

# Surveillance and Broadcast Services



Federal Aviation Administration

## Wide Area Multilateration (WAM)

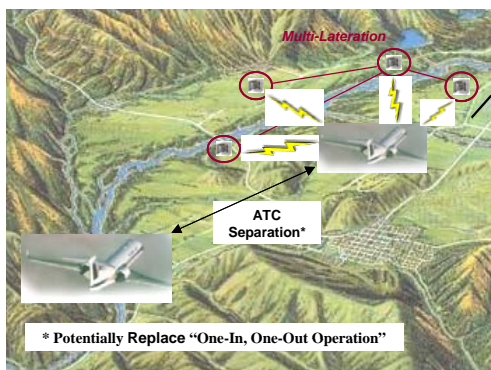
To: ICAO Surveillance Seminar  
By: Jim Linney, Program Manager  
Date: December, 2010



## Wide Area Multilateration (WAM)

- Multilateration - surveillance technology that employs multiple remote sensors throughout area to compensate for terrain obstructions.
- Data determines aircraft position and identification, processed for Air Traffic Control and provides En Route separation services

Typical Mountain Approach (Single Runway/mountain airport)



- Juneau, Alaska and Yampa Valley, Craig-Moffat, Steamboat Springs, Garfield County Regional in Colorado - first U.S. sites to receive multilateration systems (5nmi separation services).



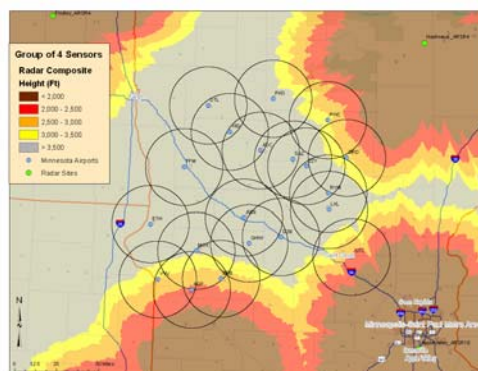
## Benefits of Multilateration

- **Enhanced Safety:** Increase safety by being able to see aircraft that are currently outside radar coverage
- **Improve Overall Flow Efficiency:** Improve arrival and departure efficiency
- **Benefits**
  - Backup surveillance for ATC separation services during an ADS-B outage
  - Acts as a surveillance source for TIS-B
- **Economic Benefits:** Reduce lost revenue due to diversions of flights to other than destination airports
  - Improved surveillance translates into more efficient flight tracks, which means less fuel burned and increased hourly capacity



## Function of Wide Area Multilateration

- FAA exploring in Colorado and possibly other sites
- WAM provides surveillance for non-radar areas
- Serves as a back-up for ADS-B after 2020
- Affords benefits for existing transponders, but at greater costs due to requirement to have 4 ground units see aircraft at all times



Example non-radar area in Minnesota



## Colorado WAM Phase 1

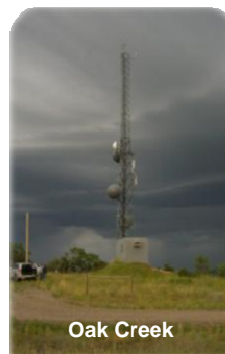
Phase 1 of the Colorado WAM System covers the En Route Services supporting the following regional Rifle and Hayden Airports:

