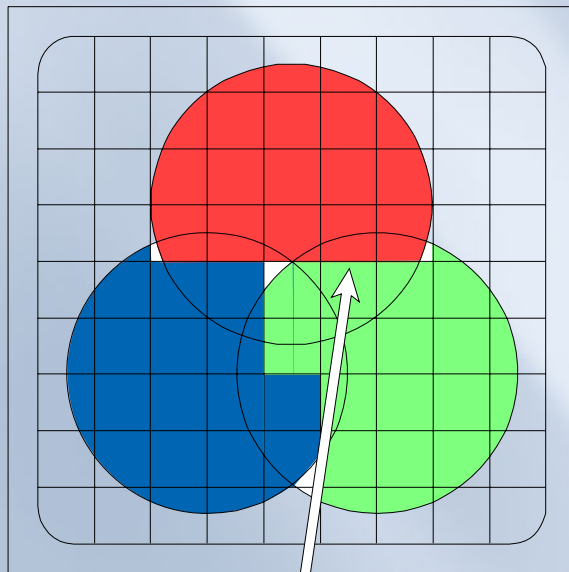
- ◆ **Telephonics has developed a Multi-Sensor Fusion Tracking and Multi-Radar Fusion Tracking (MRT) system for our AeroTrac® automation system**
- ◆ **This multi-sensor tracking function is the result of over 18 years of continuous design and improvements based on practical ATC experience**
- ◆ **Telephonics has successfully installed and operated its multi-sensor tracking function in several domestic air surveillance command and control systems, and, in multiple international civil ATC applications**

MRT for Enroute, Approach and Tower

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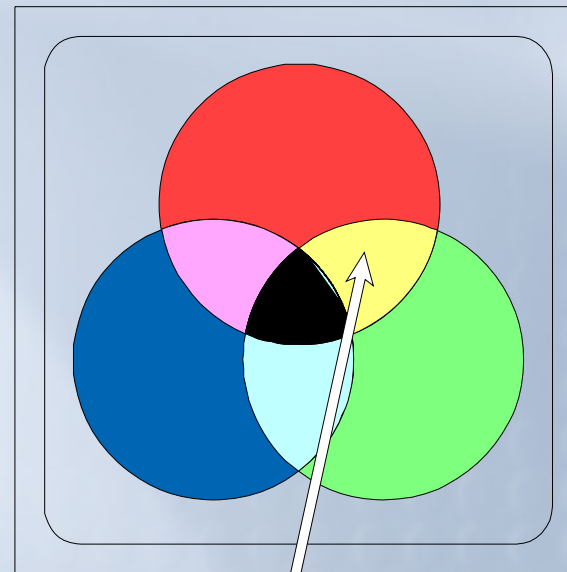
MOSAIC



