CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT (CAASD)

A Concept for Pairing Departures from Parallel Runways for Wake Avoidance

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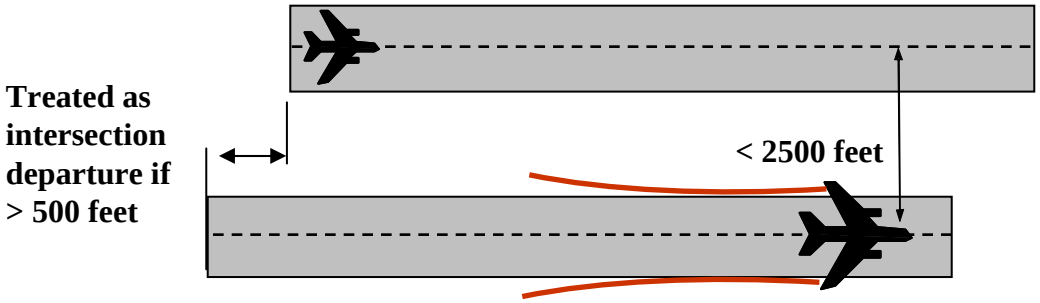
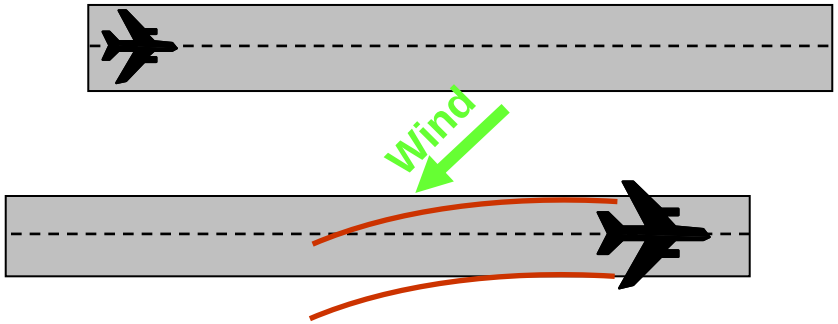
Evolution of Concepts for Departures From Closely Spaced Parallel Runways

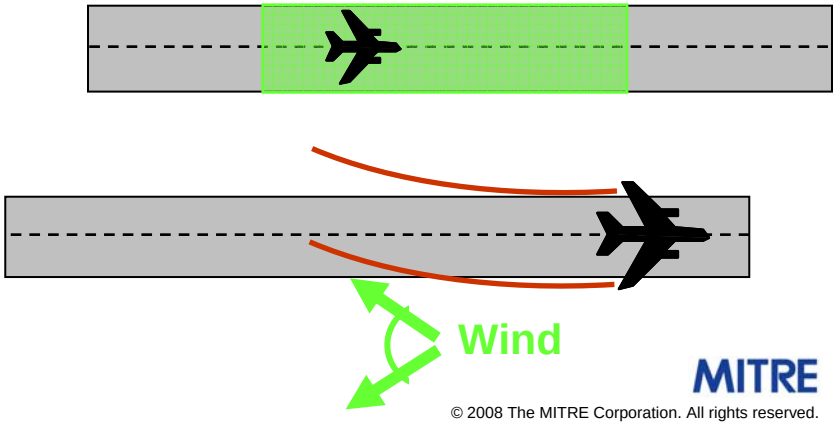
Current Rules: Aircraft departing after Heavy or B757 must wait 2-3 minutes for wake (always)



WTMD: Wake delay avoided due to wind moving wake away from parallel runway (available 10-30% of time depending on airport and season)



Paired Departure: Wake delay avoided with a short interval (window) between departures. Accommodates additional wind conditions.



Premise for Paired Departures

- As a lead aircraft departs, it takes a certain amount of time for the wake to drift toward the parallel runway, depending on:
  - Crosswind strength
  - Wake strength and self-transport
  - Spacing between runways
  - Spacing between departure paths (FTE, divergence, on heading or RNAV route…)
- For worst case, the wake still cannot drift to the trailer departure path faster than X seconds
  - For example, 1500 ft spacing between departure paths, max 10 kt crosswind, max 5 kt self-transport
  - Results in minimum of 60 seconds for wake to be a problem for the next departure off the parallel

