



**Federal Aviation
Administration**

ADS-C Oceanic In-Trail Procedures (ITP)

Presented to: ISPACG
By: The FAA
Date: March, 2007

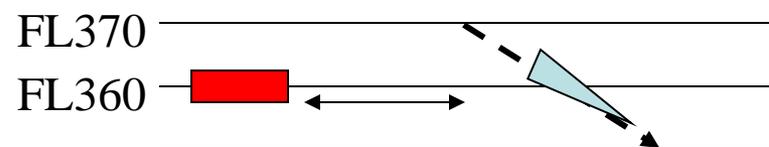
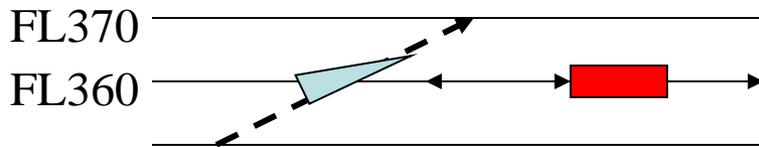


Introduction ADS-C In-Trail Climb or Descent Procedure

- **The FAA is conducting a concept analysis for an oceanic In-Trail Climb or Descent Procedure (ITP)**
 - Climb/descent to a Requested Flight Level through one intermediate FL occupied by a blocking aircraft
 - Based on ADS-C reports and new ATC procedures
 - Builds on domestic DME rules in ICAO Doc. 4444, paragraph 5.4.2.3.2.3 and FAAO 7110.65, 6-4-2, c.1
 - Incorporate lessons learned from TCAS ITP, ADS-B ITP
- **This briefing presents initial analysis**
 - Need to refine and validate, identify issues
 - Work in progress

Introduction (continued)

- **ADS-C ITP will have a smaller longitudinal separation minima (10 nm) than standard rules (e.g., 30 nm, 50 nm) with aircraft at intermediate flight levels**
- **ADS-C ITP is a controller initiated procedure**
- **Controller is responsible for ensuring separation with all aircraft (assisted by Ocean21 conflict probe and tools)**



Current Status

- **Business Case/Concept Analysis Began in Dec '06**

Cost/benefits

Controller workload

Schedule

Procedure alternatives

Implementation strategies

- **International Coordination is ongoing**

- Coordination for Atlantic development began at the Sept. AP-22 meeting in Glasgow

- Group agreed to assess ADS-C ITP in the Atlantic, share information, and coordinate future planning

Strategy for ADS-C In Trail Procedures Business Case

- **ZOA benefits analysis**
 - Frequency of ADS-C ITP events
 - Distance and time intervals at higher altitudes
 - Estimate fuel burn savings within Oakland airspace
- **Review and revise ADS-C ITP concept to identify business case parameters and preliminary risk issues**
- **Cost estimate (Rough Order of Magnitude) for ADS-C ITP development and implementation**
- **June 2007 Initial Decision Point**
 - Conclude business case if Oakland fuel benefits justify proceeding with next steps
 - Conduct additional benefits analysis
 - for other airspace volumes
 - benefits from increases in cargo carried or decreases in fuel carried (e.g., from other sources such as the ADS-B ITP work by CSSI)
 - Terminate based on unsupported benefits case



Analysis Issues

- **Additional analysis needed to determine performance criteria and procedural steps such as**
 - Definition of simultaneous reports
 - Maximum time from granting clearance to aircraft reestablishing vertical separation
 - Guidelines for maximum converging speed and initial separation distance (similar to TCAS ITP conditions)
 - Initial separation distance from Ocean21 displays
- **Hazard analysis and safety assessment (collision risk) needed**

