SFO GDP Parameters Selection Model (GPSM)

Lessons Learned

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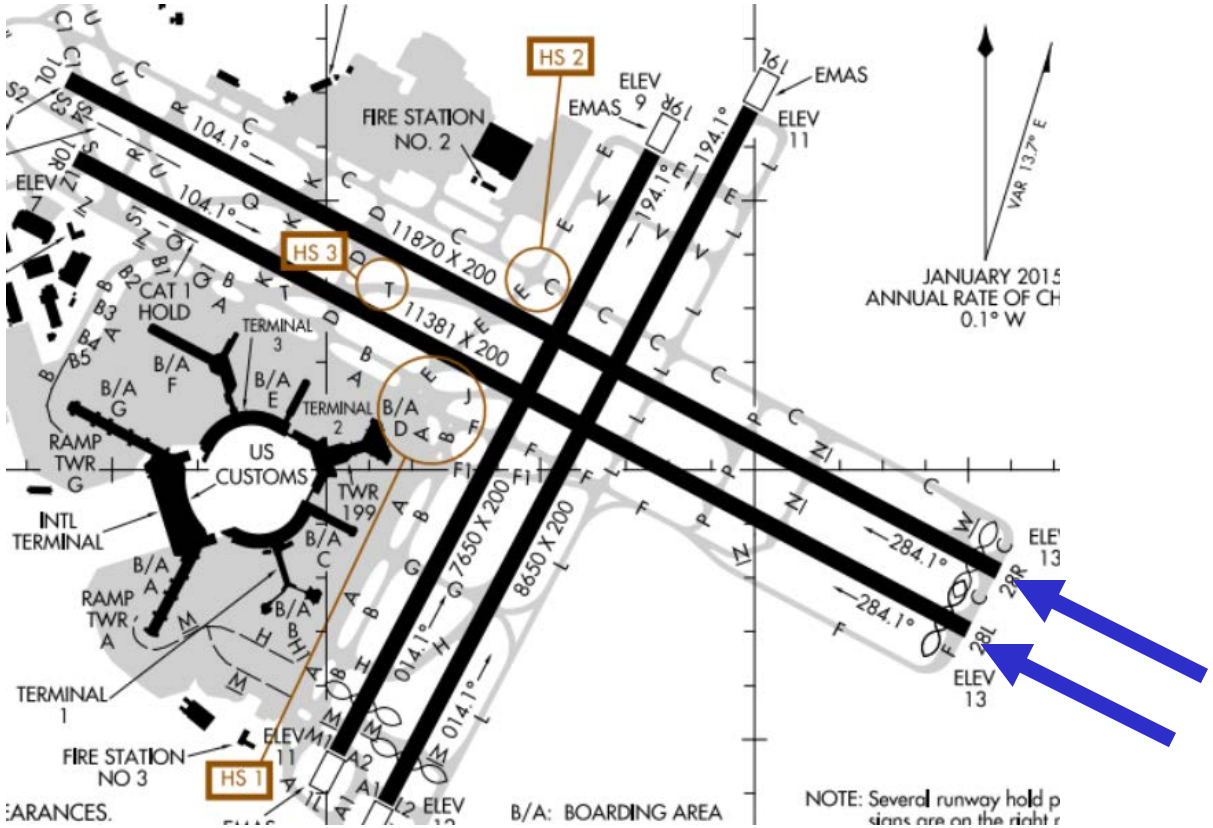
MOSAIC ATM

