



The ADS-B Link Decision Workshop Session B: User Breakout Session

June 25, 2001

Facilitator: Col. Allan Overbey, USAF



Objectives

- **Review baseline assumptions**
 - Baseline set of ADS-B enabled applications and availability timeframe
- **Review types of data required for the cost/benefit analysis**
 - Equipage models
- **Review desired user inputs**
- **Collect user inputs that will help estimate the expected rate of ADS-B user equipage (worksheets)**
 - Sensitivity of equipage rates to benefits offered
 - Sensitivity of equipage rates to costs

Baseline Assumptions

Jim Baird, FAA/ASD-140



Assumptions

- **National deployment of the ADS-B ground infrastructure in support of the OEP applications will occur between 2006 and 2010**
- **There are five applications in the OEP that reference ADS-B technologies:**
 - AD-5: Expand Use of 3-Mile Separation Standard
 - AD-6: Coordinate for Efficient Surface Movement
 - AD-7: Enhance Surface Situational Awareness
 - AW-2: Space Closer to Visual Standards
 - ER-5: Reduce Offshore Separation
- **For the purposes of our analysis, all applications will deliver their expected benefits to some degree, if supported by the chosen link(s).**



Assumptions: Baseline Application Set

- **OEP/AD-5: Expand Use of 3-Mile Separation Standard**
 - **Expanded use of 3-mile separation standards and terminal separation procedures**
 - Identify opportunities to maximize the use of the 3-mile separation standard for additional airspace efficiency
 - Deriving equivalent position accuracy as that within 40 miles of a radar may be achievable through evolving technologies like ADS-B
 - Related to SF21 Apps 8.2: Radar-Like Services with ADS-B, and 8.3: (VFR) Tower Situational Awareness with ADS-B



Assumptions: Baseline Application Set (ctd)

- **OEP/AD-6: Coordinate for Efficient Surface Movement**
 - Improved planning, movement, and decision-making due to shared situational awareness of surface operations
 - Use of a Surface Management System (with other technologies) will increase shared situational awareness between ATCT, Ramp Tower, TRACON, ARTCC, and air carriers
 - ADS-B will provide accurate down-link of GPS-based position reports for equipped aircraft and some vehicles
 - TIS-B will provide fused position reports of all aircraft and vehicles, whether ADS-B equipped or not
 - With AD-7, related to SF21 Apps 6.2: Airport Surface Situational Awareness, and 7.1: Enhance Existing Surface Surveillance with ADS-B



Assumptions: Baseline Application Set (ctd)

- **OEP/AD-7: Enhance Surface Situational Awareness**
 - **Improve surface navigation and traffic situational awareness with cockpit-based tools**
 - Cockpit-based tools provide more robust surface navigation increasing pilot awareness of the aircraft's position on the airport surface
 - Other aircraft and surface vehicle traffic would also be displayed on a cockpit moving map for airports providing this added information via ADS-B/TIS-B
 - With AD-6, related to SF21 Apps 6.2: Airport Surface Situational Awareness, and 7.1: Enhance Existing Surface Surveillance with ADS-B



Assumptions: Baseline Application Set (ctd)

- **OEP/AW-2: Space Closer to Visual Standards**
 - **Using cockpit tools and displays to achieve VMC throughput capacity in all weather conditions**
 - Help the pilot, through the use of ADS-B/CDTI, visually acquire and identify an aircraft that has been referenced as traffic by ATC, so the controller may clear the aircraft for a visual approach
 - Ability to continue visual approaches into marginal VMC
 - Maintain closer spacing during the approach phase to parallel runways
 - Related to SF21 Apps 4.1.x: Enhanced Visual Acquisition of Other Traffic for See-and-Avoid, 3.1.x: Enhanced Visual Approaches, and 3.2.1: Approach Spacing for Visual Approaches



Assumptions: Baseline Application Set (ctd)

■ OEP/ER-5: Reduce Offshore Separation

– Provide communication, navigation, and surveillance services similar to domestic en route airspace

- Gulf of Mexico operations will be changed to allow the use of domestic en route standards and procedures
- Appropriate CNS enhancements should be provided for high altitude users (>FL290 across whole Gulf) and for offshore users (>1500 feet in oil exploration/production areas).
- A combination of radar and/or ADS-B surveillance in the Gulf may enable further reductions in aircraft separation



Assumptions: Other Candidate Applications

(Details can be found in the workbook)

