



# Air Traffic Flow Management (ATFM)



U.S. Department of Transportation  
Research and Innovative Technology Administration

## ATFM Systems and Required Infrastructure

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# Air Traffic Flow Management Systems and Required Infrastructure

- U.S. Technology-Based Solution -



Air Traffic Control

Air Traffic Management



*Figures extracted from selected FAA, Air Force, NOAA and Commercial web sites*

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# Air Traffic Flow Management Systems and Required Infrastructure

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Enables traffic flow operations in the United States

Jointly provides FAA traffic managers and NAS users:

- Real-time domestic & international air traffic situational awareness
- Forecasted demand at airports, sectors, fixes, other NAS elements and user defined airspace volumes based on 4D flight trajectories
- Visual warnings and alerts on airspace congestion and potentially unsafe air traffic operating levels
- Tools to implement congestion avoidance programs

Enables shared situational awareness with NAS Users

- FAA, DoD, Airlines, International Partners, General Aviation

Provides Aircraft Situation Display to Industry (ASDI)

- Travel Vendors, Airlines, Others

Provides ATFM Data to Government (TFMDG)

- U.S. DoD/Military, Other DOT Agencies, Others



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## Domestic Operational Sites

- Continental U.S. (CONUS)
  - Air Traffic Control Systems Command Center (ATCSCC)
  - 21 Air Route Traffic Control Center (ARTCC) Facilities
  - 31 Terminal Radar Approach Control (TRACON) Facilities
  - Others (e.g., Towers, Regional)
- Outside Continental U.S.
- Military/U.S. DoD Sites
  - Air Defense (10 sites), Scott AFB, Andrews AFB, DISA

## International sites

- Canada (10 sites)
- London, Mexico
- Chile, Columbia

## Others

- NASA Ames Research Center, Airlines, Mitre, Lincoln Labs, Aviation Weather Center



## Adding Sites Each Year

- Additional Air Defense Sites
- Department of Homeland Security
- International – Japan, Eurocontrol

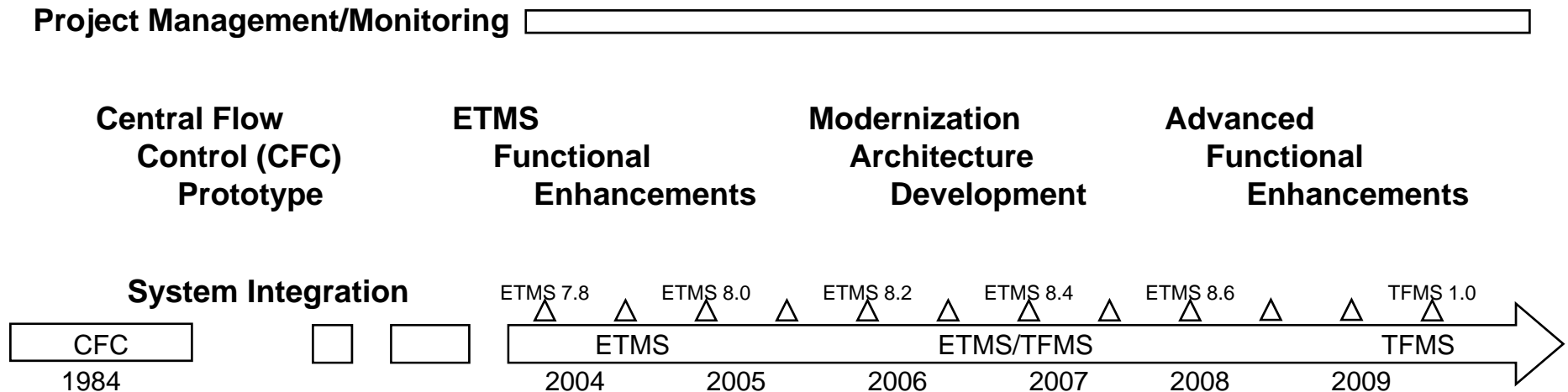


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## ***Continuous Improvement through Evolutionary Development and Incremental Delivery of ATFM Products***



- Established CFC Facility at FAA HQ
- Conversion to Open System Architecture
- Air Space Flow Programs
- Development of Aircraft Situation Display
- Introduction of Airline Data through CDM
- Modernization
- Move to ATCSCC in Herndon, VA
- Development of Interactive ATFM Tools
- Certification for Year 2000 Compliance
- Non-Proprietary System Technology Refresh

