

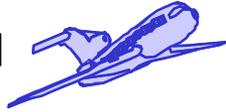


Summary of ADS-B Link Configuration Alternatives, Interoperability, and Preliminary Vendor Responses

October 19, 2001

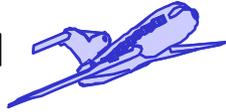
Briefer: Todd Stock (MITRE/CAASD)

Purpose and Discussion Topics



- Provide a summary of:
 - ADS-B link configurations examined by the link decision team
 - Interoperability between link configurations
 - Results of vendor submissions and follow-on meetings
- Discussion Topics:
 - Overview
 - ADS-B link configurations
 - Development of the 13 ADS-B link configurations
 - Interoperability (near-term vs. end state)
 - Responses from Vendors

Development of Link Configurations



- Candidate link architectures based on single and multiple link combinations
 - Single Links (1090ES, UAT, VDLM4)
 - Multi-Links (1090ES + second link or 1090ES + second and third link)
- Transmit-only and receive-only cases considered to permit examination of impacts on cost and interoperability
 - 1090ES and UAT Tx and Rx
 - VDLM4 Rx only
- 13 link configurations finalized based on 25-26 Jun 01 FAA-sponsored ADS-B link decision workshop

Single Link Configurations



Config Number	Config Description	GA Low/Mid	GA High/Corp	Transport (Non-PFD)	Transport (Integ PFD)
1 (CRC)	Single Link: 1090ES	Mode S 1090ES	Mode S 1090ES	Mode S TCAS 1090ES	Mode S TCAS 1090ES
2	Single Link: UAT	Mode A/C UAT	Mode A/C UAT	Mode S TCAS UAT	Mode S TCAS UAT
3	Single Link: VDLM4	Mode A/C VDLM4	Mode A/C VDLM4	Mode S TCAS VDLM4	Mode S TCAS VDLM4

Multi-Link Configurations: 1090ES + UAT



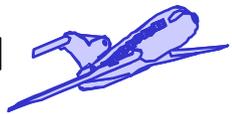
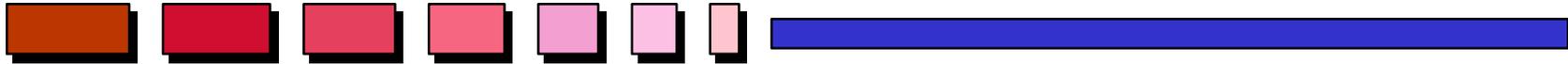
Config Number	Config Description	GA Low/Mid	GA High/Corp	Transport (Non-PFD)	Transport (Integ PFD)
4	Multi-Link: 1090/UAT	Mode S 1090ES UAT	Mode S 1090ES UAT	Mode S TCAS 1090ES UAT	Mode S TCAS 1090ES UAT
5	Multi-Link: 1090 with UAT Tx-Only	Mode S 1090ES UAT Tx	Mode S 1090ES UAT Tx	Mode S TCAS 1090ES UAT Tx	Mode S TCAS 1090ES UAT Tx
6	Multi-Link: 1090 with UAT Rx-Only	Mode S 1090ES UAT Rx	Mode S 1090ES UAT Rx	Mode S TCAS 1090ES UAT Rx	Mode S TCAS 1090ES UAT Rx
7	Multi-Link: UAT with 1090 Tx-Only	Mode A/C 1090ES Tx UAT	Mode A/C 1090ES Tx UAT	Mode S TCAS 1090ES Tx UAT	Mode S TCAS 1090ES Tx UAT
8	Multi-Link: UAT with 1090 Rx-Only	Mode A/C Xpdr 1090ES Rx UAT	Mode A/C 1090ES Rx UAT	Mode S TCAS Rx 1090ES UAT	Mode S TCAS Rx 1090ES UAT

Multi-Link Configurations: 1090ES+VDLM4



Config Number	Config Description	GA Low/Mid	GA High/Corp	Transport (Non-PFD)	Transport (Integ PFD)
9	Multi-Link: 1090/VDLM4	Mode S 1090ES VDLM4	Mode S 1090ES VDLM4	Mode S TCAS 1090ES VDLM4	Mode S TCAS 1090ES VDLM4
10	Multi-Link: 1090 with VDLM4 Rx- Only	Mode S 1090ES VDLM4 Rx	Mode S 1090ES VDLM4 Rx	Mode S TCAS 1090ES VDLM4 Rx	Mode S TCAS 1090ES VDLM4 Rx
11	Multi-Link: VDLM4 with 1090 Tx-Only	Mode A/C 1090ES Tx VDLM4	Mode A/C 1090ES Tx VDLM4	Mode S TCAS 1090ES Tx VDLM4	Mode S TCAS 1090ES Tx VDLM4
12	Multi-Link: VDLM4 with 1090 Rx-Only	Mode A/C 1090ES Rx VDLM4	Mode A/C 1090ES Rx VDLM4	Mode S TCAS Rx 1090ES VDLM4	Mode S TCAS Rx 1090ES VDLM4