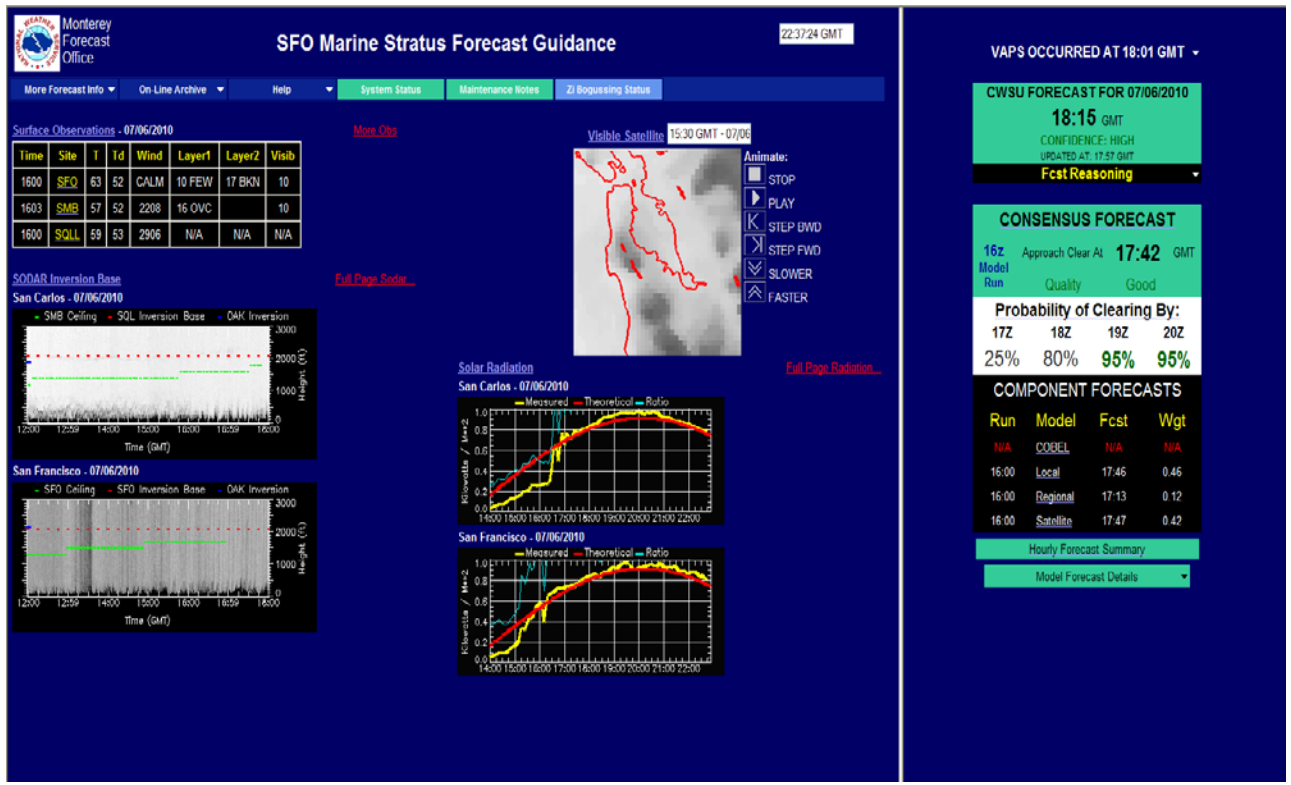
System Solutions for Air Traffic Management

Stratus GDPs at SFO

- Low ceilings at SFO reduce arrival rates from 60 flights/hour to 30 flights/hour
- Marine stratus creates low ceilings on a near daily basis May-October
  - 40-60 marine stratus GDPs
  - Average ground delay of **240K minutes per year** since 2008



SFO Stratus Forecast System



- SSFS: dedicated marine stratus forecast product
- Automated clearing time forecasts every 1-2 hours
- Meteorologist-in-the-loop oversight
- Deployed in 2004
  - Limited observed impact on GDP efficiency