■ Terminal Spacing

- SF21/3.2.2: Approach Spacing for Instrument Approaches
- SF21/3.4: Departure Spacing/Clearance (VMC/Radar)

■ Conflict Management

- SF21/4.2.1: Conflict Detection
- SF21/4.2.2: Conflict Resolution

■ Surface

- SF21/6.1.x: Runway and Final Approach Occupancy Awareness
- SF21/7.2: Surveillance Coverage at Airports without Existing Surface Surveillance



Assumptions: Other Candidate Applications (ctd)

■ En Route

- SF21/5.2.1: Pilot Situational Awareness Beyond Visual Range

■ Radar Augmentation

- SF21/9.1: Radar Augmented with ADS-B in Terminal Airspace
- SF21/9.2: Radar Augmented with ADS-B in En Route Airspace

■ Weather in the Cockpit

- SF21/1.1.x: FIS-B

(Although not an ADS-B application, it could potentially share the same link)

Benefits & Equipage Models

Anne Rurup, FAA/ASD-410



Equipage Models

- **Established equipage models for GA and Air Taxi and for Air Carrier for range of avionics costs**
 - **NAS-wide**
 - **Ohio River Valley (ORV)**
 - **Capstone**
- **Built curves in Analytica for the cases of**
 - **Independent equipage (benefit to be realized when only one is equipped)**
 - **Dependent equipage (both aircraft must be equipped to realize benefit)**
 - **Mixed equipage (ADS-B equipped aircraft can benefit if other aircraft is transponder equipped)**



CONUS Equipage

Existing Equipment	Population Percentage	Equipage Assumptions			Overall Equipage Level
		Initial Air-to-Air	Additional Ground Stations	Total	
Transponder and Precision Equipment	69.0%	15.0%	40.0%	55.0%	38.0%
Transponder Only	13.6%	5.0%	30.0%	35.0%	4.8%
No Transponder	17.4%	0.0%	0.0%	0.0%	0.0%
Total	100.0%				42.7%

GA Equipage Assumptions

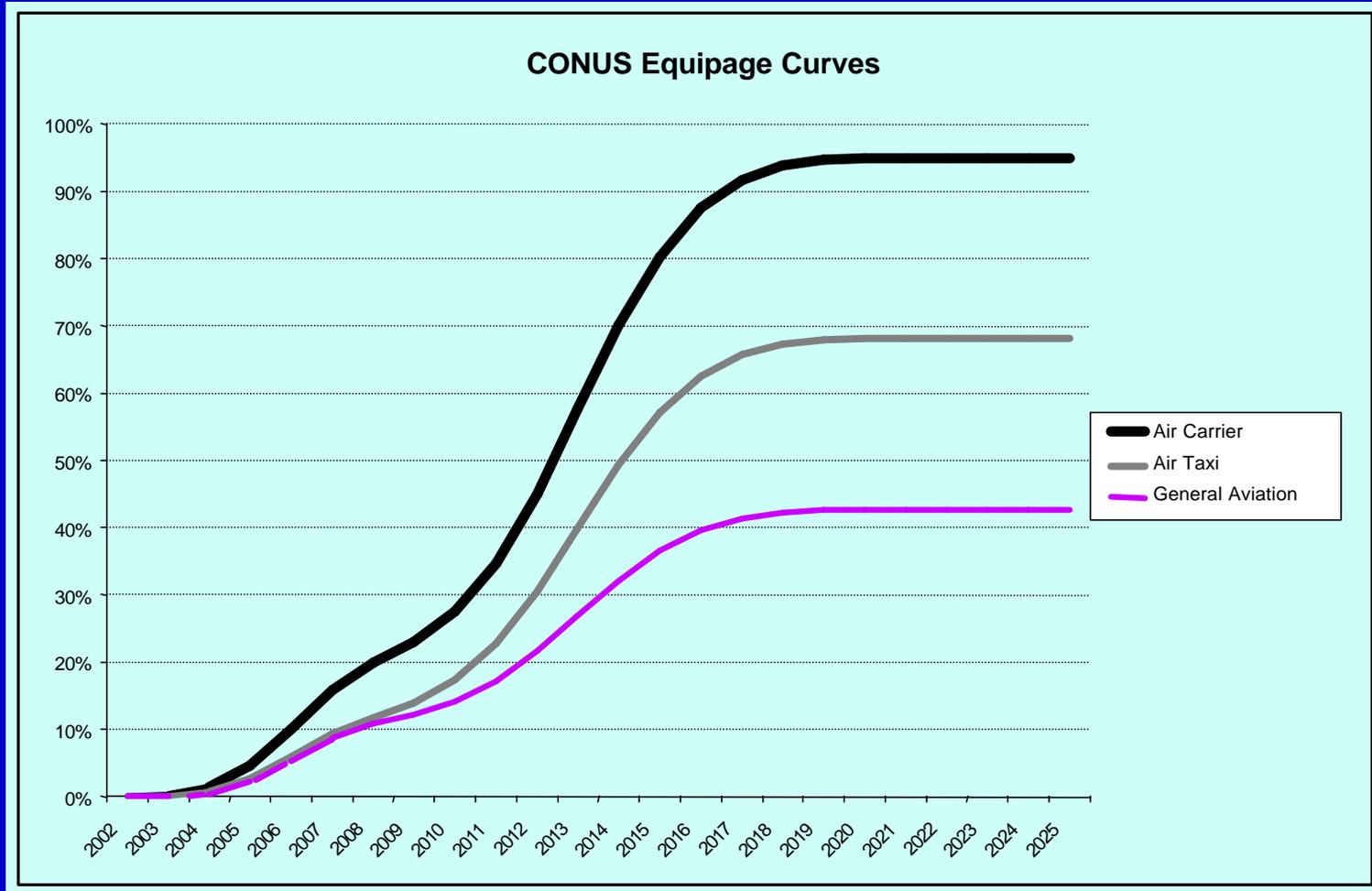
Existing Equipment	Population Percentage	Equipage Assumptions			Overall Equipage Level
		Initial Air-to-Air	Additional Ground Stations	Total	
Transponder and Precision Equipment	69.0%	15.0%	70.0%	85.0%	58.7%
Transponder Only	13.6%	10.0%	60.0%	70.0%	9.5%
No Transponder	17.4%	0.0%	0.0%	0.0%	0.0%
Total	100.0%				68.2%

