Performance Metrics for Oceanic Air Traffic Management

Moving Metrics Conference
Pacific Grove, California
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Oceanic Metrics Team
Agenda

- Metrics Team
  - Michele Merkle, FAA AUA-600
  - Lynne Hamrick, MITRE/CAASD
  - Yueh-Shiou Wu, MITRE/CAASD
  - Tamara Karakis, CSSI
- Introduction: Purpose & Background of Oceanic Air Traffic Control (ATC)
- Background of Oceanic Metrics
- Air Carrier Meetings
- Oceanic Metrics Overview
- Metrics Based on Priorities
- Sample Dashboard Charts
- Current Challenges Related to Oceanic Metrics
- Baseline Performance Results
- Summary
Introduction

- **Purpose of Briefing**
  - Provide an overview of oceanic performance metrics
  - Describe challenges related to measuring oceanic Air Traffic Control (ATC) service qualities
  - Discuss initial results and trends

- **Background of Oceanic Air Traffic Control (ATC)**
  - Non-radar procedural separation
  - Communications via
    - Controller-Pilot Data Link (CPDLC) for Future Air Navigation System 1/A (FANS 1/A)-equipped aircraft
    - High Frequency (HF) Radio Operator for non-equipped aircraft
  - Oakland Oceanic Center (ZOA) controls 21.3 million square miles
  - New York Oceanic Center (ZNY) controls 3.3 million square miles
Oakland Oceanic Airspace

Legend:
1) Canada/Continental US and Asia
2) Canada/Continental US and Hawaii
3) Hawaii and Asia, Guam and Asia/South Pacific, Asia and South Pacific
4) Continental US-Hawaii and South Pacific
Background of Oceanic Metrics

1993 Government Performance and Results Act (GPRA)
- Required federal agencies to measure their performance and effectiveness

FAA moves towards Performance Based Organization (PBO) and Air Traffic Organization (ATO) formed
- Goal to develop a more efficient and businesslike air traffic system
- AUA goal to continue improving oceanic service, while measuring the effect of new automation/procedures on the service provided
Air Carrier Meetings

Onsite Air Carrier Meetings in 1999 and 2003

- Dialogue with air carriers coordinated via Air Transport Association (ATA) meeting
- Onsite air carrier visits in 1999 and 2003
  - Air Canada Corporation, American Airlines, Continental Airlines, Delta Airlines, Federal Express Corporation, Northwest Airlines, United Airlines, United Parcel Service Corporation, US Airways Corporation
- Air Carrier Personnel
  - Operational Analysts, Dispatchers, Meteorologists, Pilots, Instructors, ATC, Operational Managers

Summary of Air Carriers Visits

- Received an overview of air carrier operations
  - operating environment, route structure, fleet mix
- Consolidated and compared lists of priorities
- Discussed data sources
- Established baseline metrics
Oceanic Metrics Overview

**Purpose of the “Dashboard”**
- Provides visual summary of performance of pertinent metrics for facility and airspace regions within the Flight Information Region (FIR)
- Tracks customer demand and level of service provided by the FAA oceanic ATC
- Establishes baseline to determine affect of automation and/or procedure changes (e.g., Advanced Technology and Oceanic Procedures or ATOP)
- Identify anomalies and areas that need more tracking
- Provide monthly charts for monitoring trends in oceanic service qualities

**Established data exchange process with Centers**
- Primary data source: Oceanic Display and Planning System (ODAPS)
- Other data sources: Oceanic Data Link (ODL), Track Advisory (TA)

**Generated programs to process and analyze data**
- Oceanic Data Repository (ODR)
- Oceanic Analysis Tool Set (OATS)
- Oceanic Metrics Generator (OMG)
## Metrics Based on Priorities

### Air Carrier Priorities and Oceanic Metrics

<table>
<thead>
<tr>
<th>Air Carrier Priorities</th>
<th>Metrics</th>
<th>Data Availability and Sources</th>
</tr>
</thead>
</table>
| **Operating Environment**       |  › Flight count  
                                         › Avionics equipment  
                                         › Fleet mix                  | **Available**  
                                         › Flight Plans from ODAPS |
| **Communication**               |  › Avionics equipment  
                                         › Altitude requests  
                                         › Response times          | **Available**  
                                         › Flight Plans from ODAPS  
                                         › HF messages from ODAPS  
                                         › CPDLC messages from ODL  |
| **Safety**                      |  › Operational errors  
                                         › Altitude requests due to WX  
                                         › Deviation requests        | **Available**  
                                         › AAT-200  
                                         › HF messages from ODAPS  
                                         › CPDLC messages from ODL  |
| **Efficiency - Flexibility**    |  › Altitude requests granted  
                                         › Response time             | **Available**  
                                         › Plans from ODAPS  
                                         › HF messages from ODAPS  
                                         › CPDLC messages from ODL  |
| **Requests Granted**            |                                             |                                                    |
### Metrics Based on Priorities (Continued)

