Arrival Procedures- From Standard to Tailored Arrivals

Presented to: LAX /Community Noise Roundtable
By: Steve Pinkerton, FAA
Date: 10 July 2013
Arrival Procedures

• Historically, arrival procedures designed with constraints related to traffic and aircraft capabilities
  – Consider major traffic flows for both arriving and departing aircraft. Often have restrictions associated with traffic or procedural requirements
  – Environmental impact considered
  – Designed to ensure that a variety of aircraft can fly procedure, from basically equipped to the most modern equipped
  – Result has been safe arrival procedures but maybe not the most efficient from various standpoints
Standard Terminal Arrival (STAR)

- Most common type of arrival procedure
- Has a defined lateral track
- Contains expected altitude and speed restrictions
- Generally, not designed as continuous descent procedure
- Can be flown by aircraft with various navigational capabilities
Example of a STAR

(NARRATIVE ON FOLLOWING PAGE)

NOTE: DME or radar required.
NOTE: Chart not to scale.
Continuous Descent Operations (CDO’s)- Improved Arrival Procedures

• Modern navigational capabilities have made more efficient arrival procedures a possibility

• CDO is a generic term that encompasses several different types of procedures. These procedures designed to allow aircraft to descend continuously, with minimal thrust
  – Result is reduction in noise, fuel burn, and emissions
Optimized Profile Descent (OPD)

- OPD’s are a descent profile normally associated with a published standard terminal arrival (STAR).
- Designed to allow maximum practical use of a CDO. Considers the following:
  - Airspace and ATC constraints
  - Traffic
  - Environment
  - Aircraft capabilities
  - Local airport issues
- **Seeing more frequent implementation**
  - Most modern aircraft equipped and able to fly
  - Used at numerous airports throughout country
NOTE: DME or RADAR required.

NOTE: Expect runway assignment on initial contact with Southern California TRACON. In the event of lost communications prior to runway assignment, proceed via ILS RWY 25L.

RIIVR TWO ARRIVAL

RIIVR Star

NOTE: Chart not to scale.

HECTOR TRANSITION (HEC RIIVR2): From over HEC VORTAC via HEC R-203 and PDZ R-046 to RUSTT, then via LAX R-068 to RIIVR.

PEACH SPRINGS TRANSITION (PGS RIIVR2): From over PGS VORTAC via PGS R-229 and PDZ R-046 to RUSTT, then via LAX R-068 to RIIVR.

LOST COMMUNICATION: In the event of lost communications prior to runway assignment proceed via ILS RwY 25L.
ILS 25 Left
Optimized Profile Descent (RNAV)

NOTE: RNAV 1.
NOTE: RADAR required.
NOTE: DME/DME/IRU or GPS required.
NOTE: For non-GPS aircraft, HIMDU, EED and JOLAR transitions. JLI DME must be operational.

(NARRATIVE ON FOLLOWING PAGE)

NOTE: Chart not to scale.
Tailored Arrival

• Tailored Arrivals (TA)
  – Similar concept to OPD, except a non-published, dynamic procedure
  – “Tailored” for traffic, environment, time, etc.
    • In current practice, “static”
  – Sent to aircraft from controller via Controller Pilot Data Link Communication (CPDLC)
  – Currently in an operational trial phase for Oceanic flights arriving at SFO, LAX, and MIA
    • Trial at MIA suspended- training/airspace issues
    • At LAX, only arrivals routed over SXC
LAX Tailored Arrival
BUFIE STAR

NOTE: RNAV 1
NOTE: RADAR required.
NOTE: For turbojets only.
NOTE: DME/DME/IRU or GPS required.
NOTE: RADAR required for non-GPS equipped aircraft.
NOTE: Rwys 25L/R or 24L/R: Expect RADAR vectors to final approach course.

ROSIN TRANSITION (ROSIN.BUFIE2)

From SXC VORTAC on track 066° to FITOW. Cross FITOW at 12000, at 250 KIAS. Thence as depicted to cross SLI VORTAC at 7000. Then on 330° heading. Expect RADAR vectors to final approach course.
Catalina 1 TA vs. BUFIE STAR

• Both fly along the same ground track
• Current airspace design necessitates use of altitude restrictions to ensure separation from other traffic
• At present, aircraft on either arrival essentially fly the same descent profile after SXC
LAX vs. SFO TA Use

• At SFO, approx. 33% of aircraft on a TA fly a full TA
• Arrivals assigned a TA arriving at LAX fly a partial TA
• SFO has opened trial to multiple airlines
• LAX trial limited to United, Air New Zealand, and Qantas
Benefits of TA’s and OPD’s

• **Noise Reduction**
  – Aircraft descending at optimal flight profile
  – Pilot advised of speed to maintain in descent
    • Flight Management System compensates for speeds and adjusts descent accordingly
  – Descent conducted at flight idle
    • Minimal power adjustments until final
  – Bottom line- Optimal descent profile + minimal power adjustments= less noise
SFO TA Noise Contours

Non-TA  Full-TA
SFO TA Noise Contours (Boeing Technology/Phantom Works)