GDP Parameter Selection Model

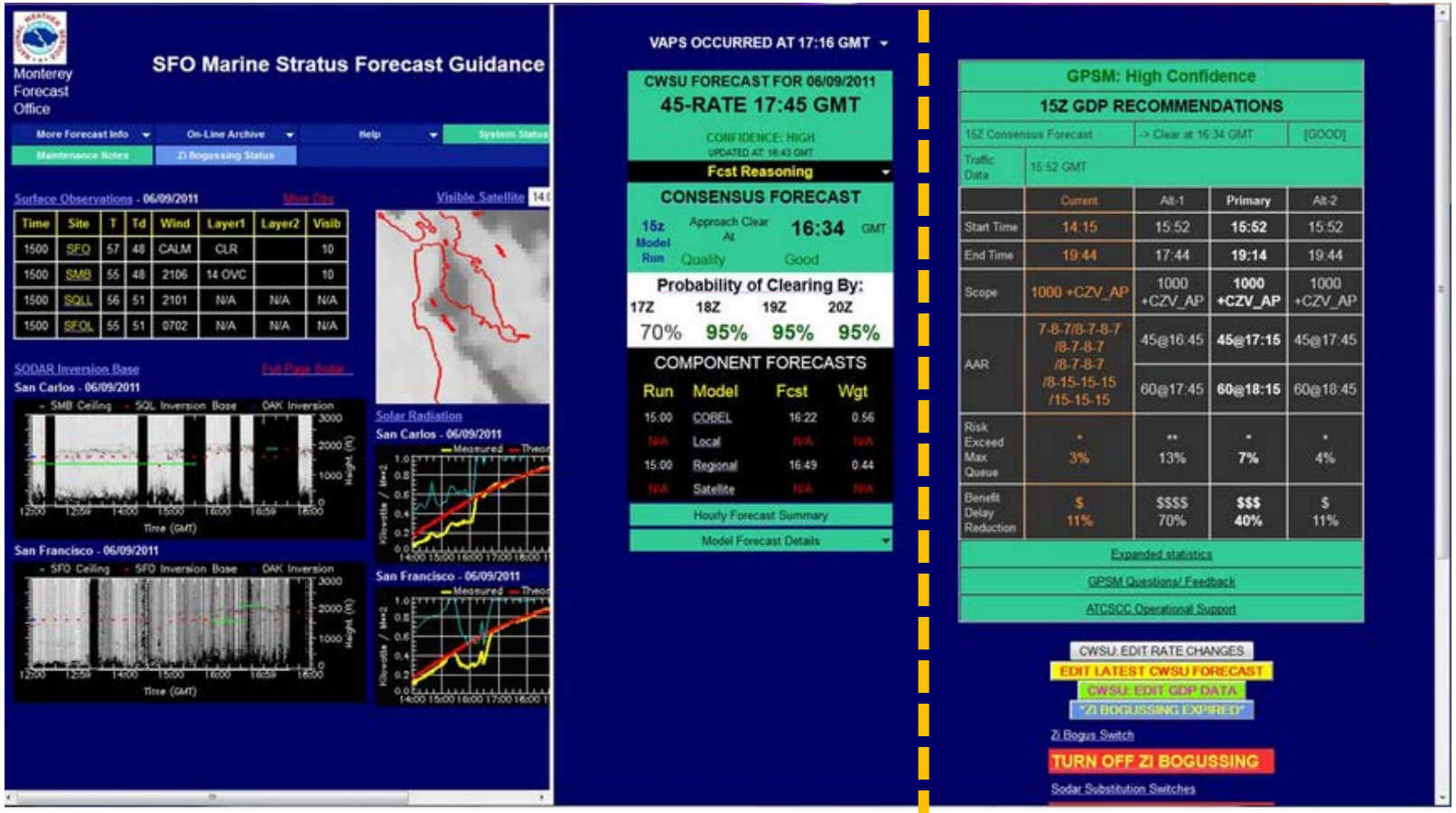
GPSM: High Confidence				
11Z GDP RECOMMENDATIONS				
11Z Consensus Forecast		-> Clear at 17:19 GMT		[GOOD]
Traffic Data	12:30 GMT			
	No GDP	Alt-1	**Primary**	Alt-2
Start Time	n/a	14:15	**14:15**	14:15
End Time	n/a	19:14	**19:44**	20:14
Scope	n/a	1000 +CZV_AP	**1000 +CZV_AP**	1000 +CZV_AP
AAR	n/a	45@n/a	**45@n/a**	45@n/a
		60@17:45	**60@18:15**	60@18:45
Risk Exceed Max Queue	***** 97%	*** 22%	** **11%**	* 8%
Benefit Delay Reduction	$$$$$ 100%	$$$ 41%	**$$ 26%**	$ 12%
Expanded statistics				
GPSM Questions/ Feedback				
ATCSCC Operational Support				

- GPSM: decision support tool to **recommend stratus GDP parameters**
- Balances:
  - Ground delay issued
  - Risk of airborne holding and diversion
- Leverages SSFS forecasts and 15+ years of historical errors
- UI integrated into SSFS dashboard