ONE RADAR
PER TILE

*Difficult to Characterize
Airspace by a Series of Tile Rectangles*

MULTI-RADAR FUSION

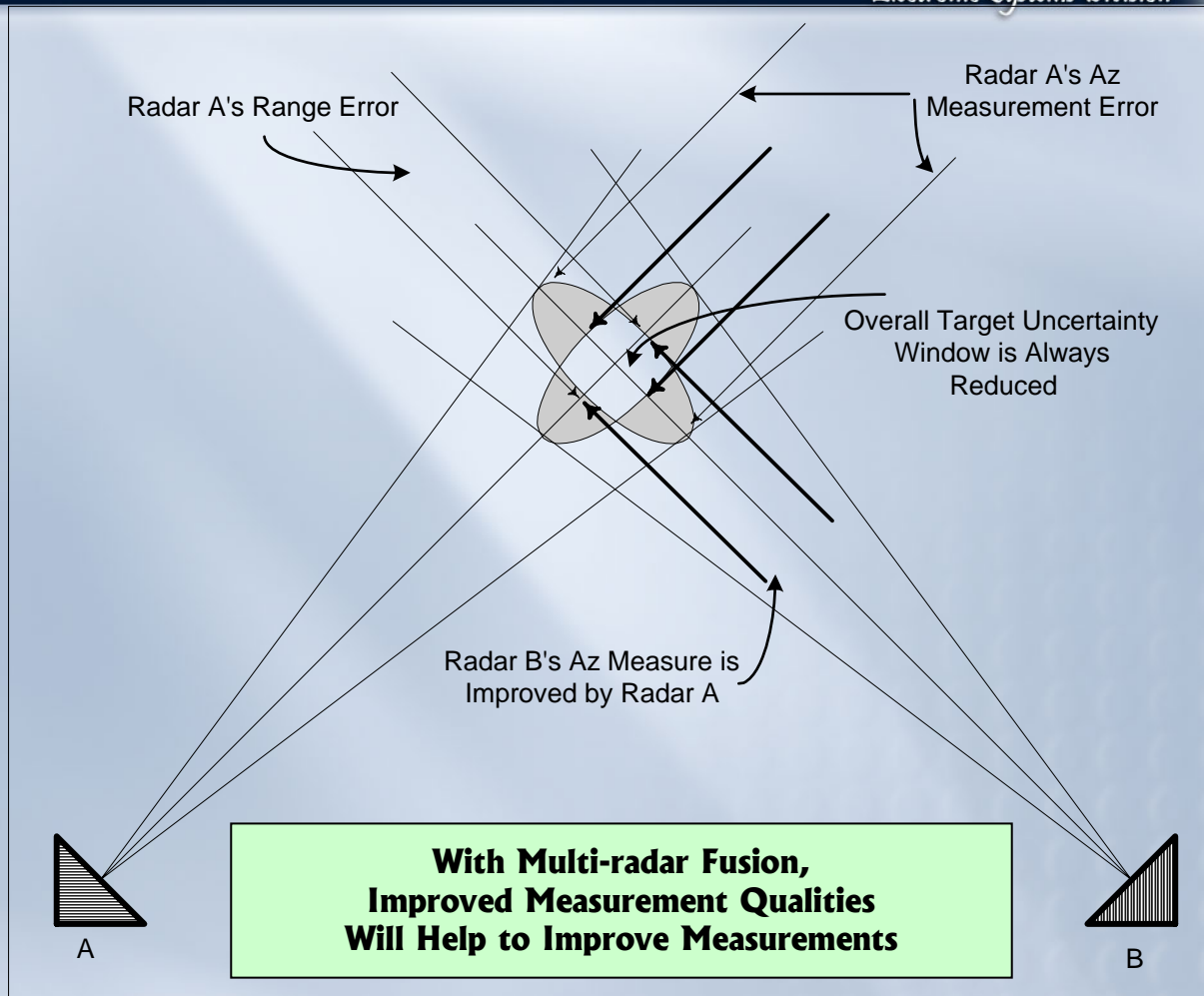


ALL RADAR DATA
USED & FUSED

*High Quality Measurements Always
Dominate*

MRT Provides More Accurate Results with Multiple Radars

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Our Algorithms Take Advantage of Overlap Uncertainties to Improve Positional Accuracy

Benefits

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- ◆ **As a result of our experience with multi-radar tracking, Telephonics has been able to determine that its Multi-Sensor Fusion Tracking algorithms and processing procedures are more accurate and reliable than similar monoradar trackers and other multi-radar tracking technologies**
- ◆ **Due to our installed base and operational experience, we can summarize what we view to be the benefits of using a Multi-Sensor Fusion Tracking approach similar to ours**

Minimized Track-Induced Uncertainties

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- ◆ **Our approach to multi-radar tracking optimizes the use of radar positional measurements by minimizing any tracker-introduced uncertainty associated with the measurement**
- ◆ **This allows the MRT to provide enhanced tracking performance**

Minimized Tracking Induced Errors

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- ◆ **Our MRT design reduces the difference between estimated and actual positions and track velocities by minimizing positional measurement tracking-induced errors**

- ◆ **Allows our MRT to minimize track smoothing**
 - **Minimize lags, and allows for earlier detection of target maneuvers**
 - **Results in fewer track losses during aircraft maneuvers**

Enhanced Controller Air Situation Picture

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- ◆ **Our MRT's improved positional accuracy enhances the controllers' air situation picture for separation monitoring in both approach and ACC enroute applications**
- ◆ **Enables the application of both terminal and enroute separation standards within the same system context**
- ◆ **This improved positional accuracy also has a positive impact on controller safety aids, such as Minimum Safe Altitude Alerting, Conflict Alerting, Restricted Area Intrusion Warning, and Flight Conformance Monitoring, all of which depend on reliable position data**

Improved Surveillance Coverage

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- ◆ **By integrating ADS-B and voice data position reports, with or without the use of radar, within the MRT's WGS-84 based coordinate system, our multi-radar tracker is able to further enhance the positional accuracy that is already provided**
- ◆ **The Telephonics MRT allows simultaneous use of all sensor inputs without the use of mosaic techniques**
 - **Improves overall surveillance coverage, minimizing coverage gaps, improving reliability, and improving situational awareness**
 - **Provides cost benefits to the user by readily interfacing to existing and new radars through its modular/open architecture and flexible input data message definition functions**

Reduced Systemic Errors

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- ◆ **As a by-product of its unique Sensor Fusion Process, the MRT provides automatic radar registration and bias corrections that continually reduce systemic errors that occur over time**
- ◆ **This greatly assists in maintaining superior performance and reducing system maintenance**

Summary

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- ◆ **Multi-Sensor Track Fusion – More accurate air situation picture**
- ◆ **Optimizes the use of radar positional measurements**
- ◆ **Reduces the difference between actual and estimated positions and tracks**
- ◆ **Improved positional accuracy enhances the air situation picture for separation monitoring**
- ◆ **Allows simultaneous use of all sensor inputs**
- ◆ **Provides automatic radar registration and bias corrections – reduces systemic errors over time**

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75 Years



1933-2008