Multi-Link Configurations: Triple-Link



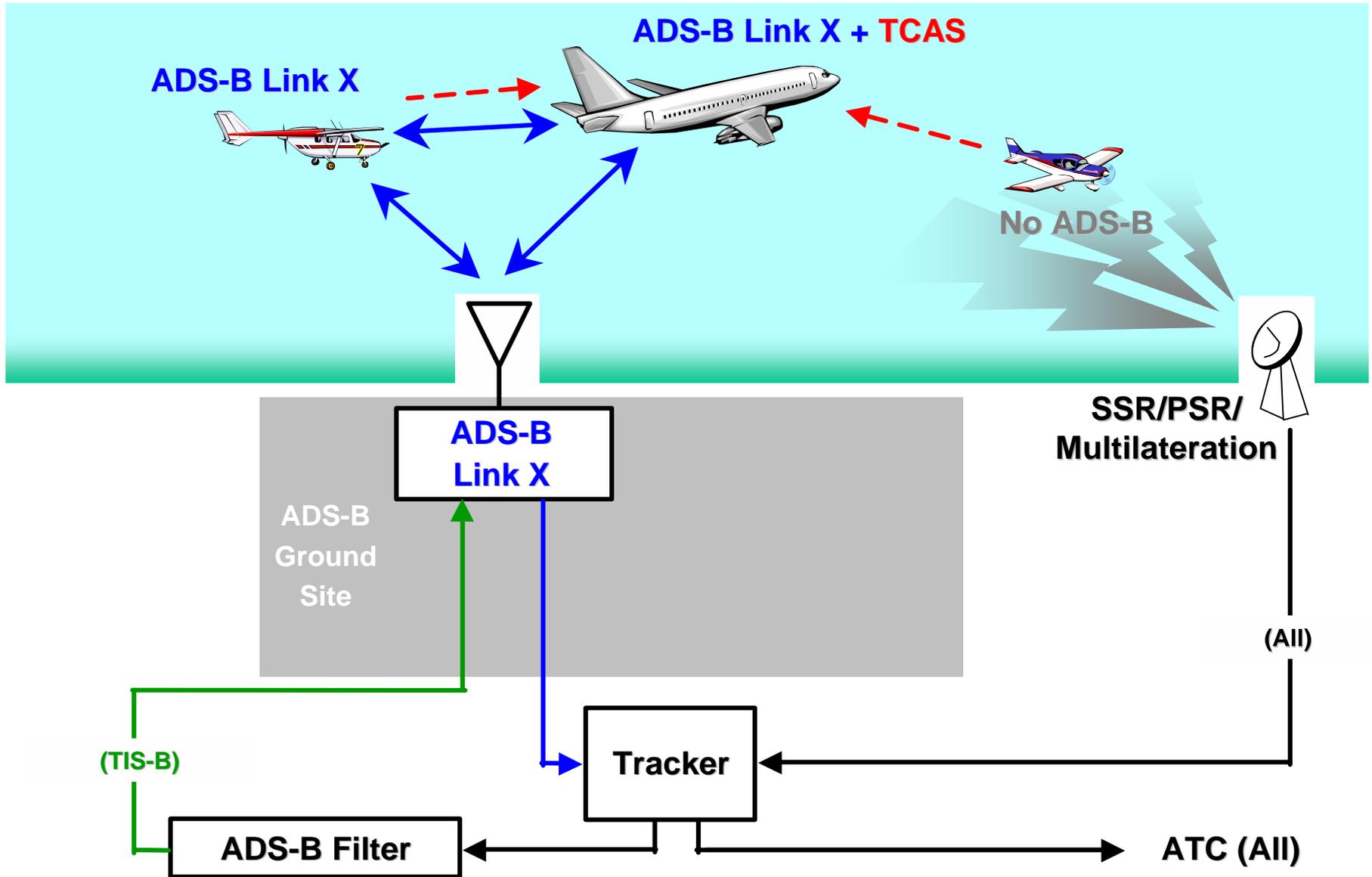
Config Number	Config Description	GA Low/Mid	GA High/Corp	Transport (Non-PFD)	Transport (Integ PFD)
13	Multi-Link: Triple-Link	Mode S 1090ES UAT VDLM4	Mode S 1090ES UAT VDLM4	Mode S TCAS 1090ES UAT VDLM4	Mode S TCAS 1090ES UAT VDLM4