**Hayden**

- Yampa Valley
- Craig-Moffat
- Steamboat Springs

**Rifle**

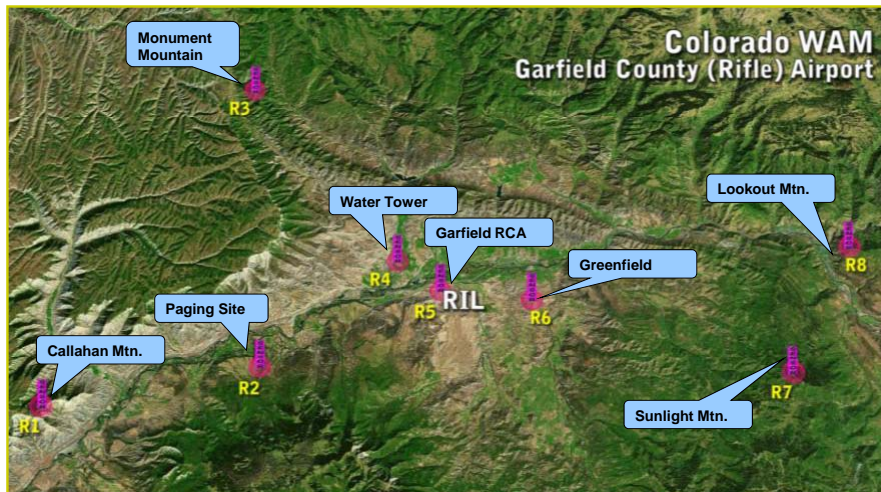
- Garfield County Regional



## Colorado WAM Hayden locations (12 locations)



## Colorado WAM Rifle locations ( 8 locations)



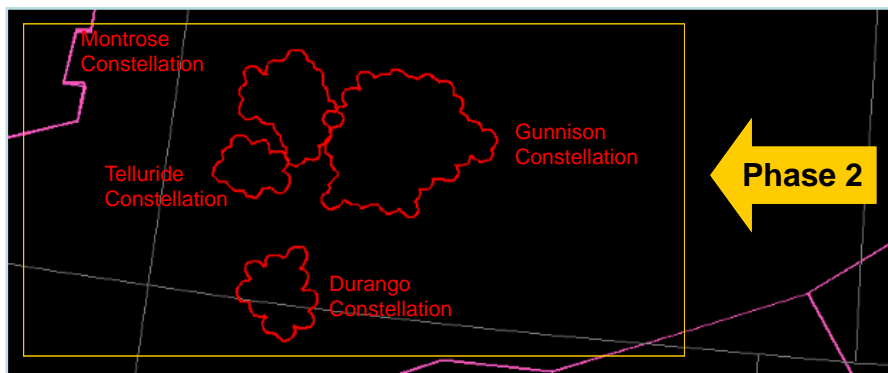
## Colorado WAM Phase 2

- **New service provider – ITT**
- **Risk reduction for SBS with multiple radio vendors on ITT contract**
- **Integrated WAM/ADS-B system**
- **Additional TIS-B/FIS-B (and ADS-B) coverage**



## Colorado WAM Phase 2 Schedule

- Automation Testing – October 2011
- ITT WAM Development & Test – February 2012
- Integration Test – April 2012
- IOC – June 2012



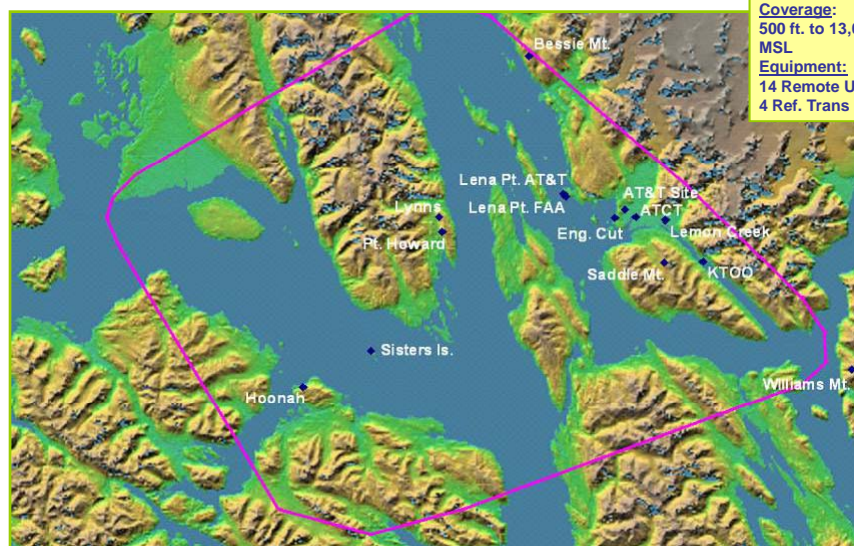
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## Juneau WAM Coverage



**Coverage:**  
500 ft. to 13,000 ft.  
MSL  
**Equipment:**  
14 Remote Units  
4 Ref. Trans

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## Example: Surveillance Alternatives Analysis

- **Following example of how FAA determining the appropriate surveillance solution**
- **FAA Acquisition and Systems Engineering Management processes**
- **Considers costs, benefits, risks, schedules and opportunities for each alternative**
- **This example represents one example where surveillance gap existed**