Air Taxi Equipage Assumptions

- For Air Carrier operators, a total of 95% of the aircraft are assumed to equip. An initial 20% is expected solely based on air-to-air capabilities. An additional 75% is assumed to be motivated to equip due to the ground station installations



CONUS Equipage Curves



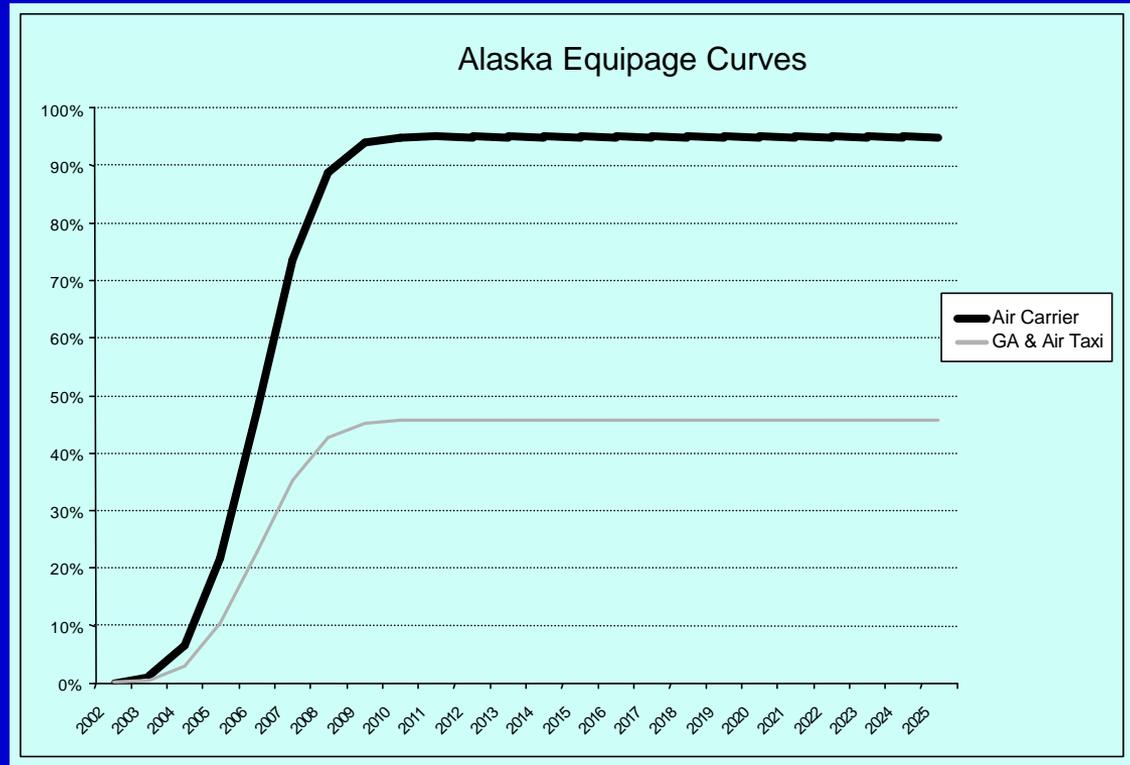


Capstone Equipage

Existing Equipment	Population Percentage	Equipage Assumptions			Overall Equipage Level
		Initial Air-to-Air	Additional Ground Stations	Total	
Transponder and Precision Equipment	32.4%	10.0%	65.0%	75.0%	24.3%
Transponder Only	17.9%	5.0%	45.0%	50.0%	9.0%
No Transponder	49.7%	0.0%	25.0%	25.0%	12.4%
Total	100.0%				45.7%