## ***Integrated Delivery of Functional Enhancements and Infrastructure***

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## User mode sharing

- Early Intent messages
- Collaborative (CDM) airline messages (FC, FM, FX)
- Interfaces to neighboring countries for flight data
- Common Situational Awareness (e.g. Common Constraint Situation Display)

## Protection of data

- Military filtering
- International data
- Airline competitive sensitive data
- Filtered list requests

## Automation and algorithms

- Flight trajectory modeling
- Monitor/Alert future predictions
- Weather forecasts
- Flow Evaluation Areas (FEAs)/Flow Constrained Areas (FCAs)
- Ground Delay Programs (GDPs)/Issuing Clearance Times (CTs)
- Rerouting options

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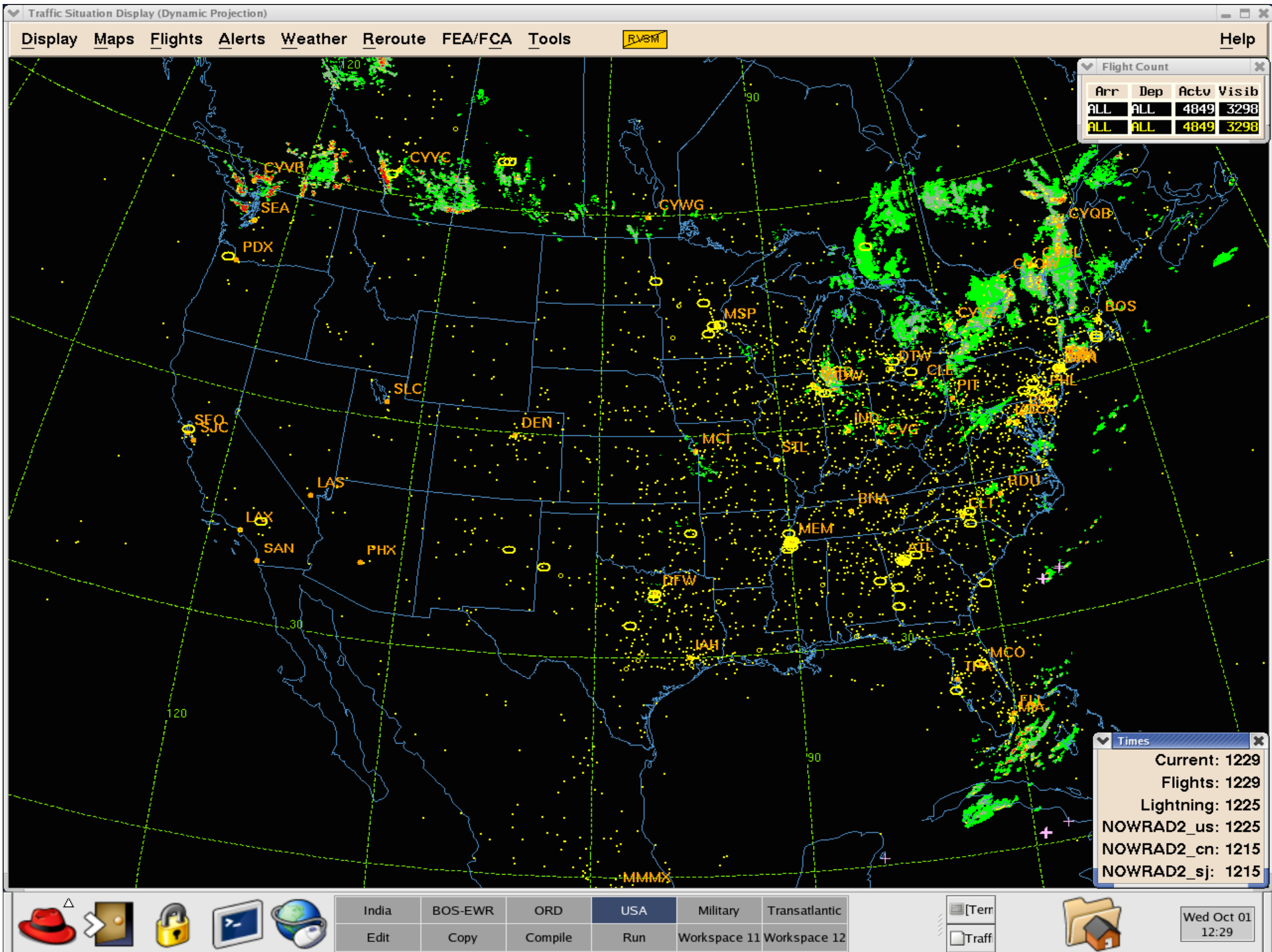
## Modernized H/W Platform - Technology Refresh System “State” Maintained for +/- 24 Hours:

