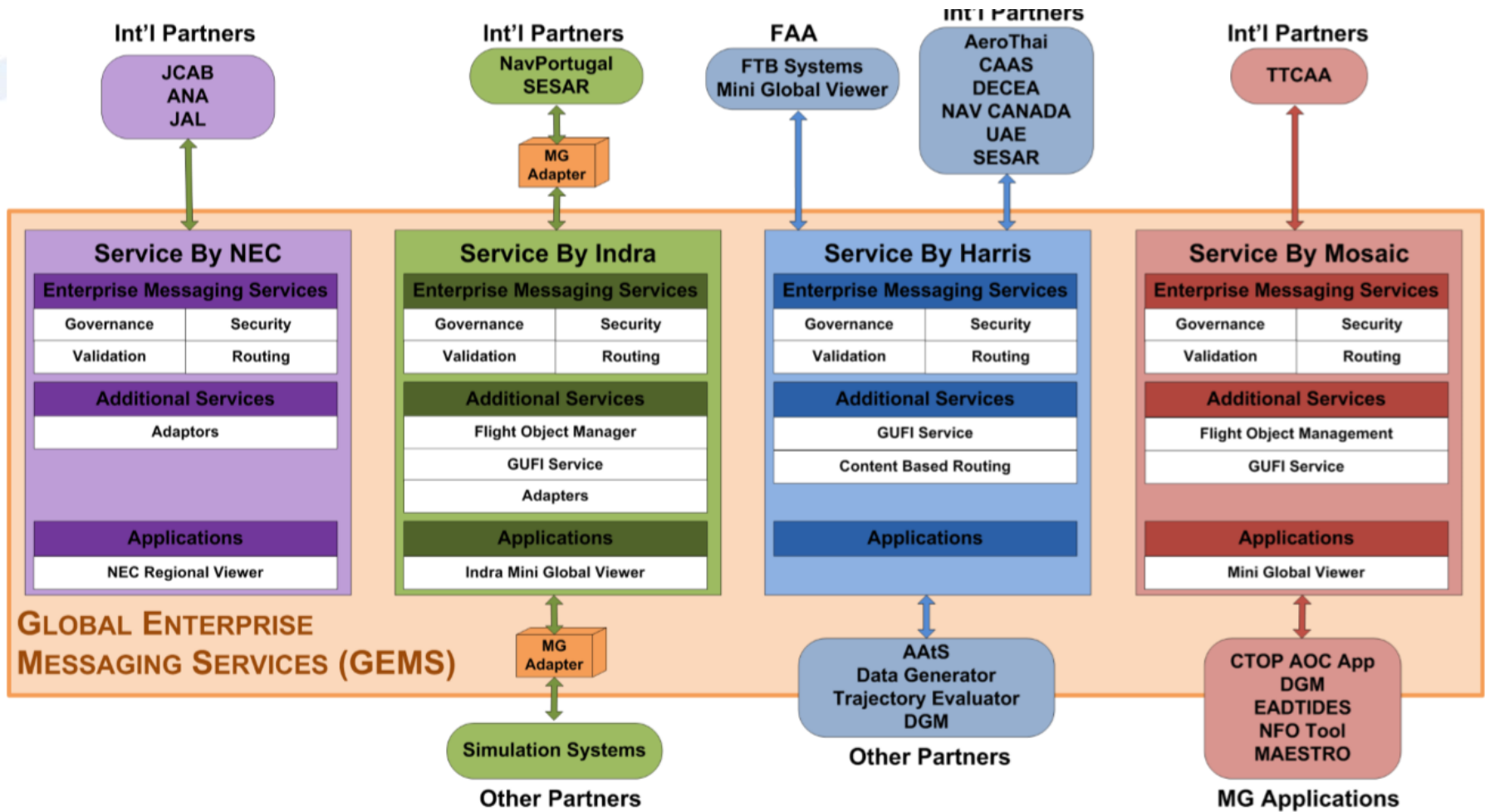


# GEMS Architecture



# SWIM Applications

- Trajectory Evaluator (TE)
  - Run queries on airspace constraints
  - Evaluate impact to planned flight routes
- Data Governance Module (DGM)
  - Check compliance of all messages with the AIXM, FIXM and iWXXM standards
  - Keeps a record of all message passing through it
  - Data query on stored messages
  - Display tracks and messages
  - Performance dashboard