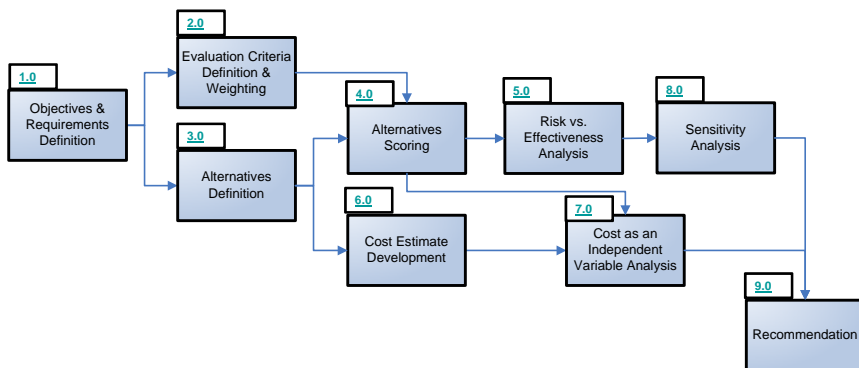


## Alternatives

- **Alternative #1: ATCBI-6 Secondary Surveillance**
  - Three ATCBI-6 radars
- **Alternative #2: ADS-B Surveillance**
  - Three ADS-B radio stations
- **Alternative #3: Wide Area Multilateration (WAM)**
  - 24 transmitter/receiver stations and an additional 6 receiver only units provide the required coverage

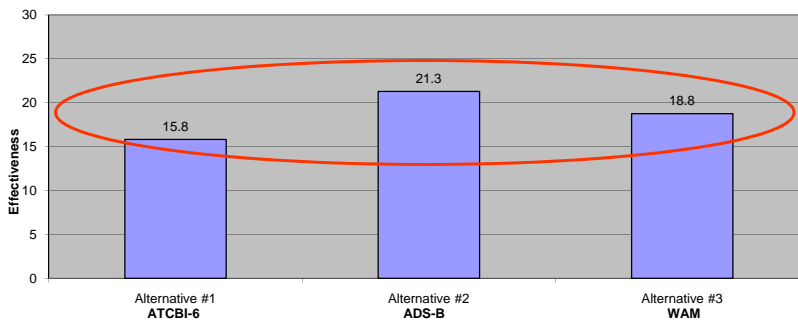


## Process Flow Diagram

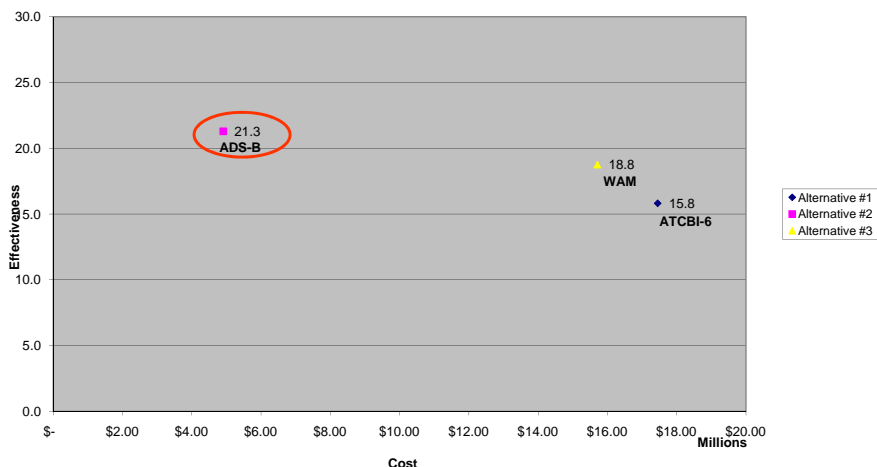


## Alternatives Effectiveness

Criterion	Sub-Criterion	Criterion Weights	Alternative #1	Alternative #2	Alternative #3
Coverage	Coverage Volume	35%	6.6	8.4	7.7
	Update Rate				
Performance	Service Availability	35%	5.6	6.8	5.7
	Accuracy				
Execution Schedule	Acquisition and Deployment Complexity	30%	3.7	6.1	5.3
Total		100%	15.8	21.3	18.8