Link Interoperability

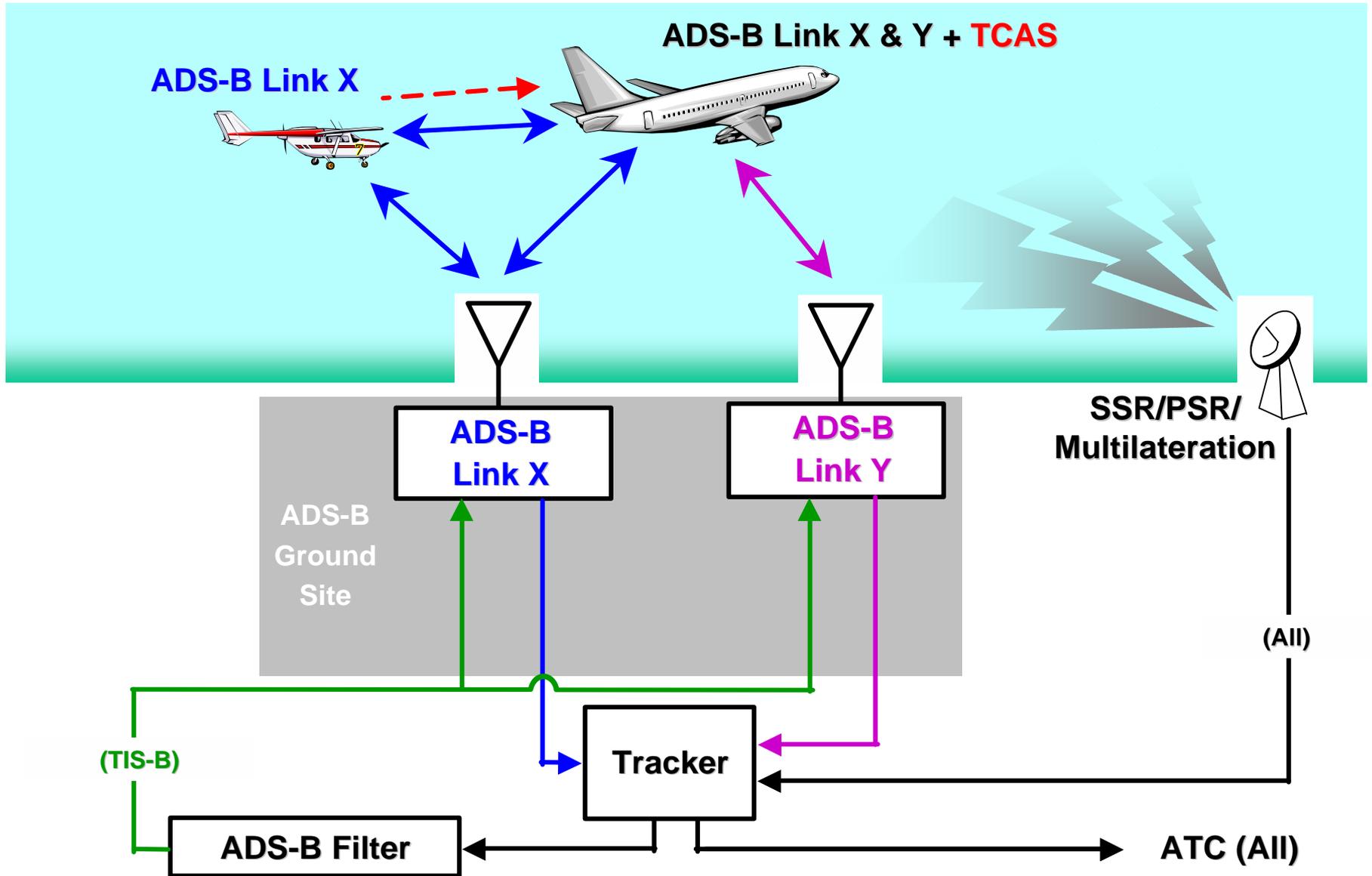


- Link interoperability may be:
 - One-way or two-way
 - One-way interoperability based on at one aircraft in pair with compatible receive capability and other with compatible transmit capability
 - Two-way interoperability based on both aircraft with compatible transmit and receive capability
 - Enabled by ADS-B ground station when compatible cross-link gateway function is operating
 - Interoperability limited to service volume of specific gateway