# Partner Systems

- CAAS Mini Global Simulator (far left screen)
- JCAB Mini Global Simulator (center left screen)
- DGM and TE (center right screen)
- AEROTHAI Enterprise Messaging Service and MG II Test simulator (far right screen)

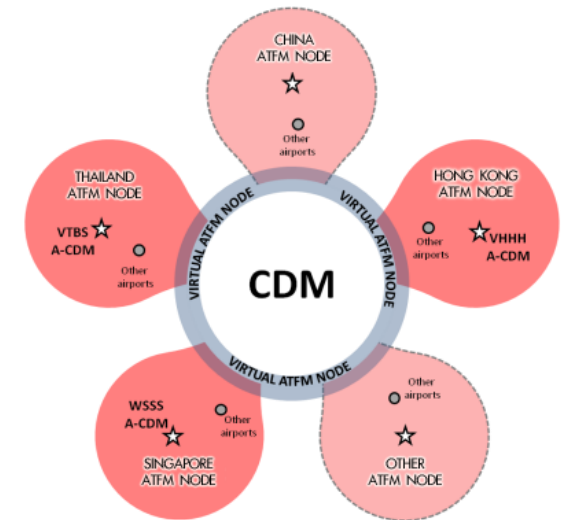
**SCENARIO**

**Cross Border Air Traffic  
Flow Management  
(AEROTHAI)**

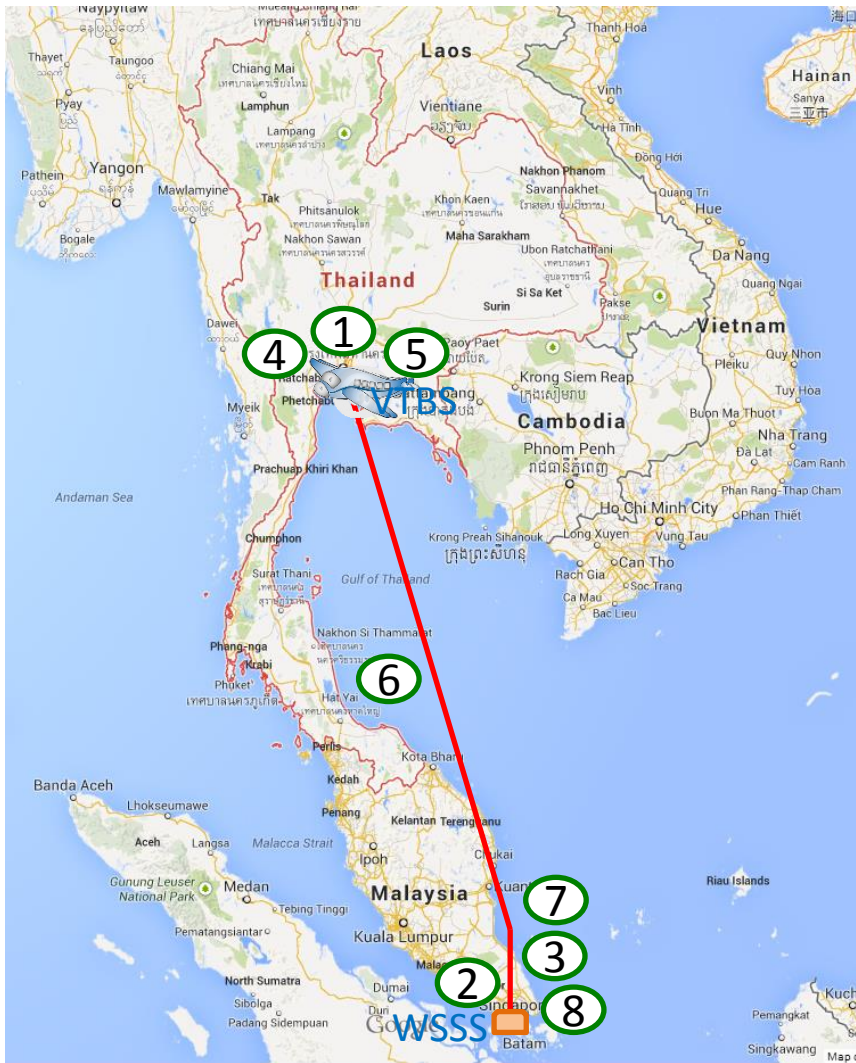
# Cross-Border Air Traffic Flow Management