GDP Parameter Selection Model

Legacy Dashboard

GPSM UI

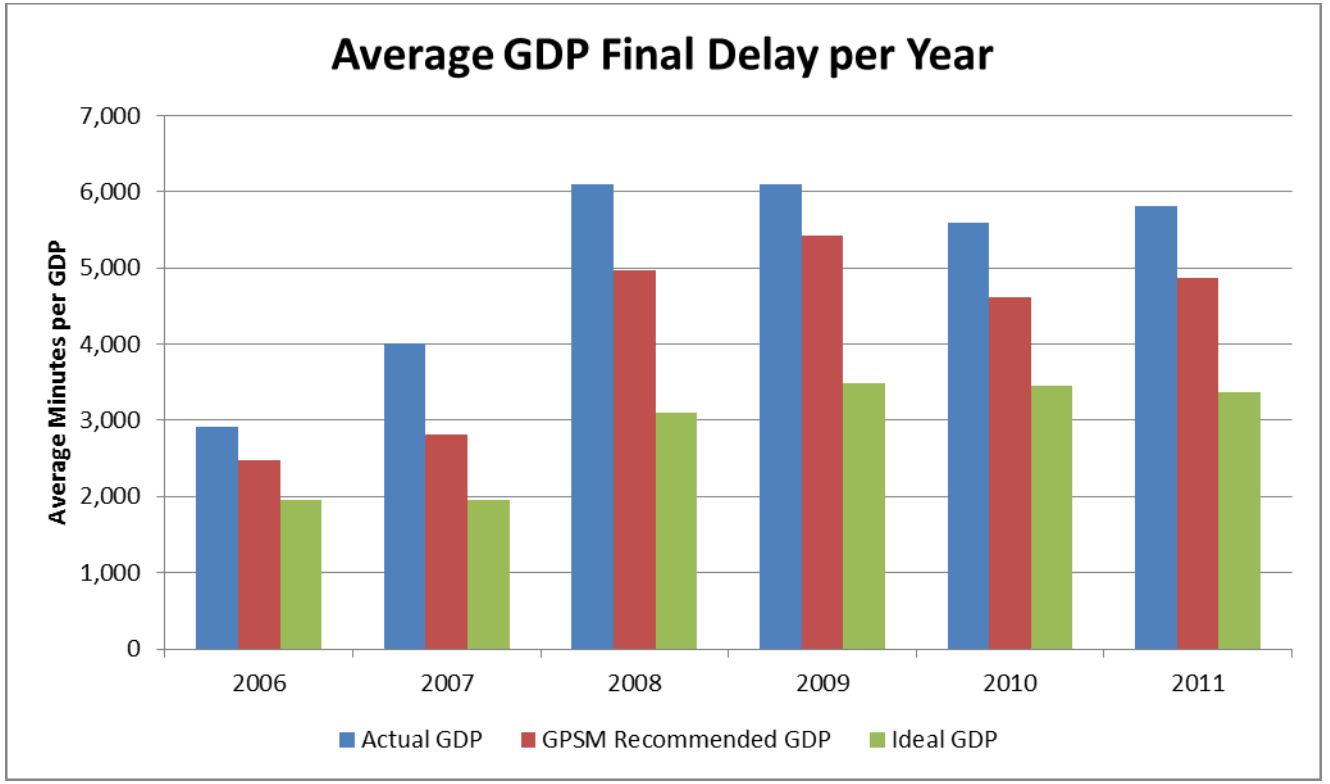


GDP Parameter Selection Model

- JPDO Weather-ATM integration plan identified 5 levels of integration:
  - Level 0 - **Stand-Alone Displays:** Weather data displayed on dedicated interfaces separate from ATM data.
  - Level 1 - **On-the-Glass Weather Integration**: Weather overlays added to ATM tools.
  - Level 2 - **Translated Weather Integration**: Weather data translated into ATM constraints.
  - Level 3 - **Impact Integration**: Weather and ATM data integrated to determine ATM impacts.
  - Level 4 - **Machine-to-Machine (M2M) Integration**: Automated recommendations for ATM decisions without the need of human interpretation or translation.
- GPSM: ***first operational evaluation*** of a Level 4 ATM-Wx integration tool