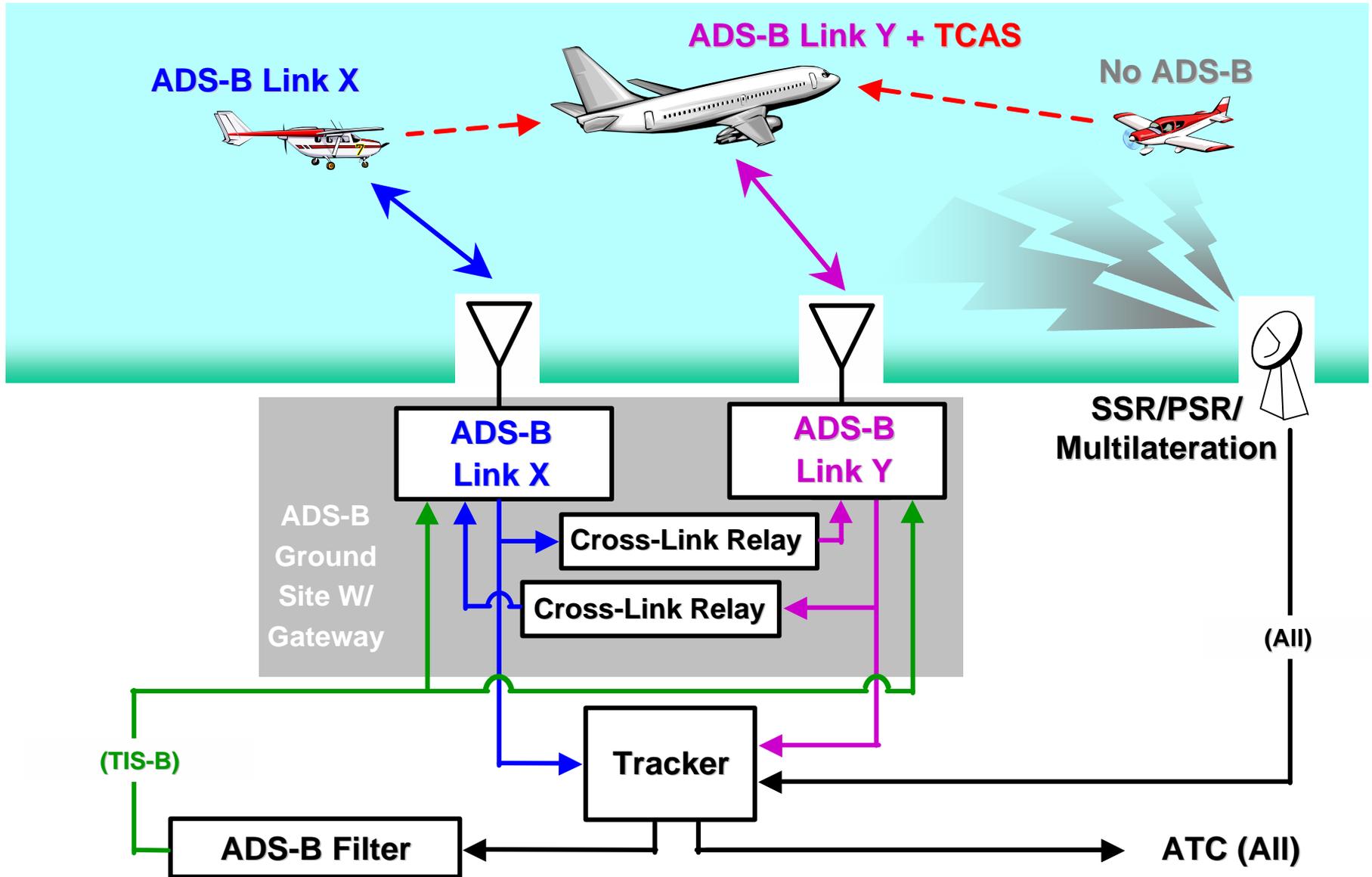
Interoperability for Single-Link ADS-B (With TIS-B)



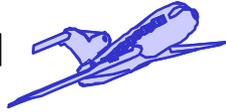
Interoperability for Multi-Link ADS-B (With TIS-B)



Interoperability Through ADS-B Gateway (With TIS-B)



Preliminary Responses from Vendors



- Responses for all configurations received from vendors in all market segments
 - Some responses in each segment based on full preliminary design efforts (v. first order approximations)
 - Significant time and effort expended by all vendors in developing and refining responses
- Follow-up meetings/teleconferences/site visits conducted with all responding vendors

Initial Findings



- No vendor interest in A0 (VFR) configurations
- Air carrier vendors selected transponder, TCAS , and ‘new box’ integration schemes
 - No significant cost advantages associated with any integration scheme for single ADS-B system installations
 - All VDL4 and some 1090ES/UAT combinations required additional boxes
 - Display & GPS upgrade requirements, installation, and certification costs appeared to dominate total system cost estimates
- Preliminary vendor estimates and feed-back provided CBA team with sufficient data to develop equipage scenarios