## Distributed Multi-Nodal ATFM Operational Trial

- Demand and Capacity Balancing at capacity-constrained airports
- Manage arriving flights using Ground Delay Program
- Issuance of Calculated Take-Off Time (CTOT)
  - Publish CTOT on Web Portal
  - E-mail alerts about the implementation of ATFM measures, CTOT published on Web Portal, and slot management Web Conference
  - Optional delivery of CTOT using AFTN/ADEXP message



# Cross-Border Air Traffic Flow Management



1. AEROTHAI submits Flight Plan
2. CAAS issues NOTAM for runway closure at Singapore Changi Airport
3. CAAS publishes Calculated Take-Off Time (CTOT)
4. AEROTHAI publishes Target Take-Off Time (TTOT)
5. AEROTHAI publishes Departure message
6. AEROTHAI publishes airborne track data within Bangkok FIR
7. CAAS publishes airborne track data within Singapore FIR
8. CAAS publishes Arrival message

# Cross-Border Air Traffic Flow Management Operational Benefit

- Improve Air Traffic Flow Management across international FIR boundaries
- Improve information flow
  - Improved predictability
  - Improved information access
  - Improved flight data exchange between authorized stakeholders
  - Improved CDM
  - Improved efficiency – Optimize traffic flow to accommodate airport and airspace constraints
  - Reduced unnecessary fuel burn and carbon emission



**SCENARIO**

**Hazardous Weather  
Avoidance (CAAS)**

# Hazardous Weather Avoidance (Tokyo-SIN)

- Operational Story
  - Advance information allows for better planning
  - Increased predictability
  - Better flying experience for passengers
  - This scenario gives advance warning for severe turbulence in Singapore's FIR
  - Allows time to file a flight plan change to re-route around the turbulence

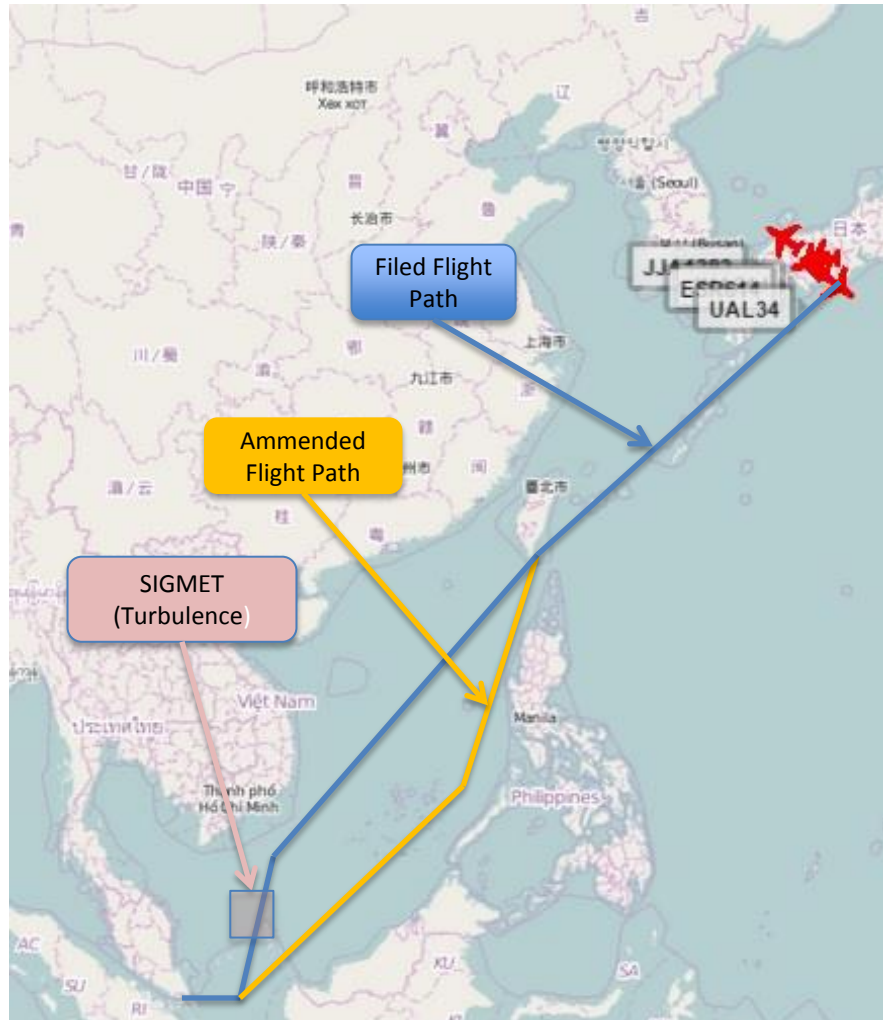
# Hazardous Weather Avoidance (Tokyo-SIN)