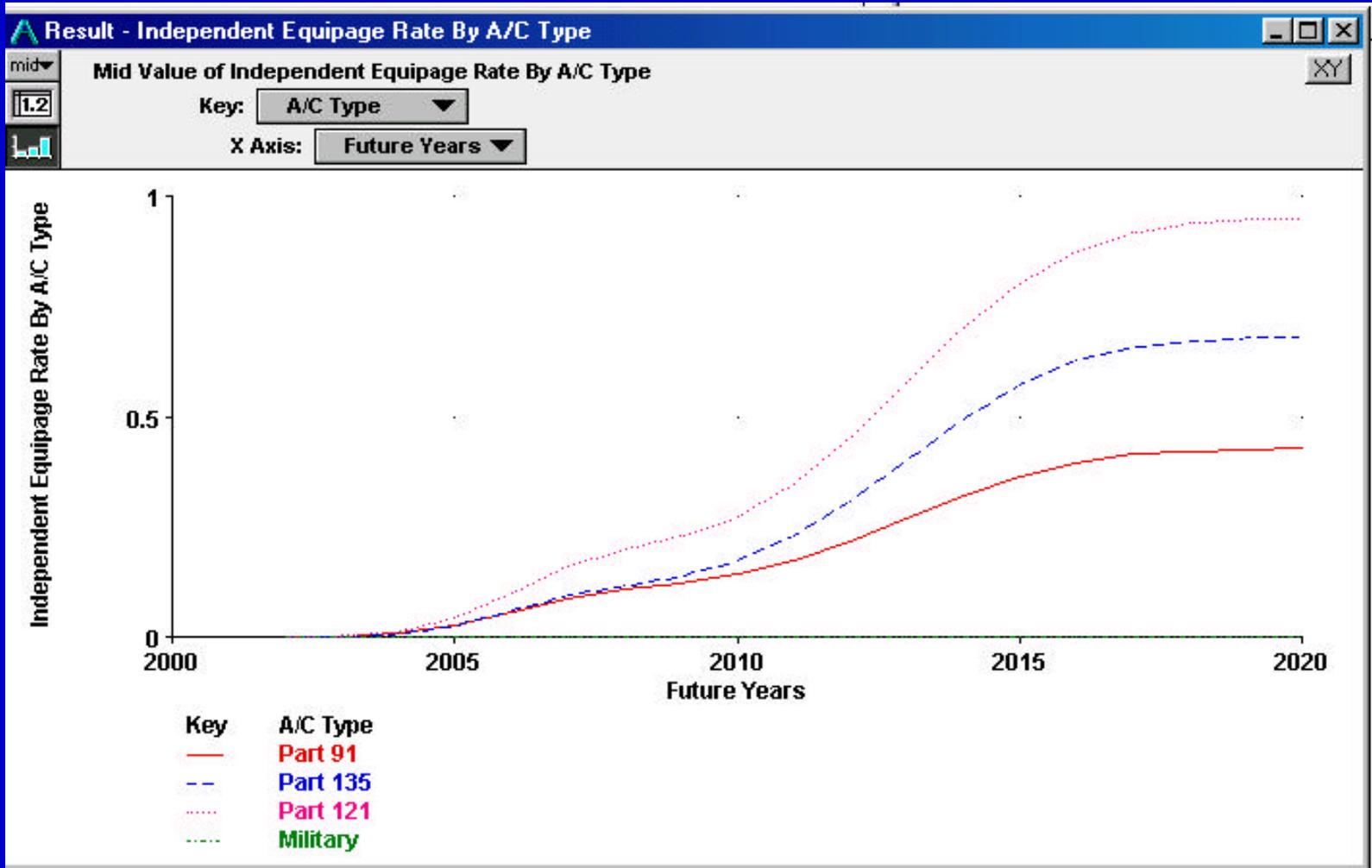
GA and Air Taxi Equipage

- Air carrier operators will equip at a level consistent with what is estimated for the CONUS.