- 23,000 Airports (2600 monitored)
- 1300 Sectors (dynamically reallocated)
- 38,000 Fixes and Waypoints
- 1200 Jet and Victor Airways
- 8000+ Active Flights (Instantaneous Total Count)
- 70,000 Flights Per Day

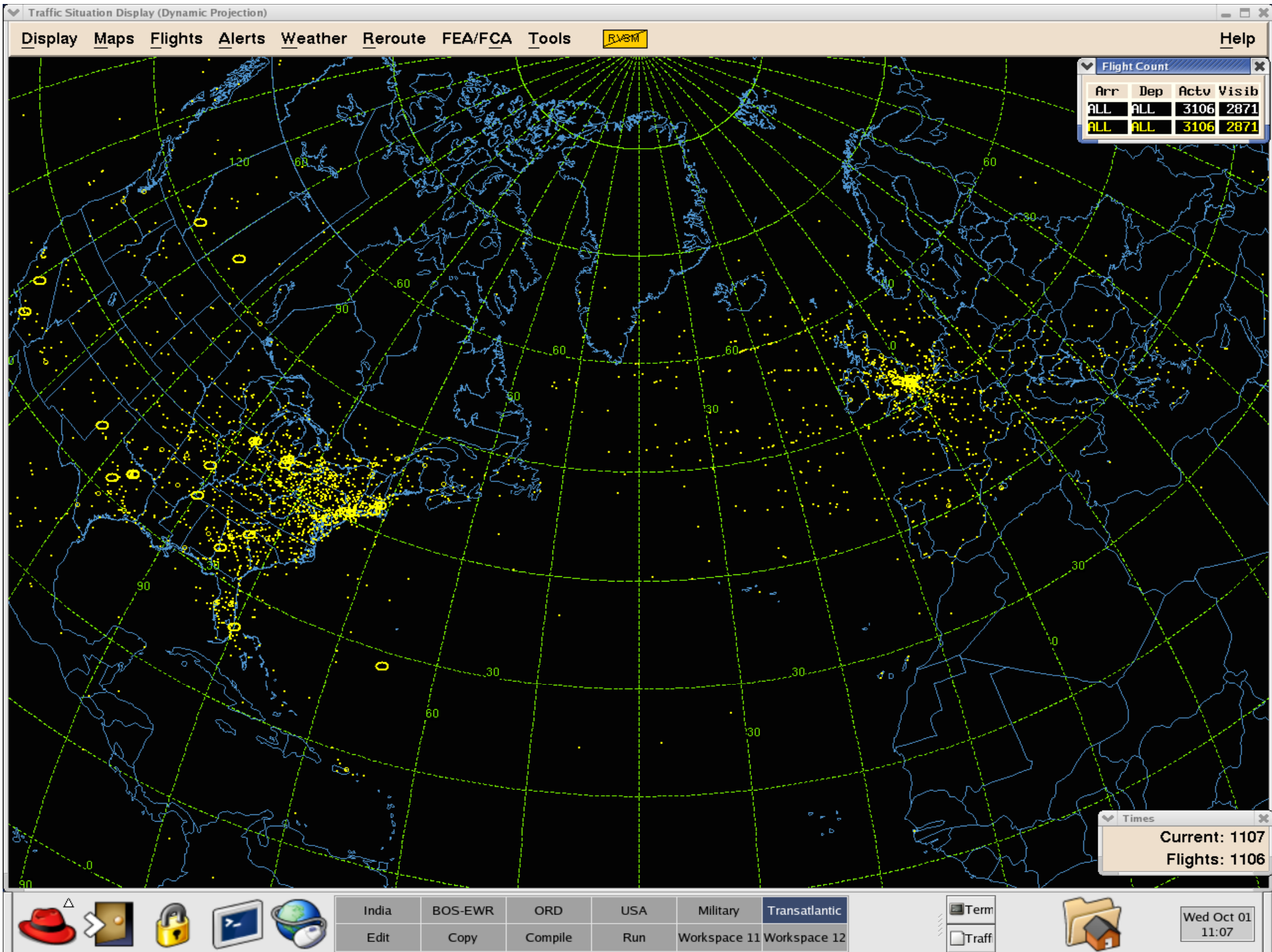
## Data Frequency - Typical Message Load:

- 10,000,000 Flight Data Messages Per Day
- 20 Ground Delay Programs, 10 National Playbook Reroutes
- 400 Flow Constrained Areas, 500 Airport Demand Lists
- 40,000 User Requested NAS Element Demand Lists

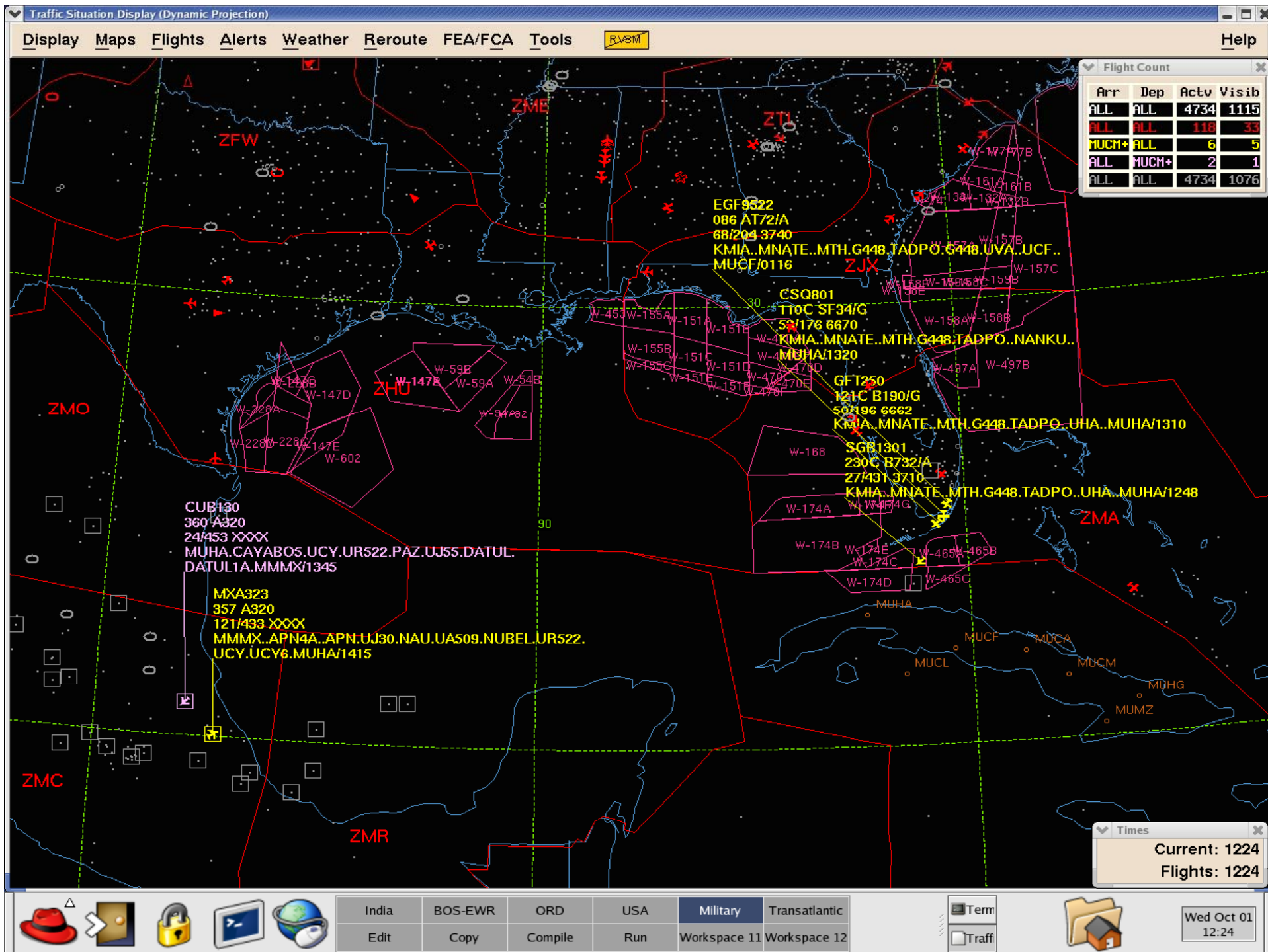
Approximately 1,500,000 lines of C and C++