## Scenario

1. JCAB Files the flight plan for JAL77
2. CAAS issues a SIGMET for severe turbulence over an area of the South China Sea that impacts the flight plan.
3. JCAB updates the flight plan of JAL77 to avoid this area
4. JCAB publishes a DEP message
5. JCAB issues TRACKS
6. CAAS issues TRACKS
7. CAAS issues ARR message

## Ops Benefits

- Same as before early information about weather aids in decision making
- This time the decision is to fly an alternate route to avoid the turbulence.



# **SCENARIO**

## **Data Confidentiality with AIXM (CAAS)**

# Data Confidentiality AIXM (SIN – BKK)

- Operational Story
  - Similar to the previous scenario
  - Advance information allows for greater predictability
  - Also to demonstrate data confidentiality.
    - Information is only shared between qualified parties
    - Only AEROTHAI and CAAS receive each other's information
    - JCAB cannot see the tracks being published by either party.

# Data Confidentiality AIXM (SIN – BKK)

## Scenario



1. AEROTHAI issues NOTAM activating the Danger Area
2. CAAS Submits Flight Plan
3. AEROTHAI issues 2<sup>nd</sup> NOTAM de-activating Danger Area
4. CAAS submits a flight plan update
5. CAAS publishes a DEP message
6. CAAS issues TRACKS
7. AEROTHAI issues TRACKS
8. AEROTHAI issues ARR message

## Ops Benefits

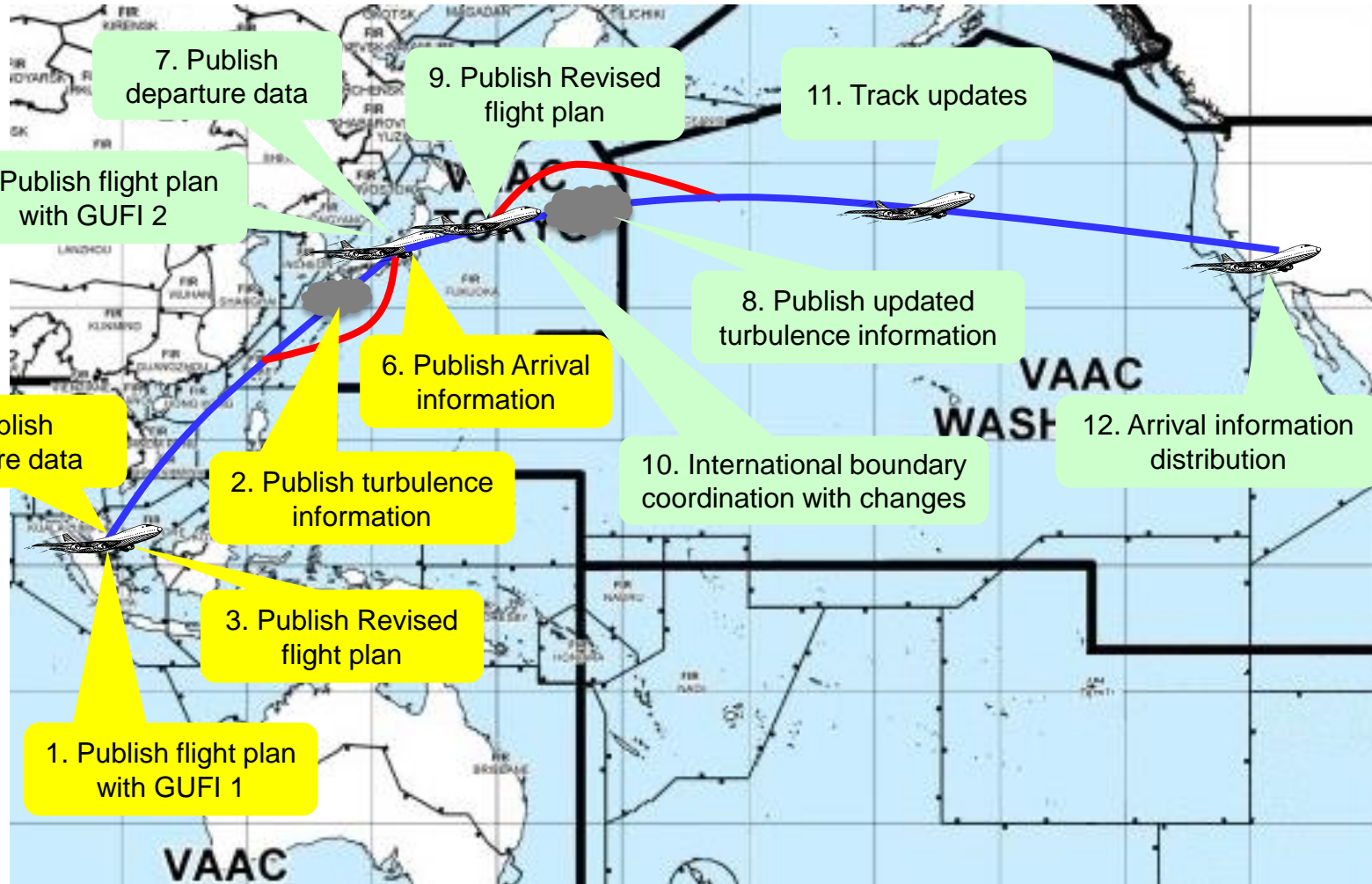
- Timely provision of information allows for optimization of the flight route to take a shorter path.

