

**Twenty-Third Meeting of the  
Informal South Pacific ATC Co-ordinating Group (ISPACG/23)**

**Santiago, Chile, 26-27 March 2009**

---

**Agenda Item 3: Review Relevant Work Conducted Since ISPACG/22**

**TAILORED ARRIVALS**

(Presented by Federal Aviation Administration)

**SUMMARY**

This paper provides information on the use of Tailored Arrivals in California.

**1. INTRODUCTION**

- 1.1 The FAA began their initial Tailored Arrival (TA) trial to the San Francisco airport (KSFO) in November 2006. The TA is a descent profile clearance which is uplinked via Controller-Pilot Data Link Communications (CPDLC) to participating aircraft. The aircraft can then use its Flight Management System to fly the most efficient descent to the arrival airport.

**2. DISCUSSION**

- 2.1 The TA provides the following savings:
- (1) Reduced fuel burn and carbon dioxide (CO<sub>2</sub>) emissions by having the aircraft fly an optimized descent profile.
  - (2) Reduced noise pollution since the aircraft is flying a power off descent.
  - (3) Reduced engine wear.
- 2.2 The initial TA trial ran for a three month period. The trial was limited to very early morning and late night United Airlines KSFO arrivals when there was very little airport demand. In December 2007, the KSFO TA trial resumed and has been expanded to include more aircraft and additional airlines.
- 2.3 A complete TA is projected to save each flight between 590 kilograms (kg) (B777) and 1000 kg (B744) of fuel over the standard arrival profile into KSFO. Due to runway configuration and airport demand, it is not always possible for an aircraft to fly the full TA to the runway threshold. When the arrival demand for the airport increases, aircraft flying the TA may need to be vectored for arrival spacing, causing the TA to be terminated. There are, however, still savings to be gained for the aircraft flying partial TAs. A partial TA has been calculated to save between 181-590 kg of fuel burn.
- 2.4 When developing a TA, several considerations must be included. The goal is to create a profile that allows the aircraft to fly an engine idle descent to the runway. If the TA profile contains restrictions that require the aircraft to level off, the aircraft must add power to maintain altitude and the overall fuel savings is reduced. Ideally, the descent profile, when viewed from the side,

is a wedge of airspace that keeps the aircraft on a continuous descent. Different factors affect the optimum altitudes at which the aircraft cross waypoints on the TA profile. These factors include such items as initial altitude, aircraft descent speed, aircraft type, and winds.

- 2.5 When building the KSFO TA vertical profile, the first factors that were considered were air traffic control (ATC)-required altitude crossing restrictions. The routing and those vertical crossing restrictions were given to Boeing to fly in their simulators for the B744 and B777 aircraft. Boeing flew the TA several different times, under different flight conditions and then provided the FAA with minimum and maximum altitudes for each waypoint on the TA routing.
- 2.6 The minimum and maximum altitudes were used to develop altitude crossing restrictions for the points on the TA route that did not over restrict the aircraft. These crossing restrictions were developed into a Minimum Operational Performance Standards (MOPS) element 83 clearance to uplink to the aircraft.
- 2.7 The following procedures are used to establish a Tailored Arrival scenario:
  - (1) *Participating aircraft will request the “Pacific One TA” into KSFO at least 1 hour prior to exiting oceanic airspace. The Oceanic controller formulates a clearance which will include altitude restrictions if the Tailored Arrival is to be utilized by the flight or advise the flight unable.*
  - (2) *The controller composes the following message:*
    - (a) *“Free Text Element” - “PACIFIC ONE TA” (This is a unique name that provides a reference to the uplinked TA Clearance)*
    - (b) *Route – MOPS83Clearance – At (pos), Cleared (rte clr)*
      - *Insert filed Oceanic Boundary as “pos” (CREAN, ALLBE, CEPAS or DACEM)*
    - (c) *Route Clearance Instructions*
      - *Arrival Airport – KSFO*
      - *Arrival Runway – 28L*
      - *Approach Procedure – ILS28L MENLO*
      - *Route – appropriate routes listed below:*
        - *CINNY 3657N12223W/F270B RAINS/F210B PIRAT/N0250A150B BRINY/N0250A120B 3721N12228W/A060A OSI MENLO/N0210A040A*
        - *ALLBE SUPER/A210A PIRAT/N0250A150B BRINY/N0250A120B 3721N12228W/A060A OSI MENLO/N0210A040A*
        - *ALCOA SUPER/A210A PIRAT/N0250A150B BRINY/N0250A120B 3721N12228W/A060A OSI MENLO/N0210A040A*
        - *PAINT SUPER/A210A PIRAT/N0250A150B BRINY/N0250A120B 3721N12228W/A060A OSI MENLO/N0210A040A*
          - *SUPER/A210A = SUPER At of Above FL210*
          - *PIRAT/N0250A150B = PIRAT At or Below 15000 at 250 kts*
          - *BRINY/N0250A120B = BRINY At or Below 12000 at 250 kts*

- 3721N12228W/A060A = *At or Above 6000*
- MENLO/N0210A040A = *MENLO At or Above 4000 at 210 kts*

**Note:** *These route segments are available in saved window for the controller to Copy and Paste into the clearance window.*

- (d) *“Vertical” -MOPSI9 clearance– Maintain FXXX (Current Altitude)*
  - (e) *Probe the clearance for conflicts and send it to the aircraft.*
  - (3) *Aircraft will “WILCO” the clearance or send “Unable”*
    - (a) *The flight crews have been advised to sent an Unable if there is a Logic Reject by their navigation computer*
    - (b) *If the controller receives an Unable, they check the clearance for errors.*
  - (4) *When the pilot establishes initial contact with the controller, he will advise that the aircraft is on “Pacific One TA”*
  - (5) *The radar controller will issue an airport clearance, stating, “Cleared to the San Francisco Airport via Pacific One TA, Maintain FLxxx (Current Altitude).*
  - (6) *The phraseology for the Descent Clearance is “(Call Sign), Cleared to Descend via Pacific One TA, SFO Altimeter xxxx”*
- 2.8 The Pilot or Controller may terminate the Tailored Arrival at any time. If the Tailored Arrival is terminated the controller will issue the appropriate arrival and vertical clearances; i.e., *“UAL76, Tailored Arrival is cancelled, cleared to the San Francisco airport via BRINY OSI direct, cross BRINY at and maintain 8,000.”*
- 2.9 Based on the success of the San Francisco “Pacific One Tailored Arrival”, work has begun on developing a “Catalina One Tailored Arrival into KLAX. The Catalina One Tailored Arrival will provide a more efficient alternative to the LEENA Arrival. It is a product of the collaboration of the FAA, Boeing, NASA and the Operators. Initial Trials of a KLAX temporary procedure will begin in March 2009. The final procedure will require the publication of several waypoints to define the route and crossing restrictions.
- 2.10 Overall, the TA has worked well. About 30 percent of the aircraft that are cleared on the TA are able to complete the full arrival to touchdown. The remaining 70 percent of the aircraft are able to experience the benefits that a partial TA affords.

### **3. ACTION BY THE MEETING**

- 3.1 The meeting is invited to note the information in this paper.