#### Air Carrier Priorities and Oceanic Metrics

<table>
<thead>
<tr>
<th>Air Carrier Priorities</th>
<th>Metrics</th>
<th>Data Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User Satisfaction - Predictability</strong></td>
<td>First preference granted</td>
<td>Available</td>
</tr>
<tr>
<td>→ Optimal vs. Actual</td>
<td>Entry altitude flown as filed</td>
<td>Flight Plans from ODAPS</td>
</tr>
<tr>
<td>→ Planned vs. Actual</td>
<td></td>
<td>Position reports from ODAPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Track Advisory reports</td>
</tr>
<tr>
<td><strong>User Satisfaction - Predictability</strong></td>
<td></td>
<td><strong>In Development with Aviation System Performance</strong></td>
</tr>
<tr>
<td>→ Delay / On-time Performance</td>
<td></td>
<td>Metrics (ASPM) and Enhanced Traffic Management System (ETMS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>→ Planned departure and arrival times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>→ Actual departure and arrival times</td>
</tr>
<tr>
<td><strong>User Satisfaction</strong></td>
<td></td>
<td><strong>In Development</strong></td>
</tr>
<tr>
<td>→ Fuel Consumption</td>
<td></td>
<td>→ Preferred route and altitude in ICAO Flight Plan (FPL) vs. Actual route and altitude flown</td>
</tr>
</tbody>
</table>

**Note:**
- Available
- In Development
Current Challenges Related to Oceanic Metrics

- **US oceanic performance metrics are affected by actions taken by non-US oceanic ATC**
- **Limited end-to-end data available**
- **Variations in operations and priorities across different geographic and domain sub-regions**
- **Processing HF messages**
Baseline Performance Results

**Trends observed**
- Response time for HF flights are longer than that for FANS 1/A flights
- Percent of positive or negative response to request are basically the same regardless of the aircraft communication capabilities (i.e., FANS 1/A or HF)
- Daily traffic varies more than 30% (e.g., May and August); but variation of performance level is small
- Most flights (80%) received preferred entry altitude for New York airspace or first preference for the Pacific Organized Track System (PACOTS)
- Average response time to altitude change requests has decreased from 10-50 minutes in 1998 to 5-15 minutes for HF flights and 3-6 minutes for FANS 1/A flights in 2003

**Plausible reasons for the above trends**
- Introduction of data link not only allow FANS 1/A flights to communicate with ATC faster, it also reduced congestion on the channel allowing HF flights to get better services
- Oceanic Data Link enhanced controller productivity for all flights, not just FANS 1/A flights
- Whether a positive response can be granted is dependent on traffic situation, not on communication means
- Implementation of Reduced Vertical Separation Mimima (RVSM) allowed more flights to fly their preferred altitude profile

**Sample slides follow**
Baseline Performance Results (Continued)

ZOA Oceanic Flight Count

- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
Baseline Performance Results (Continued)

ZOA - HF Flights: Altitude Change Requests

Average Reqs / Day

Year of 1998

Average Response Time (Minutes)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

Average Reqs / Day

0  10  20  30  40  50  60

ZOA - HF Flights: Altitude Change Requests

Average Reqs / Day

227  215  218  206  198  220  225  239  222  225  221  228

Baseline Performance Results (Continued)
Baseline Performance Results (Concluded)

ZOA - HF Flights: Altitude Requests

Average Response Time (Minutes)

Percent

ZOA - FANS 1/A Flights: Altitude Requests

Average Reqs / Day

130 159 154 139 135 166 186 175 178

Percent

Year of 2003

% Cleared
% Modified
% Unable
Summary

- **Oceanic Performance Metrics**
  - Assesses the operating environment and quality of oceanic service provided to the airspace users
    - Summary of performance
    - Tracks customer demand and level of service provided
  - Provides a foundation for making sound business decisions
    - Baseline comparison
    - Anomalies
    - Trends

- **Oceanic Metrics are evolving and expanding to meet the challenges of measuring a complex system and the performance of ATC service in a meaningful way**
  - Different data sources (e.g., ATOP is replacing ODAPS and ODL)
  - Additional facilities (e.g., Anchorage)
  - Changing priorities