## Example Cost vs. Effectiveness

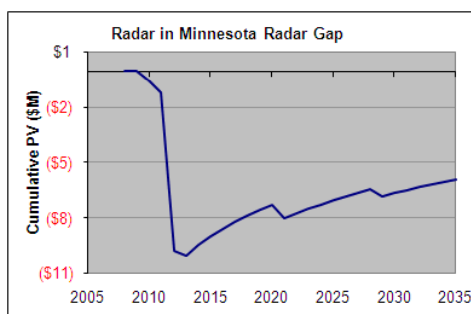


Note: Avionics cost is not included in this analysis



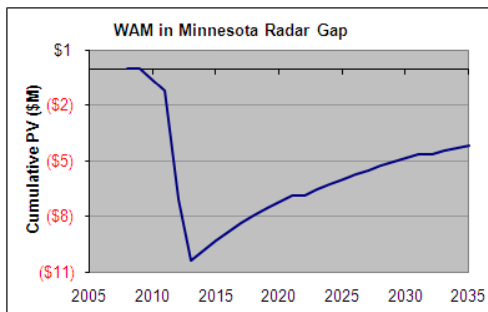
## Surveillance Business Case Results: Radar

Costs (PV \$M)	\$17.45
Benefits (PV \$M)	\$11.55
NPV \$M	(\$5.90)
B/C Ratio	0.7
IRR	NA
Payback Year	NA



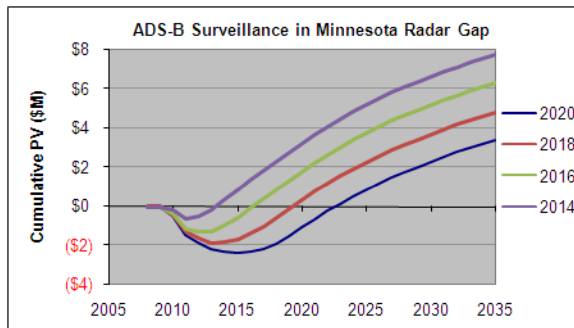
## Surveillance Business Case Results: Multi-Lat

Costs (PV \$M)	\$15.71
Benefits (PV \$M)	\$11.55
NPV \$M	(\$4.16)
B/C Ratio	0.7
IRR	2%
Payback Year	NA



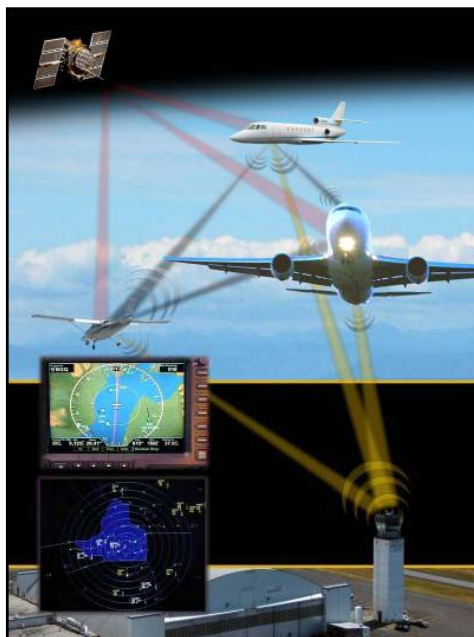
## Business Case Results: 4 ADS-B Equipage Scenarios

	2020	2018	2016	2014
Costs (PV \$M)	\$4.91	\$4.91	\$4.91	\$4.91
Benefits (PV \$M)	\$8.35	\$9.75	\$11.21	\$12.67
NPV \$M	\$3.44	\$4.84	\$6.31	\$7.76
B/C Ratio	1.7	2.0	2.3	2.6
IRR	15%	20%	29%	62%
Payback Year	2023	2020	2017	2014



## WAM Summary

- **WAM requires higher costs than ADS-B (more ground stations), but does give immediate benefits (not avionics dependent)**
- **WAM does drive costs and risks for distributed remote sites**
- **Choosing an alternative requires Costs to Benefits analysis**
  - Consider the need area (local or wide-area)
  - Consider who will benefit (air transport or general aviation)
  - Consider the lifecycle maintenance and any complexities for radio stations
- **WAM is a viable and proven surveillance product**
- **WAM allows for lower cost implementation (generically) over conventional long-range radars**
- **WAM serves as a viable back-up for ADS-B in the event of a GPS outage or failure**



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