**SCENARIO**

**Pacific Transit (JCAB)**

# Trans-Pacific Operations

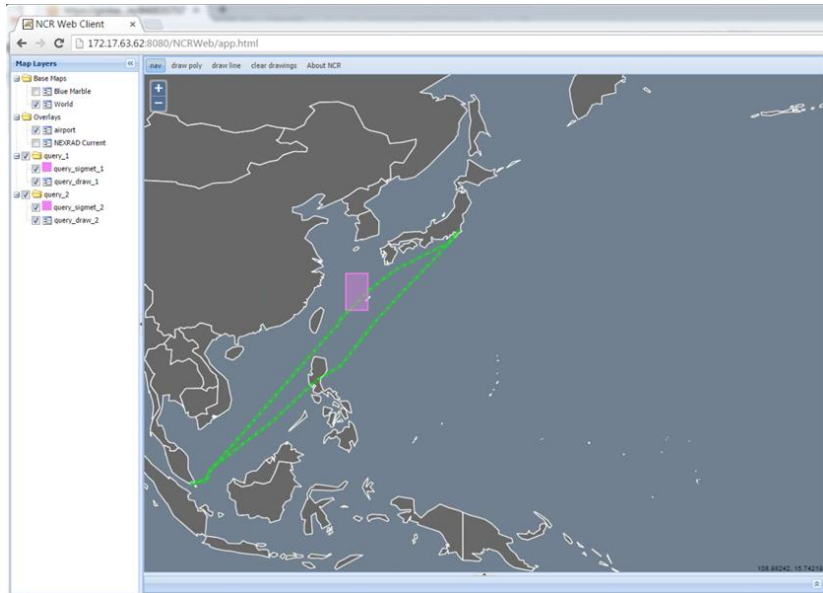
## ➤ Scenario





# Trans-Pacific Operations

## ➤ Part 1: SIN-Tokyo



1. CAAS publishes FPL of ANA77A for Part 1
2. JCAB issues SIGMET of turbulence
3. CAAS publishes CHG of ANA77A
4. CAAS publishes DEP and TRACK