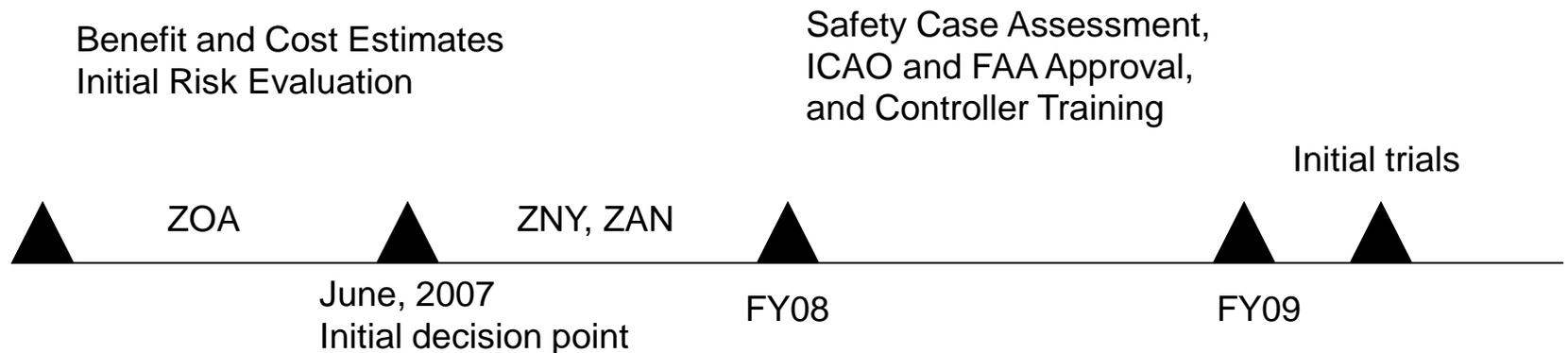
ADS-C ITP Next Steps

- Complete concept analysis, issues, and initial procedure
- Estimate controller workload effect on ADS-C ITP
- Estimate oceanic benefits in ZOA, ZAN, and ZNY
- Safety assessment and hazard analysis
- ICAO approval process
- Develop plan for ADS-C ITP implementation



ADS-C ITP Development Timeline

- FY07: Business case development
- FY08: Safety case assessment, ICAO/FAA approval
- FY09: Operational trials



Background Slides



ADS-C ITP Cases (Phase 1 Cases)

