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Fifth Eastern Caribbean Network Technical Group (E/CAR/NTG/5) and Third Eastern Caribbean Radar Data Sharing Ad-hoc Group (E/CAR/RD/3) Meetings
Guadeloupe, France, 22 to 24 October 2014

Agenda Item 5: Other Business

MULTILATERATION CONSIDERATIONS IN ECAR REGION: HIDDEN COSTS & COVERAGE LIMITATION FACTORS.

(Presented by Barbados)

EXECUTIVE SUMMARY

There are hidden costs associated with Wide Area Multilateration (WAM) that need to be factored into any cost analysis when comparing it to a SSR solution. These cost stem from the very nature of the MLat principle which requires multiple sites. These sites each will have a number of associated costs. Possible costs include (Acquisition, utility, maintenance, travel and additionally Communications).

Communications cost arise from the need to link the sites to the ATC Center.

The spread of sensors are important and can be a limiting factor in defining the limits of effective coverage meeting the required ED142 ICAO accuracy standard.

Agreements between states which allows for sensor spread to be increased by placing some sensors in neighbouring territories is a means of overcoming this limitation.

<i>Strategic Objectives:</i>	<ul style="list-style-type: none">• Safety• Air Navigation Capacity and Efficiency• Environmental Protection
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1. Introduction

Coverage & Accuracy

1.1 In considering the use of Multilateration as a Surveillance technique to be adopted in the Eastern Caribbean Region, issues such as the size of the territory, boundaries of its control zone, Terminal Manoeuvring Area, proximity and relationship with neighbouring islands need to be factored. There is a particular issue where the territories are small land masses as coverage range may be limited. Multilateration can however be shown to provide enhanced coverage in small states with area and Topography such as Barbados.

Hidden Costs

1.2 MLat has been touted as a more cost effective option to Mode S SSR; there are however associated cost considerations which result from the fact that in practice multiple sensors must be used. These must be distributed at least four locations for any practical Multilateration solution. These locations are sites that represent cost in themselves. These costs may include expenses associated with building, acquisition, utilities, and travel and maintenance costs.

1.3 These costs can be mitigated by identifying and using suitably located existing sites that can be shared with existing users.

Cost considerations

Site Costs

1.4 Multilat sensors must be distributed at least four locations for any practical Multilateration solution. This contrasts to MSSR solutions which require only one site. Each of these sites represent several cost. This cost may be Acquisition cost, Lease cost, Maintenance cost, Communications costs and Utility. These costs can be eliminated/mitigated by identifying and using suitably located shared sites.

1.5 Additionally, once operational, travel and maintenance cost are also to be factored.

Communications Costs

1.6 These sites all need to be connected back to the central processing ATC site. This results in the need for appropriate reliable communications infrastructure with its associated Communications costs.

1.7 Two possible approaches are use of Private Radio Links or Circuits on the existing public Telecommunications networks. This results in either or both Radio link equipment costs or lease line cost.

Accuracy and Territorial size Considerations

1.8 Accuracy and coverage: Multilateration studies and simulations for a country with the size and topography of Barbados, suggest that coverage meeting the ED142 standard May be limited to about 125 nautical miles.

1.9 This standard requires a horizontal position accuracy of less than 340 m for Enroute surveillance. The issue is that this accuracy falls off rapidly outside the area of the spread of the sensors. This has implications for other territories as with Multilateration size does appear to matter.

1.10 MLat sensors however need not to be all on the same island to be part of the same network. Depending on cooperative relationships with neighbouring territories this limitation can be eliminated. This issue then is one that can be addressed by the relevant states.

Conclusion:

1.11 From the table of faults reported and the operational errors experienced by AIS in Barbados, the following conclusions may be drawn.

- **Conclusion 1:** There are cost associated with Multilat as opposed to SSR Solutions, these include, multiple site acquisition cost, Lease cost, maintenance cost and Utility cost, Travel and Communications costs
- **Conclusion 2:** WAM coverage with the required Accuracy can be limited by the size of the territory and effective spread of the sensors.
- **Conclusion 3:** WAM Coverage and Accuracy issues covering large areas involving small territories can be effectively enhanced by having the sensor network include sensors on other territories.
- **Conclusion 4:** Territorial proximity and relationships are factors for consideration in WAM implementation in the region.
- **Conclusion 5:** Wide Area Multilateration studies and simulations for a country with the size and topography of Barbados, suggest that Coverage meeting the ED142 standard May be limited to about 125 nautical miles with enhanced low level coverage when compare to its existing MSSR low level coverage.