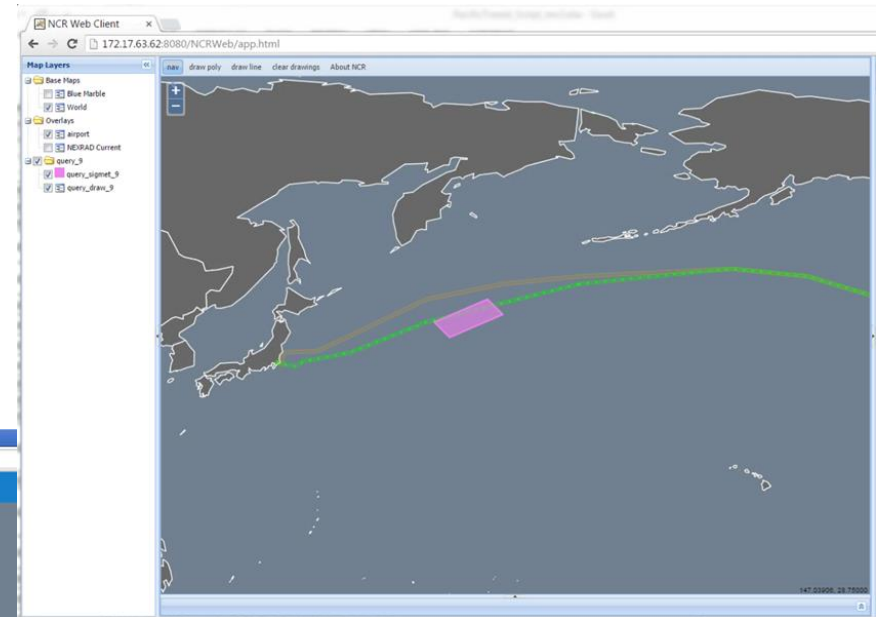
The screenshot shows a flight information table overlaid on a map of the Pacific region. The table is titled 'Flight Information' and contains the following data:

GUFI	Acid ↑	Msg Type	Orig	Dest	Status	Est Out	Act Out	Est Off	Ctrl Off	Pred Off	Act Off	Est On	Act On	Route
ad4082d3-7831-...	ANA77A	DEP	WSSS	RJAA		01/01:30								
376d00bf-9328-...	ANA77B	FLIGHT_OBJECT	RJAA	KLAX		31/23:08					31/23:13			
95ac74b9-7758-...	ANA77C	FLIGHT_OBJECT	RJAA	KLAX		31/23:08					31/23:13			
5ef5e483-9a15-...	ANA77D	FLIGHT_OBJECT	RJAA	KLAX		31/23:08					31/23:13			

# Trans-Pacific Operations

## ➤ Part 2: Tokyo-LAX

5. JCAB publishes FPL of ANA77A for Part 2
6. JCAB publishes ARR of ANA77A for Part 1
7. JCAB publishes DEP and TRACK
8. JCAB issues updated SIGMET
9. JCAB publishes updated FPL

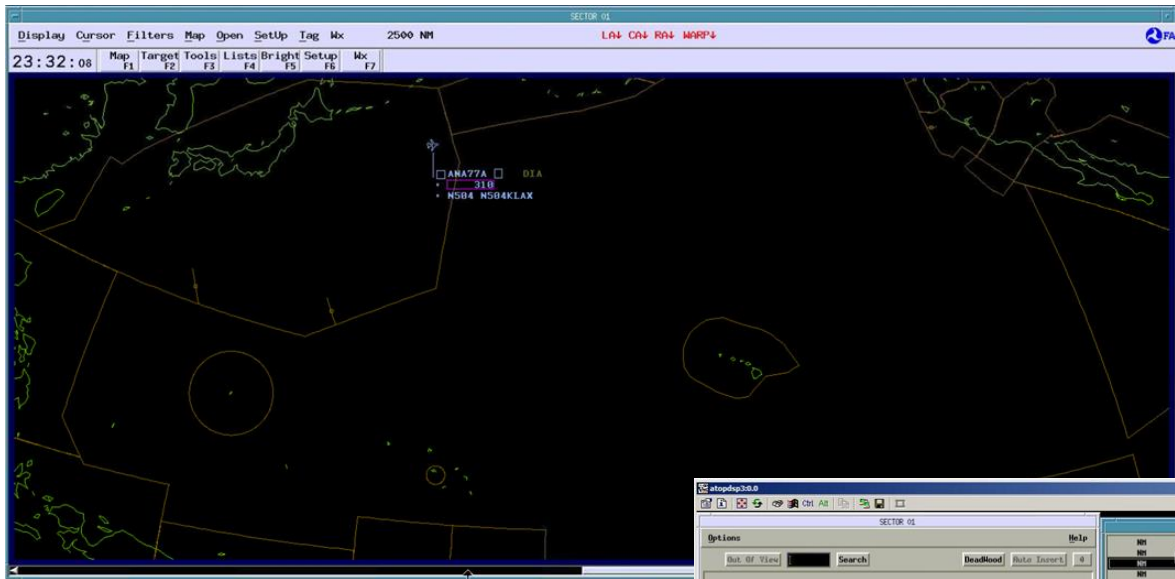


The screenshot shows the Mosaic ATM Viewer interface. The top bar displays 'ALL' and the time '03/31 23:26:25'. The main map shows a flight track over the Pacific Ocean. Below the map is a 'Flight Information' table.