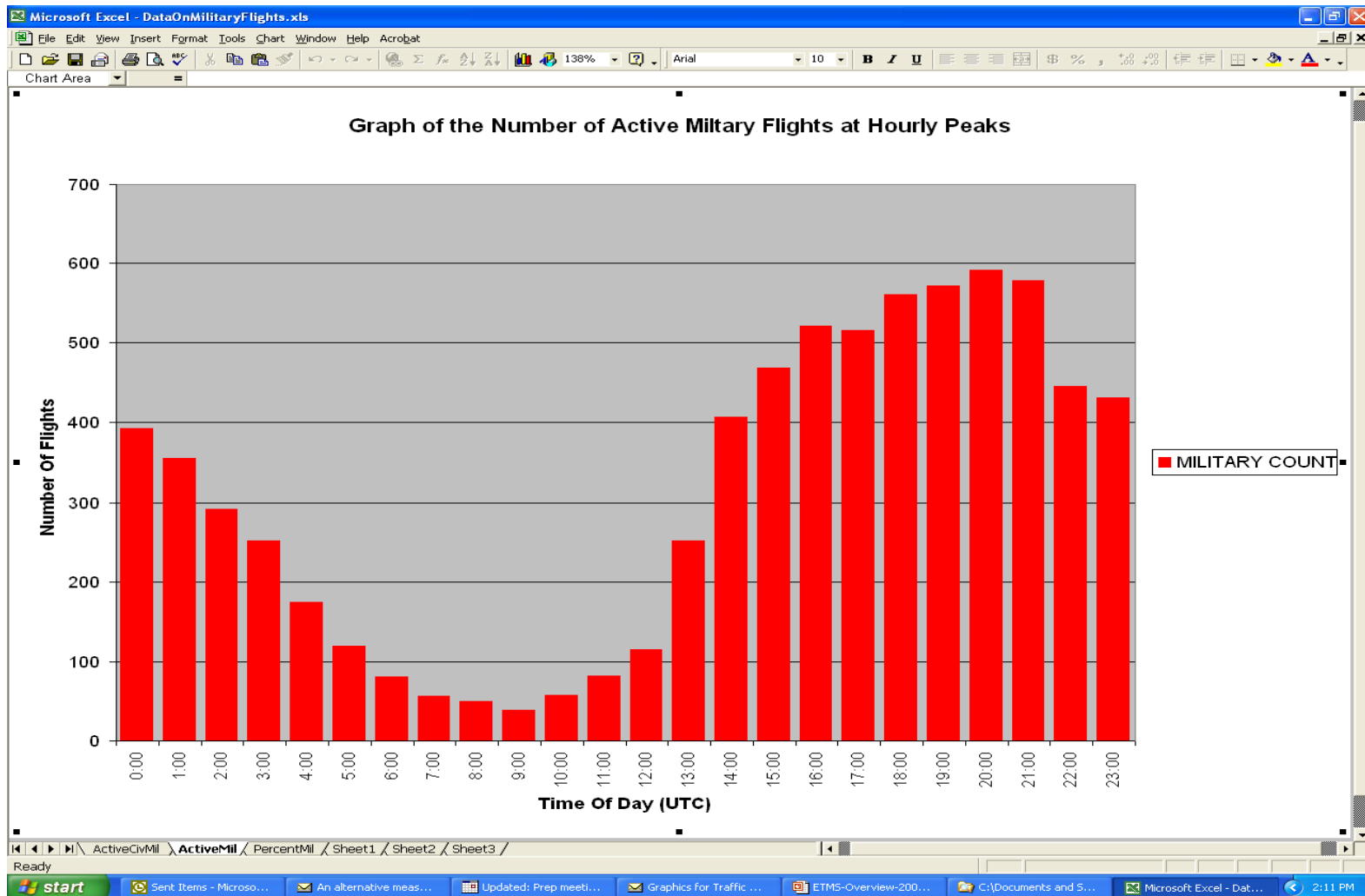






# Air Traffic Flow Management Systems and Required Infrastructure

## - U.S. Technology-Based Solution -

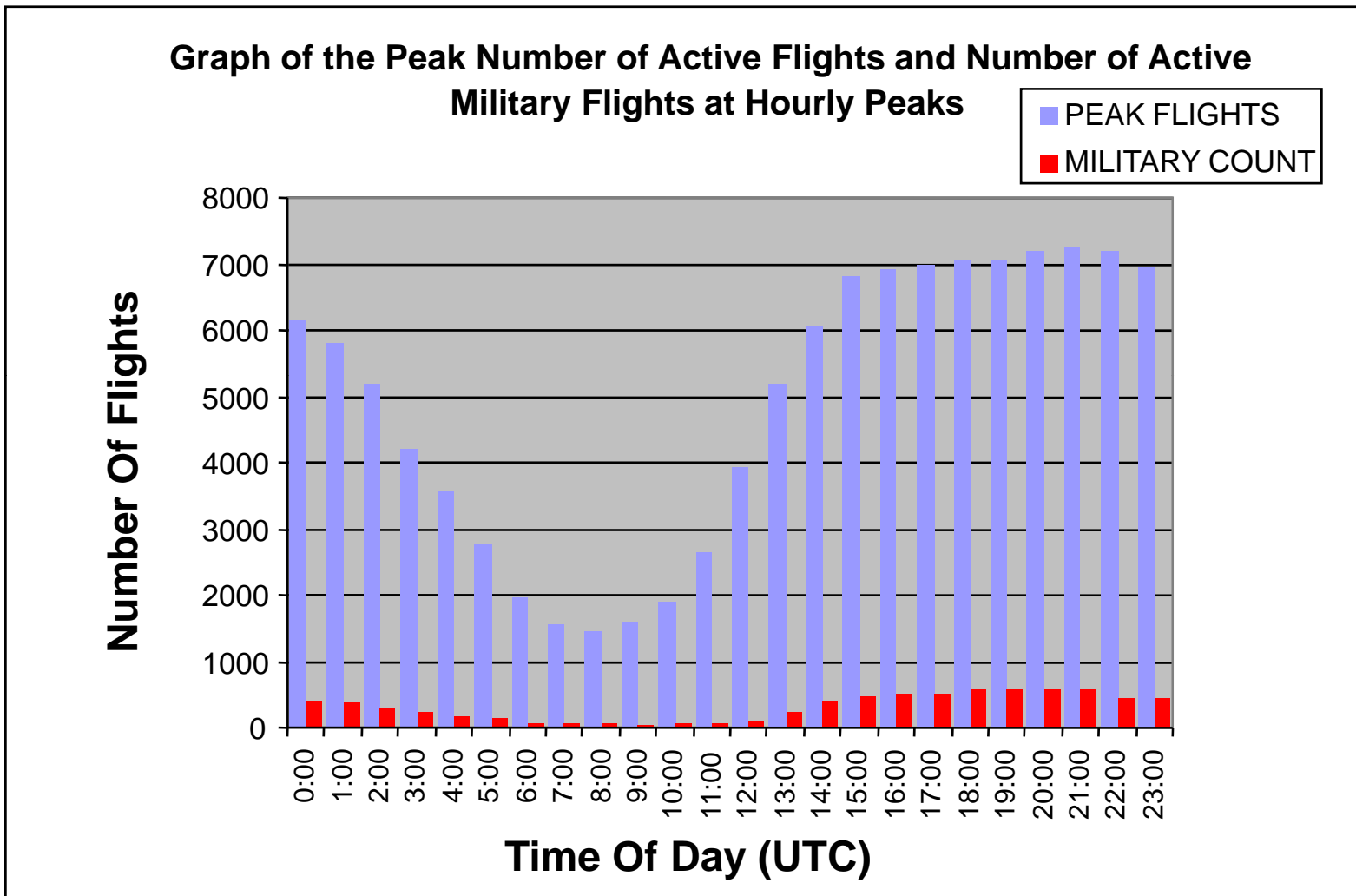


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## India Air Traffic Flow Management Movie