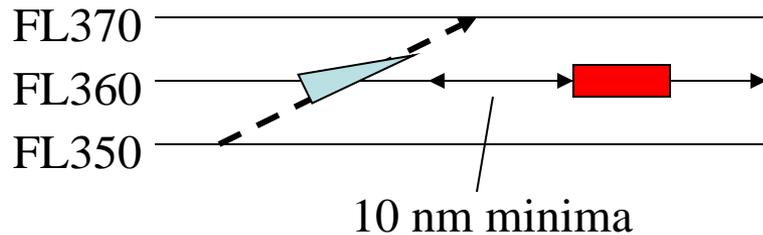


Blocking aircraft

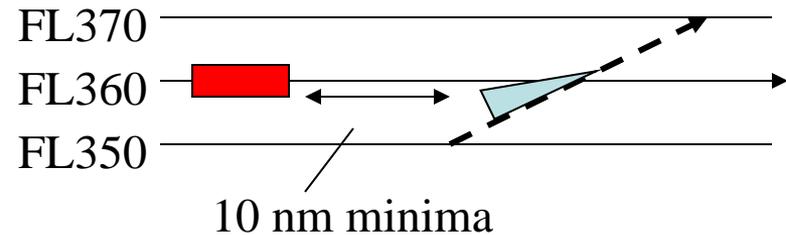


Requesting aircraft

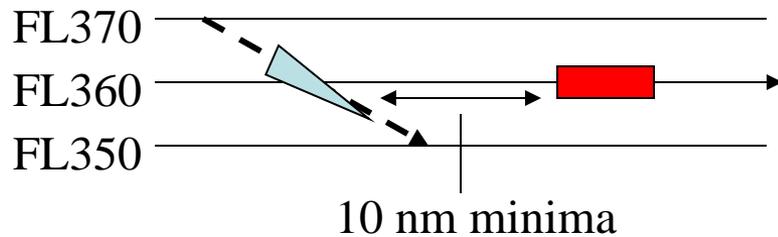
Trailing Climb



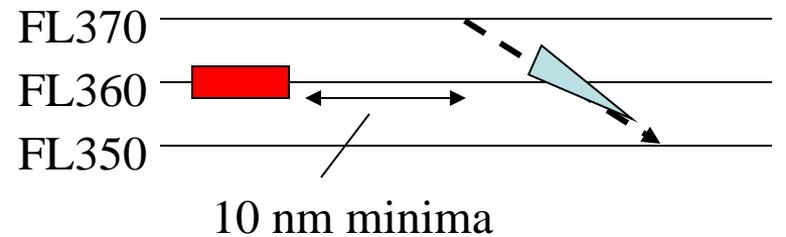