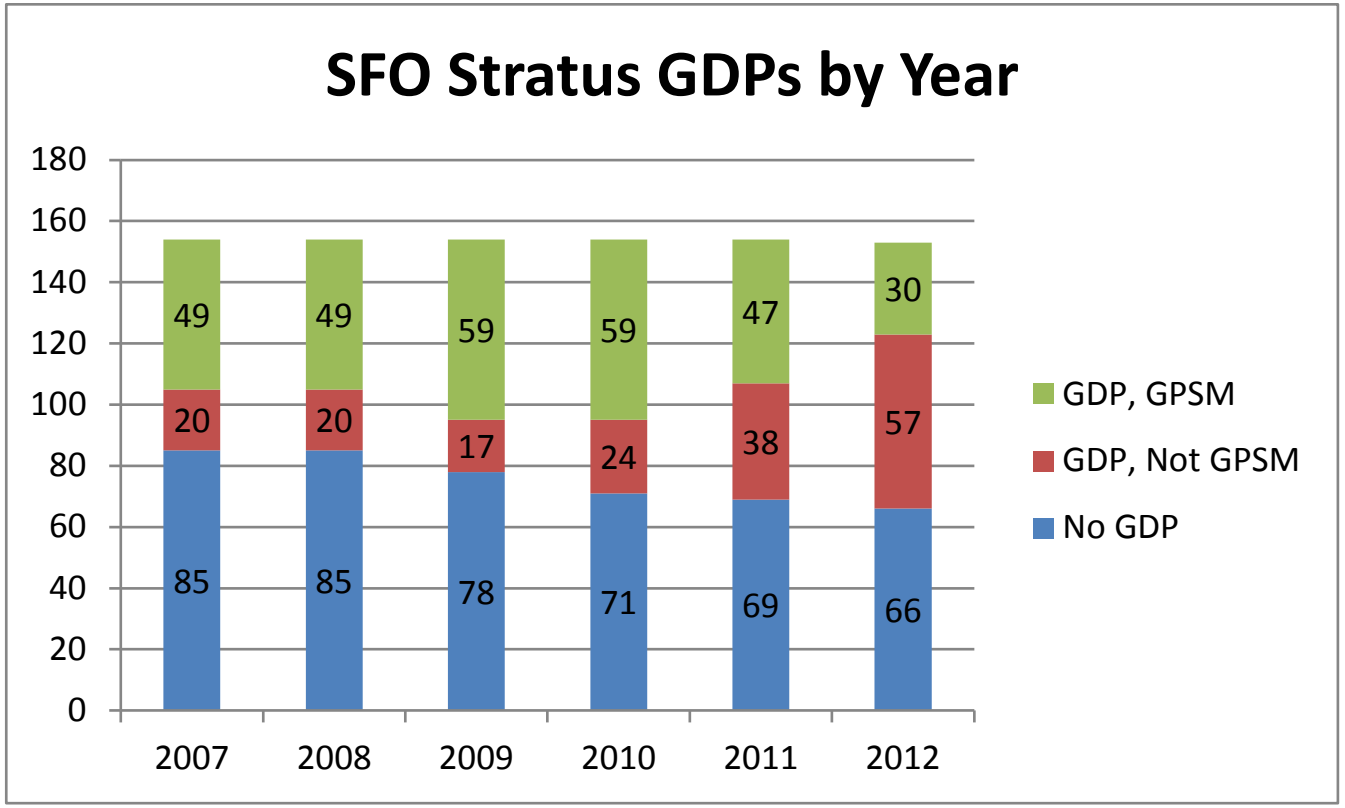
Historical Analysis and Shadow Evaluation

- Historical data from 2006-2011 used to tune model and estimate potential benefits
  - 15-20% decrease in total delay
  - 35-45% decrease “reducible” delay
- Shadow evaluation in 2012
  - Expose users to tool
  - Develop procedures