GUPI	AzId ↑	Msg Type	Orig	Dest	Status	Est Out	Act Out	Est Off	Ctrl Off	Pred Off	Act Off	Est On	Act On	Route
ad4082d3-7831-...	ANA77A	ARR	WSSS	RJAA	COMPL...	31/13:30						31/19:58		
e1e868b3-3d22-...	ANA77A	FLIGHT_OBJECT	RJAA	KLAX	FILED	31/21:30					31/21:40			CUPID Y808 ONO
376d00bf-9328-...	ANA77B	FLIGHT_OBJECT	RJAA	KLAX		31/23:08					31/23:13	31/23:23		
95ac74b9-7758-...	ANA77C	FLIGHT_OBJECT	RJAA	KLAX		31/23:08					31/23:13	31/23:23		
5ef5e483-9a15-...	ANA77D	FLIGHT_OBJECT	RJAA	KLAX		31/23:08					31/23:13	31/23:23		

# Trans-Pacific Operations

## ➤ Part 2: Tokyo-LAX



### Boundary Coordination:

10-1. JCAB publishes ABI and CPL

10-2. FAA issues CDN with a change to the boundary crossing altitude

10-3. JCAB publishes ACP

Altitude	410	400	390	380	370	360	350	340	330	320	310
410	400	390	380	370	360	350	340	330	320	310	

**BRIEFING**

B744	310	40N	6449N	40N	47N	40N	47N	40N	47N	40N	R 300	10
W504	310	100N	16334E	170E	100E	1604	1504	1404	1304	1204	R	10

**BRIEFING MESSAGES**

MM	POS	00077R	23:30:04
MM	CDN	00077R	23:35:04
MM	CDN	00077R	23:35:04
MM	CDN	00077R	23:35:46
MM	CPL	00077R	23:31:10
MM	TXT	00077R	23:30:00

**ERROR QUEUE**

TXT	CESS77	23:35:42
MM	CESS77	23:36:47
TXT	CESS77	23:36:15
TXT	CESS77	23:36:47

**SECTOR QUEUE**

UR	SYS	CESS77	23:25:03
UR	TXT	00077R	23:30:30
UR	CPL	00077R	23:31:10
MM	RCP	00077R	23:35:04

# Trans-Pacific Operations

## ➤ Local applications

WELCOME TO ELECTRONIC NAVIGATION RESEARCH INSTITUTE

**Aircraft Details** Message Type... Q ANA77A Search

**Message Headers** << Message Data

**Time** 2016-04-07T23:41:27.473Z  
**Guff** 96ad64a0-b0ec-493f-982a-688e37d879da  
**ACID** ANA77A  
**Source** CAAS  
**System** CAAS  
**Message** FPL  
**Category** FIXM  
**Category Version** FIXM\_3\_0  
**Airline** ANA  
**Departure Country** WS  
**Departure Airport** WSSS  
**Arrival Country** RJ  
**Arrival Airport** RJAA  
**Aircraft Type** B744  
**Estimated Departure Time** 2016-04-08T01:30:00Z  
**Beaconcode** 2777

**Received Messages** Total Results: 84

Show 25 entries Search:

Message Type	
FPL	CAAS_OUT:1460072485284,SBH_IN:1460072485715,SBH_OUT:1460072485748,SBN_IN:1460072487184,SBN_OUT:146
CHG	CAAS_OUT:1460072573826,SBH_IN:1460072574216,SBH_OUT:1460072574229,SBN_IN:1460072574353,SBN_OUT:146
DEP	CAAS_OUT:1460072633858,SBH_IN:1460072633998,SBH_OUT:1460072634015,SBN_IN:1460072634138,SBN_OUT:146
TRACK	CAAS_OUT:1460072638893,SBH_IN:1460072639032,SBH_OUT:1460072639041,SBN_IN:1460072639185,SBN_OUT:146
TRACK	CAAS_OUT:1460072658915,SBH_IN:1460072659051,SBH_OUT:1460072659060,SBN_IN:1460072659172,SBN_OUT:146
TRACK	CAAS_OUT:1460072678934,SBH_IN:1460072679072,SBH_OUT:1460072679081,SBN_IN:1460072679190,SBN_OUT:146
TRACK	CAAS_OUT:1460072698950,SBH_IN:1460072699087,SBH_OUT:1460072699097,SBN_IN:1460072699208,SBN_OUT:146
ROUTE	JCAB_OUT:1460072888628,SBH_IN:1460072888786,SBH_OUT:1460072888818,SBH_IN:1460072890804,FOXS_IN:1460
ARR	JCAB_OUT:1460072888628,SBH_IN:1460072888786,SBH_OUT:1460072888818,SBH_IN:1460072890804,FOXS_IN:1460
DEPARTURE	JCAB_OUT:1460072888628,SBH_IN:1460072888786,SBH_OUT:1460072888818,SBH_IN:1460072890804,FOXS_IN:1460
FLIGHT_OBJECT	JCAB_OUT:1460072888628,SBH_IN:1460072888786,SBH_OUT:1460072888818,SBH_IN:1460072890804,FOXS_IN:1460
ARR	FOXS_IN:1460072893122,FOXS_OUT:1460072893367,SBH_OUT:1460072893486,SBN_IN:1460072893598,SBN_OUT:14
SDSS_EXTENSION	FOXS_IN:1460072893122,FOXS_OUT:1460072893371,SBH_OUT:1460072893491,SBN_IN:1460072893660,SBN_OUT:14
FLIGHT_OBJECT	FOXS_IN:1460072893122,FOXS_OUT:1460072893387,SBH_OUT:1460072893511,SBN_IN:1460072893816,SBN_OUT:14
ARR	FOXS_IN:1460072893143,FOXS_OUT:1460072893486,SBH_OUT:1460072893609,SBN_IN:1460072893863,SBN_OUT:14
FLIGHT_OBJECT	FOXS_IN:1460072893143,FOXS_OUT:1460072893509,SBH_OUT:1460072893626,SBN_IN:1460072893926,SBN_OUT:14
DEPARTURE	JCAB_OUT:1460073024588,SBH_IN:1460073024697,SBH_OUT:1460073024697,SBH_IN:1460073026459,FOXS_IN:1460
FLIGHT_OBJECT	JCAB_OUT:1460073024588,SBH_IN:1460073024697,SBH_OUT:1460073024697,SBH_IN:1460073026459,FOXS_IN:1460
TRACK	JCAB_OUT:1460073067021,SBH_IN:1460073067132,SBH_OUT:1460073067132,SBH_IN:1460073068892,FOXS_IN:1460

# Trans-Pacific Operations

## ➤ Local applications

The screenshot displays a flight tracking application interface. On the left, there are two panels for flight management. The top panel, titled "FDXM Subscribe Setting", includes fields for "AMQP Publisher Host" (172.16.19.12), "Port" (5672), "Topic Name" (ENR1.C), "Username" (admin), and "Password" (admin). It also has buttons for "Stop Subscribe", "Clear Flight Object", and "Trace Message". The bottom panel, titled "FDXM Publish Setting", includes a "Track data directory" field (C:\temp\TRACK) and buttons for "Load Track Data", "Clear Track Data", and "Browse".

The main area is a map of Japan with several blue airplane icons indicating flight paths. A tooltip for one of the flights is visible, showing the following data:

```
e1e656b3-3d22-44dc-b76c-c9ab5809b2e9  
ANA77A (KJAA -> KLAX)  
[2016/03/10 22:12:00]  
Lat/Lon: 35.775, 142.243  
Altitude: 23600 [Feet]
```

At the bottom of the interface, there is a toolbar with various icons for navigation and data management, including "Clear All", "Refresh", "Route", "AS", "FOO", "Event", "Map", "CHS", "Flow", "Area", "Create Area", "Cancel Area", "Finish Area", "Clear Area", "Paste Area", "Add PJO", "Add ECD", "Trace Inter", "Learn", "About", and "Lock".