Leading Climb



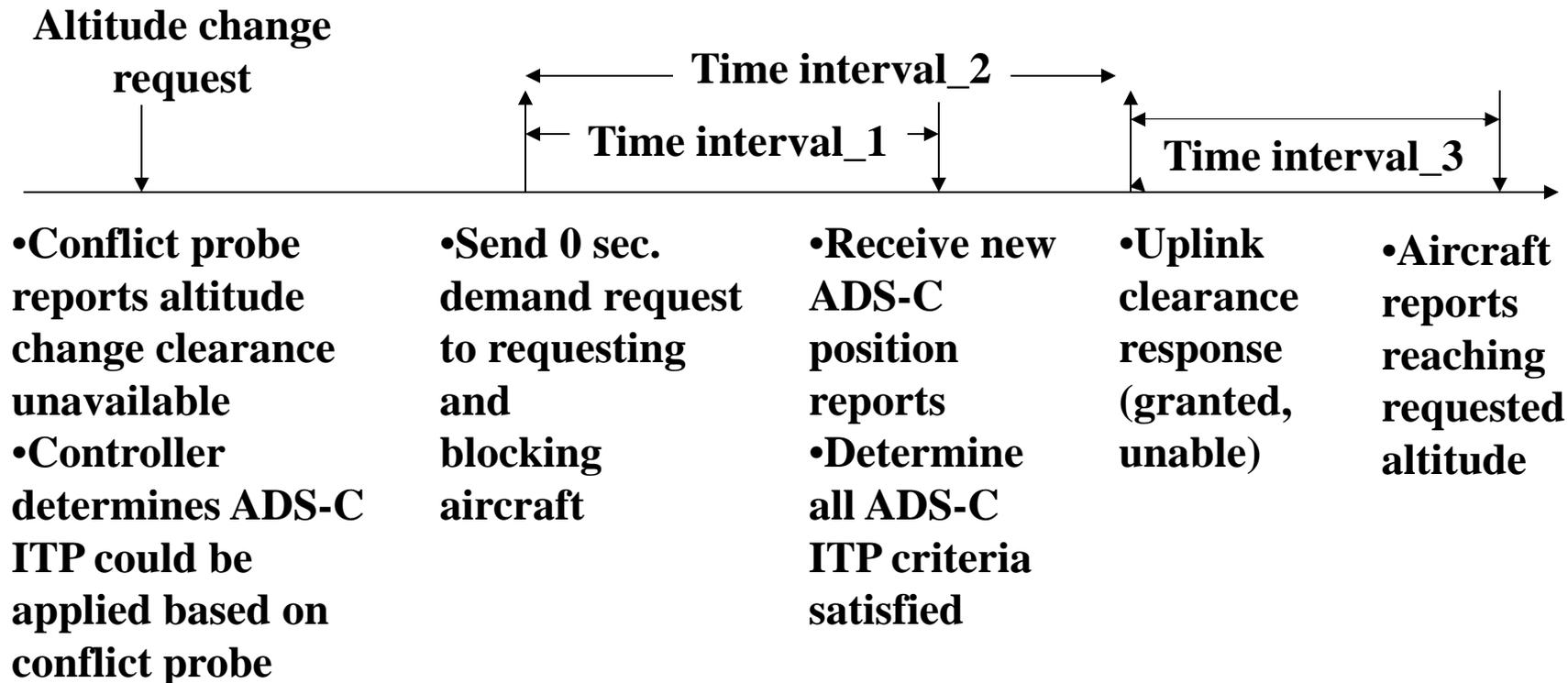
Trailing Descent



Leading Descent



ADS-C ITP Concept Timeline



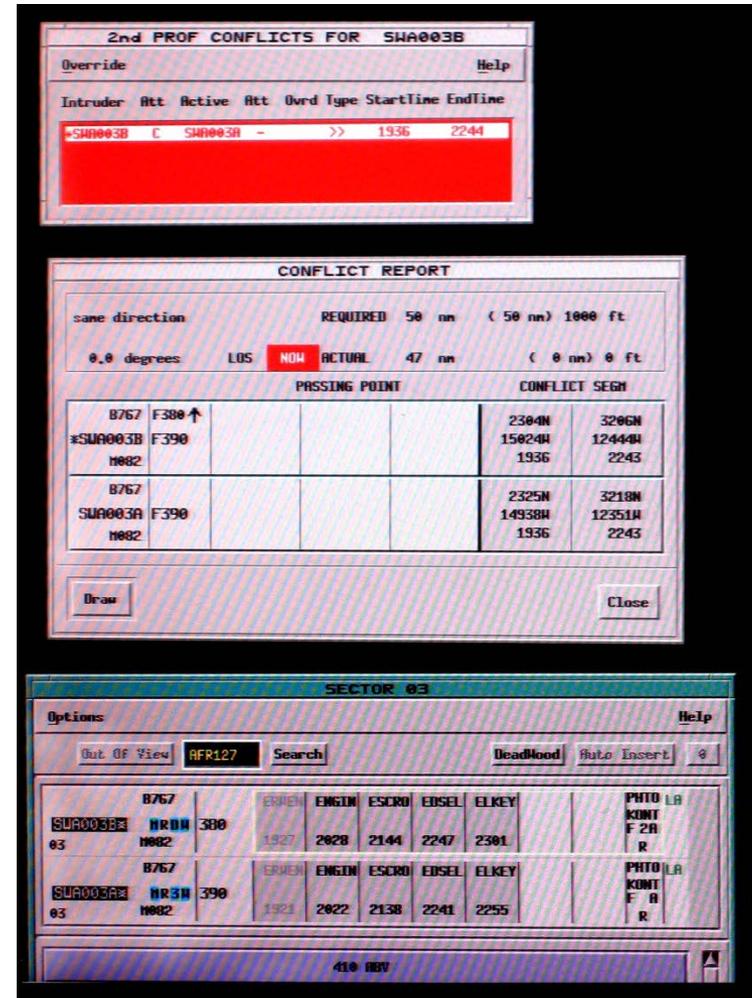
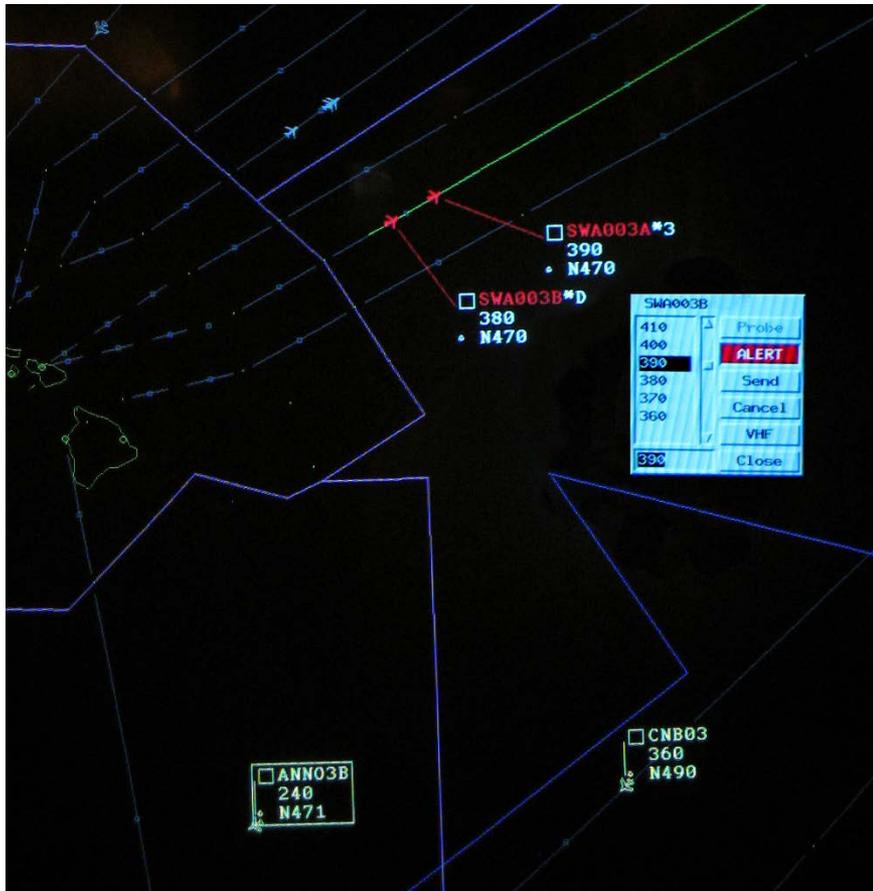
ADS-C ITP Concept Overview