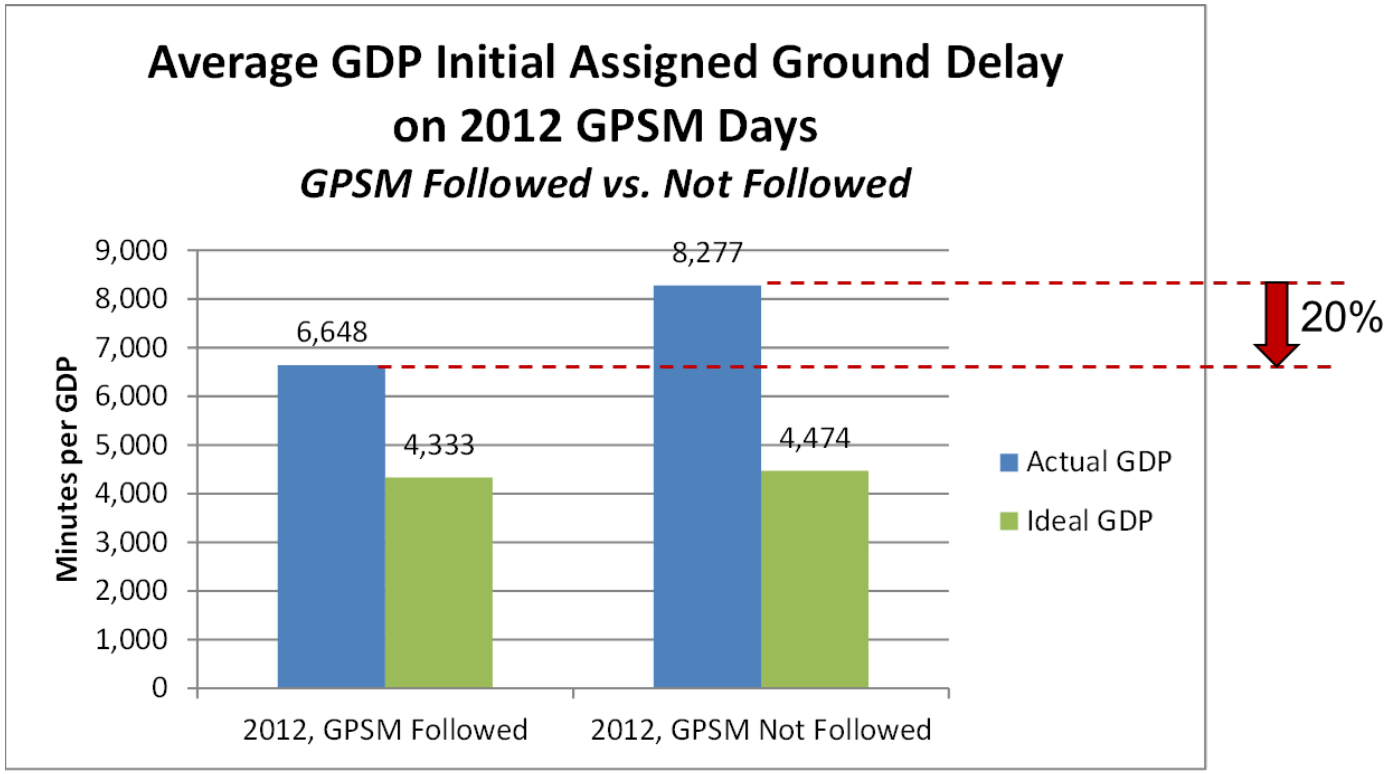


2012: Field Evaluation

- Operational evaluation May-October 2012
- Web-based SSFS/GPSM interface for collaboration
- Challenging weather season limited opportunities for use



2012: Field Evaluation



- Results validated projections
- **1,600-minute (20%) reduction** in assigned ground delay per GDP when GPSM followed
- Potential to reduce delay after revision by up to 1,500 additional minutes
- Estimated airborne holding *lower* under GPSM GDPs

Current Status

- GPSM awaiting consideration for CATM work package
- GDP delays **up significantly** in 2013
  - …with caveats
- Focus has turned to procedural changes to increase arrival rates
- What can the aviation community learn from the GPSM experience?

Lessons Learned

- Lesson #1: Level 3 to Level 4 integration is a **big jump**
  - Requires much more trust in tool
  - Burn risk goes way up
  - Perception: “Helping me do my job” vs. “Doing my job for me”
  - Shifts roles from **tactical** to **strategic**

Lessons Learned

- Lesson #2: End user buy-in and collaboration are critical
  - Involve **all** stakeholders as early as possible
    - E.g., design and concept of operations
  - Leverage existing relationships to develop trust
    - E.g., CWSU to TMU
  - Agree on clear, simple (as much as possible) metrics and success criteria up front
  - Align objectives, incentives, and procedures

Lessons Learned

- Lesson #3: Still difficult technological challenges
  - Complexity/nuance of robust forecasts
  - Strategic TFM has unique requirements
  - Where do meteorologists enter the loop?
  - Caveats can overwhelm the message

Questions (and Answers)

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