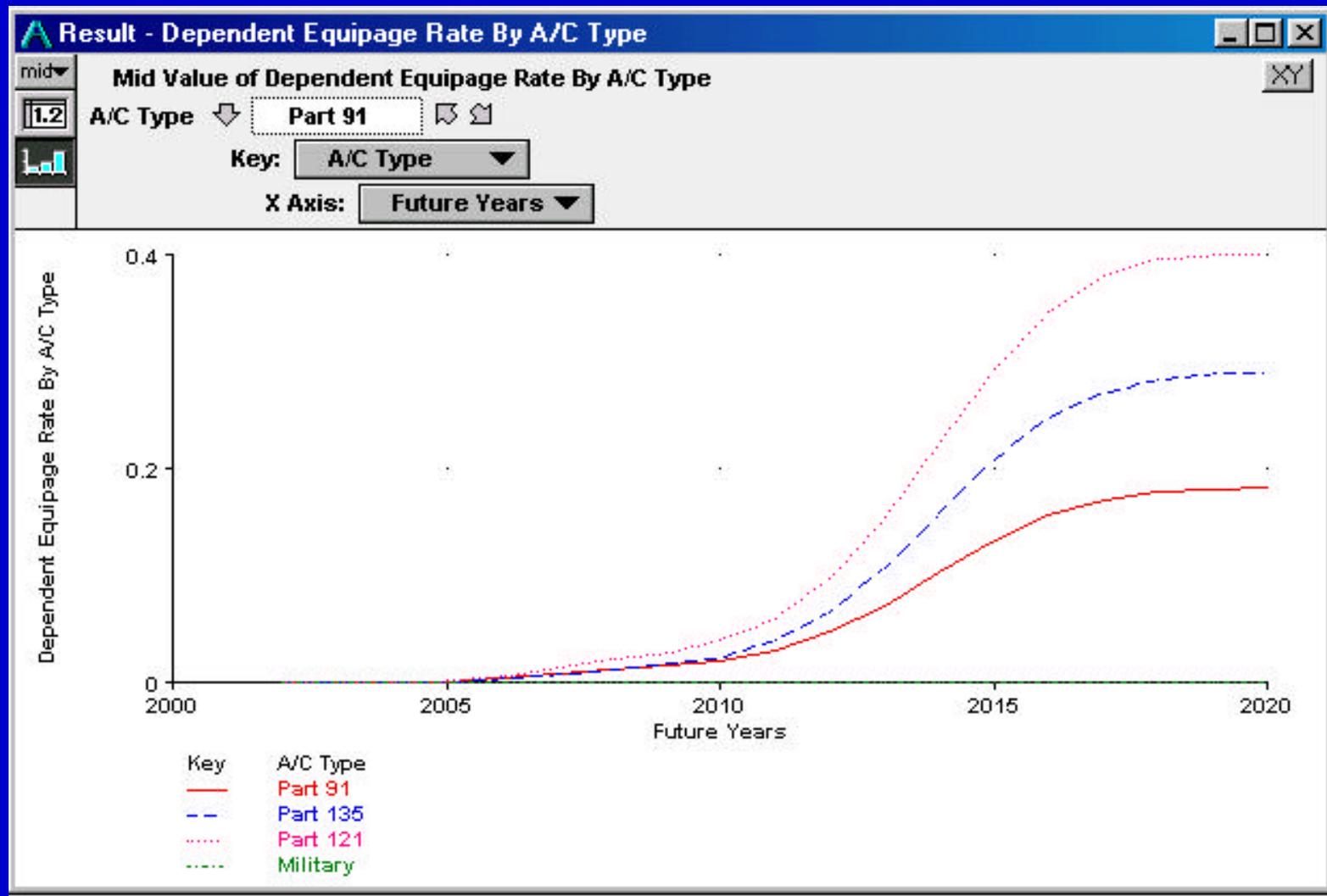


Example of Independent NAS-Wide Equipage



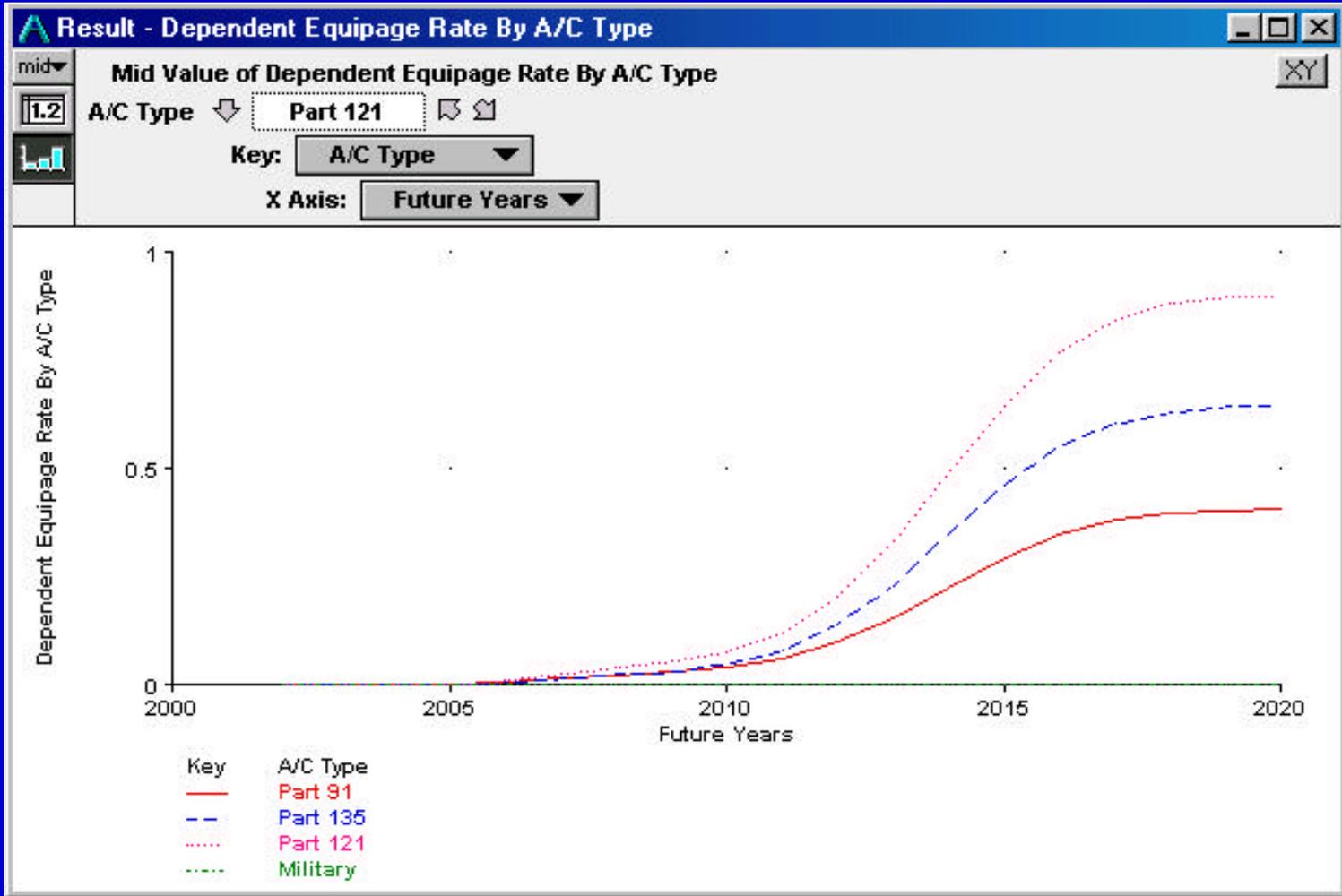


Example of Dependent NAS-Wide Equipage for GA



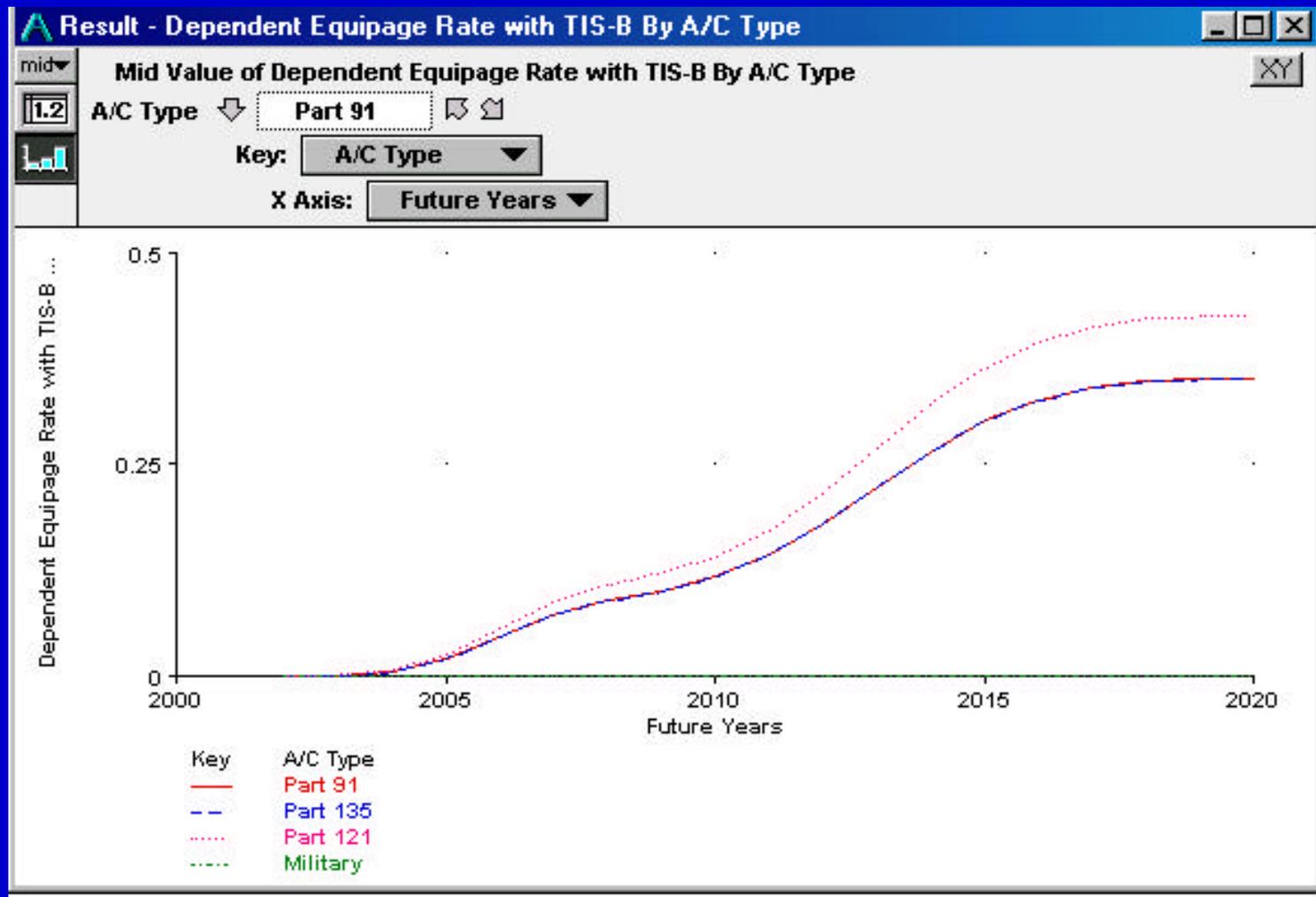


Example of Dependent NAS-Wide Equipage for Part 121



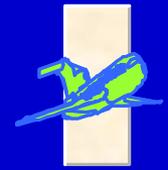


Example of Dependent NAS-Wide Equipage w/TIS-B for Part 91



Desired User Inputs & Worksheets

Jim Baird, FAA/ASD-140



Desired User Inputs (Worksheets)

- **Application priorities**
- **Minimum required application set**
- **Near/Medium/Long range plans**
- **Expected cost range**
- **Expected equipage rates**
- **Deterrents to equipage**
- **Other constraints**