Preconditions:	
10 nm longitudinal separation minima while vertical separation is lost	Doc 4444, 5.4.2.3.2.3
Direct controller pilot communication	Doc 4444, 5.4.2.3.1
One aircraft maintains level (blocking aircraft)	Doc 4444, 5.4.2.3.2.3 (b)
Same track	Doc 4444, 5.4.2.3.2.3
Simultaneous position reports (issue)	Doc 4444, 5.4.2.3.2.3 (c)
High-level summary of steps:	
Aircraft downlinks a CPDLC altitude change request; controller initiated	
Request checked for conflicts, conflict attributes displayed	Ocean21 displays
Requesting, blocking aircraft are ADS-C equipped	Ocean21 displays
Blocking aircraft within parameter distance (2000 feet) of start altitude	Ocean21 displays
Controller initiates ADS-C demand contract 0 sec. to both aircraft (see last slide for RNAV ADS)	Re Doc 4444, 5.4.2.3.2.3 (c)
Controller verifies new position reports received, trial amendment probe	Ocean21 displays
Controller verifies ADS-C ITP conditions are met (study issue)	Ocean21 displays
Controller establishes 10 nm longitudinal separation minima (study issue)	Ocean21 displays



Example of Trial Amendment Displays

Conflict aircraft, speeds, and geometry



Air Traffic Management (PANS-ATM)

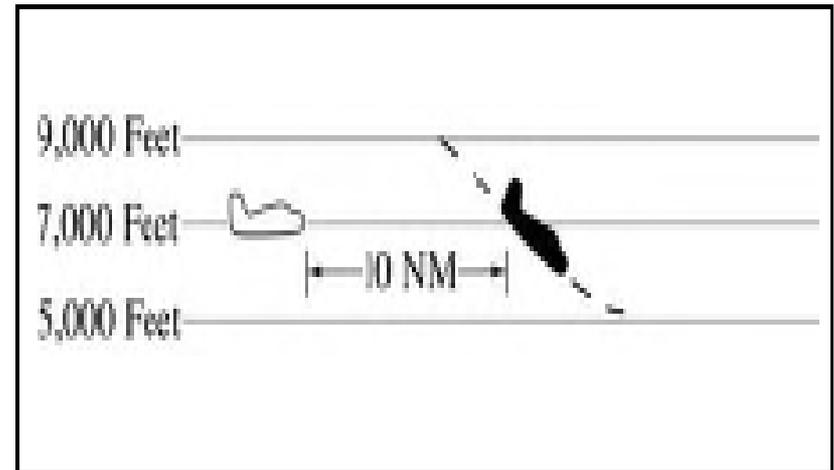
- 5.4.2.3 LONGITUDINAL SEPARATION MINIMA
- BASED ON DISTANCE USING DISTANCE MEASURING EQUIPMENT (DME)
- *Note.— Where the term “on track” is used in the provisions relating to the application of longitudinal separation minima using DME, it means that the aircraft is flying either directly inbound to or directly outbound from the station.*
- 5.4.2.3.1 Separation shall be established by maintaining not less than specified distance(s) between aircraft positions as reported by reference to DME in conjunction with other appropriate navigation aids. Direct controller-pilot communication shall be maintained while such separation is used.
- 5.4.2.3.2.3 Aircraft climbing or descending on the same
- **track: 19 km (10 NM) while vertical separation does not exist, provided:**
- **a) each aircraft utilizes “on-track” DME stations;**
- **b) one aircraft maintains a level while vertical separation does not exist; and**
- **c) separation is established by obtaining simultaneous DME readings from the aircraft (see Figures 5-24A and 5-24B).**
- *Note.— To facilitate application of the procedure where a considerable change of level is involved, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft, to permit a further check on the separation that will obtain while vertical separation does not exist.*