Partial Tailored Arrival

Non Tailored Arrival

Tailored Arrival
Benefits of TA’s and OPD’s

• Fuel Savings
  – Full tailored arrivals may save 2100+ lbs. (350+ gals.) of fuel per flight. Cost savings near $1 mil. annually
  – Partial TA’s may save 660+ lbs. (110+ gals.) of fuel per flight. Cost savings of $300k+ annually
    • Data from Boeing Research and Technology, 2009 and based on B777-200 and B747-400 aircraft
  – OPD’s may see savings of 300+ lbs. (50+ gals.) per flight. Cost savings of
    • One reason for difference between OPD’s and TA’s may be fleet mix
      – Different type aircraft and engines
SFO Non-Tailored Arrival
QF73 SYD-SFO 17 May 2009

Non-Tailored Arrival

Fuel Flow
(kg/hr)

- < 2500
- 2500-5000
- 5000-7500
- >7500

<table>
<thead>
<tr>
<th>ZFW (1000kg)</th>
<th>Time from 32,500 ft (mins)</th>
<th>Fuel from 32,500 ft (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>230.2</td>
<td>26</td>
<td>1,680</td>
</tr>
</tbody>
</table>

QF73 - SYD-SFO
17 May 09

Google

Federal Aviation Administration
SFO Tailored Arrival
QF73 SYD-SFO 20 May 2009

Tailored Arrival

Fuel Flow
(Kg/hr)

< 2500
2500-5000
5000-7500
> 7500

<table>
<thead>
<tr>
<th>ZFW (000kg)</th>
<th>Time from 32,500 ft (min)</th>
<th>Fuel from 32,500 ft (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>236.1</td>
<td>24</td>
<td>1,220</td>
</tr>
</tbody>
</table>

QF73 - SYD-SFO
20 May 09

Altitude - Fuel Flow

15,000
10,000
5,000
0

0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000

Federal Aviation Administration
Benefits of TA’s and OPD’s

• **Greenhouse Gas Emissions**

<table>
<thead>
<tr>
<th>Type of Arrival</th>
<th>Annual CO2 Emissions Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full TA</td>
<td>2,718,630 lbs.</td>
</tr>
<tr>
<td>Partial TA</td>
<td>854,867 lbs.</td>
</tr>
<tr>
<td>OPD</td>
<td>385,075 lbs.</td>
</tr>
</tbody>
</table>
Why aren’t TA’s and OPD’s everywhere?

• Equipment/Other
  – Tailored arrivals require special equipment for aircraft (FANS 1/A, CPDLC)
    • Approx. 85% of flights from SoPac are equipped
    • Approx. 25% of flights in CEP equipped
  – Domestic En Route facilities currently not able to do CPDLC, which is required for TA’s
  – Pilot requested procedure
    • If pilot doesn’t request, they get BUFIE STAR to LAX

• Training
  – Controller and pilot training
    • Current issue with controller phraseology being addressed
Why aren’t TA’s and OPD’s everywhere?

• **Airspace Design and Traffic Management Issues**
  
  – Current airspace design in LA Basin presents significant challenge to full TA’s and OPD’s
    - Multiple confliction points for Basin departures and arrivals
  
  – Full TA to runway and OPD’s require very specific airspace procedures and rules to work
  
  – Due to the dynamic nature of air traffic, continued development of procedures and controller tools, such as Time Based Metering (TBM), need to continue
June 27, 2013
1300-2200z
6am-3pm Pacific
All flights within 35nm of SXC

- Flights above FL180 are gray

1826 flights
June 27, 2013
1300-2200z
6am-3pm
Pacific
SXC LAX
Arrivals
LAX & SNA
departures

667 flights

Yellow – LAX Dept
Blue – SNA Dept
Red – LAX SXC Arrivals
June 27, 2013
1300-2200z
6am-3pm
Pacific
SXC LAX
Arrivals
LAX & SNA departures

- Yellow – LAX Dept
- Blue – SNA Dept
- Red – LAX SXC Arvls

667 flights
• June 27, 2013 0200-0600z
  7pm-11pm
  Pacific All flights within 35nm of SXC

• 625 flights

• Flights above FL180 are gray
June 27, 2013
0200-0600z
7pm-11pm
Pacific
SXC LAX
Arrivals
LAX & SNA
departures
208 flights

Yellow – LAX Dept
Blue – SNA Dept
Red – LAX SXC Arvls
June 27, 2013
0200-0600z
7pm-11pm
Pacific
SXC LAX
Arrivals
LAX & SNA
departures

- Yellow – LAX Dept
- Blue – SNA Dept
- Red – LAX SXC Arvls

208 flights
Future of TA’s and OPD’s at LAX

• Optimization of Airspace and Procedures in the Metroplex (OAPM)
  – Part of NextGen
    • FAA Modernization Program
  – Redesign of airspace and procedures
  – Goal is to improve efficiencies for arrivals and departures
    • Designed with OPD and TA procedures as integral pieces
  – Current timeline for implementation projected within next 2 to 3 years
Questions?