Two days of data compressed to 1 ½ minutes

Captured using existing U.S. ATFM system

### India airports shown:

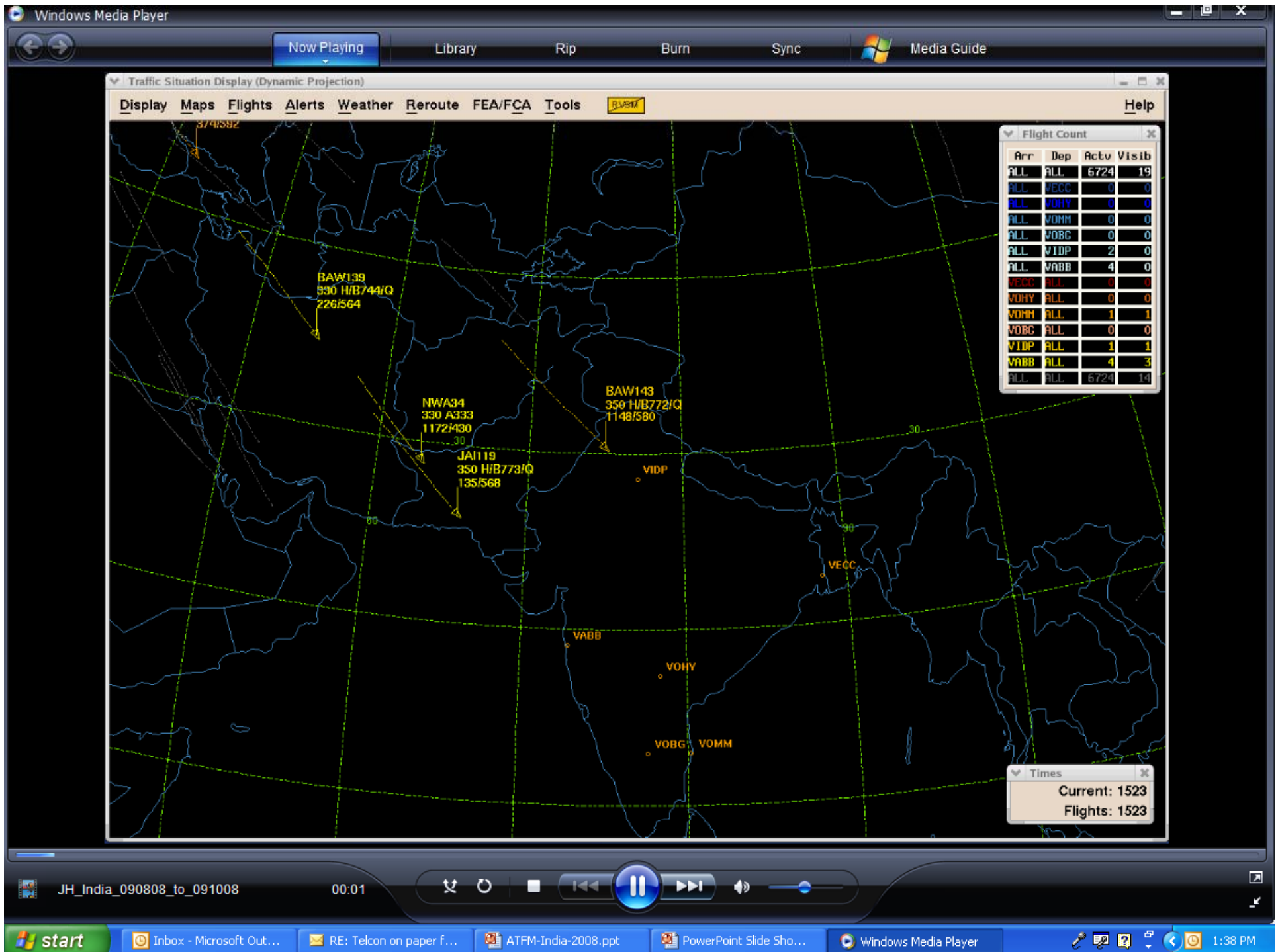
1. New Delhi, VIDP, Indira Gandhi International Airport (Palam)
2. Mumbai, VABB, Chhatrapati Shivaji International (Sahar International)
3. Kolkata, VECC, Netaji Subhas Chandra Bose International Airport
4. Hyderabad, VOHY, Hyderabad Airport
5. Bangalore, VOBG, Bangalore International Airport
6. Chennai/Madras, VOMM, Chennai International Airport

### International flights only

Only flights in feed into U.S. ATFM (London, Airlines)

Based on schedule and flight plan trajectories

No confirming real-time surveillance data



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## Observations on ATFM for India:

1. Alternative Solutions for India ATFM Exist
2. Military Interaction Must Be Addressed
3. Collaboration With Airlines/Air Space Users Must Be Established
4. Concept of Operations, Qualitative Requirements, Specifications, Road Map Need to be Defined
5. U.S. Industry Has and Can Contribute