FAA Order 7110.65

6-4-2,3

- c. **When an aircraft is climbing or descending through the altitude of another aircraft:**
- 1. Between DME equipped aircraft; RNAV equipped aircraft using LTD; and between DME and LTD aircraft provided the DME aircraft is either 10,000 feet or below or outside of 10 miles from the DME NAVAID— 10 miles, if the descending aircraft is leading or the climbing aircraft is following.**

Descending Through Another Aircraft's Altitude DME Separation



ADS Distance Measuring (ICAO Doc. 4444)

5.4.2.6.4 Longitudinal distance-based separation minima in an RNP RNAV environment using ADS

5.4.2.6.4.1 Separation based on the use of ADS shall be applied so that the distance between the calculated positions of the aircraft is never less than the prescribed minimum. This distance shall be obtained by one of the following methods:

a) when the aircraft are on the same identical track, the distance may be measured between the calculated positions of the aircraft or may be calculated by measuring the distances to a common point on the track (see Figures 5-28 and 5-29);

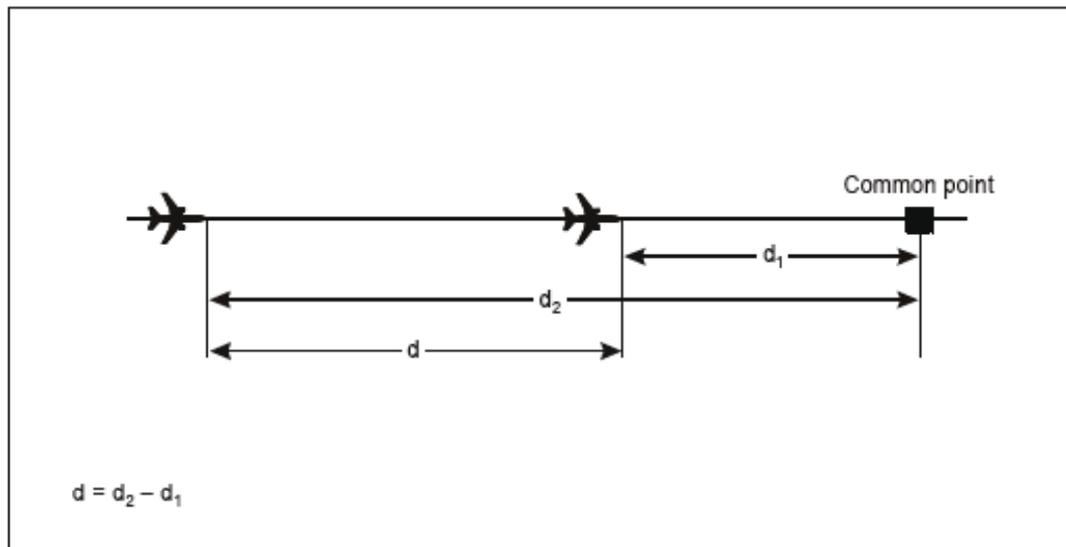


Figure 5-28. Calculation of longitudinal distance between aircraft — identical track, same direction (see 5.4.2.6.4.1 a))