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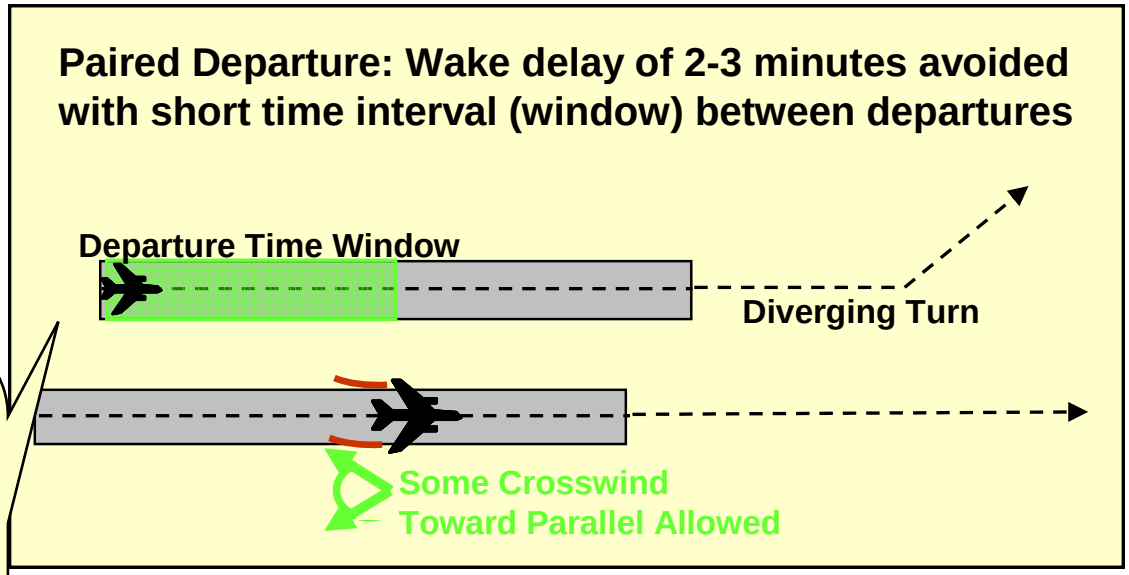
Paired Departure Procedure



United 123, cleared for immediate takeoff runway one left, turn left heading 350, paired departure with Heavy

- **Trailing aircraft starts takeoff roll within ~30 seconds of lead Heavy**
- **Controller provides Paired Departure takeoff clearance**
- **Time window can be judged by controller by**
  - **Timer or Clock (same as for wake delay)**
  - **Landmark, such as trailer must roll before leader crosses runway 28R**
  - **Automation, scan of flightstrip for Heavy takeoff clearance starts timer**

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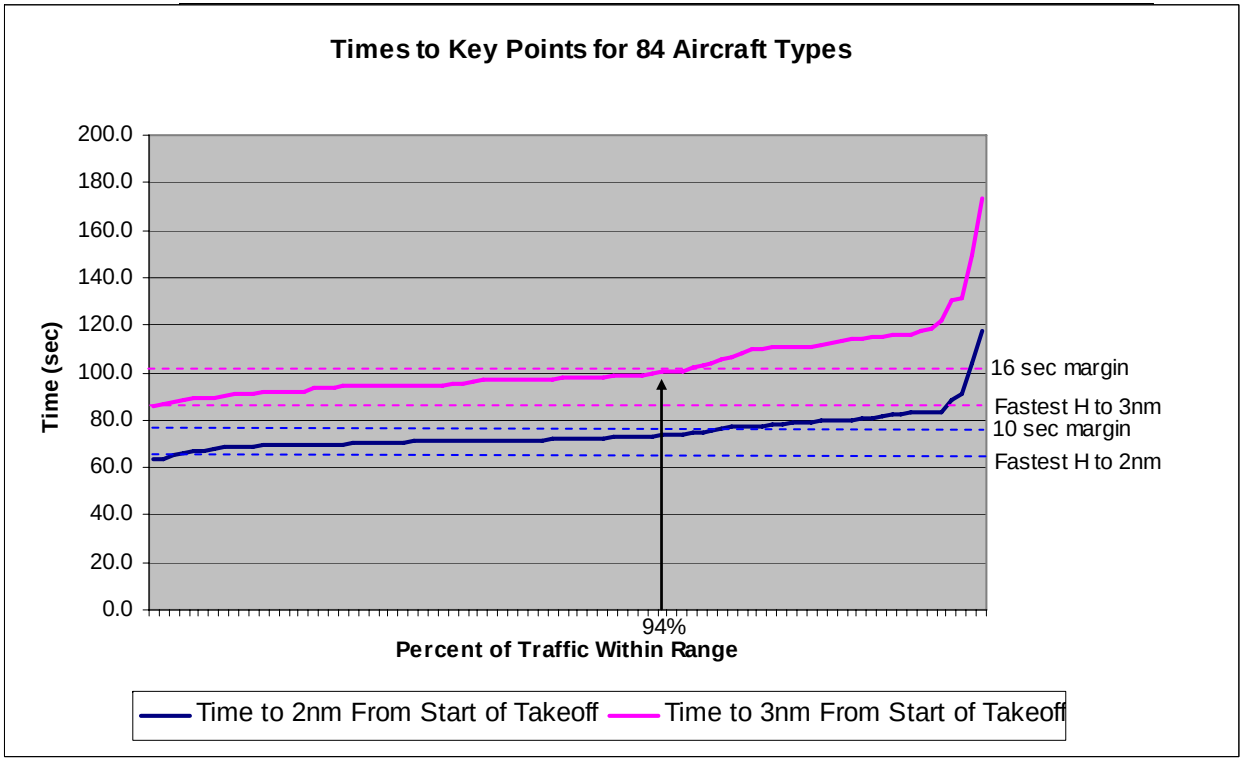
Paired Departure Procedure



- **Paired Departure Time window estimate considers**
  - **Wake transport (IGE and OGE)**
  - **Effect of lead/trail performance differences (16 second reduction)**
  - **10 second uncertainty buffer**

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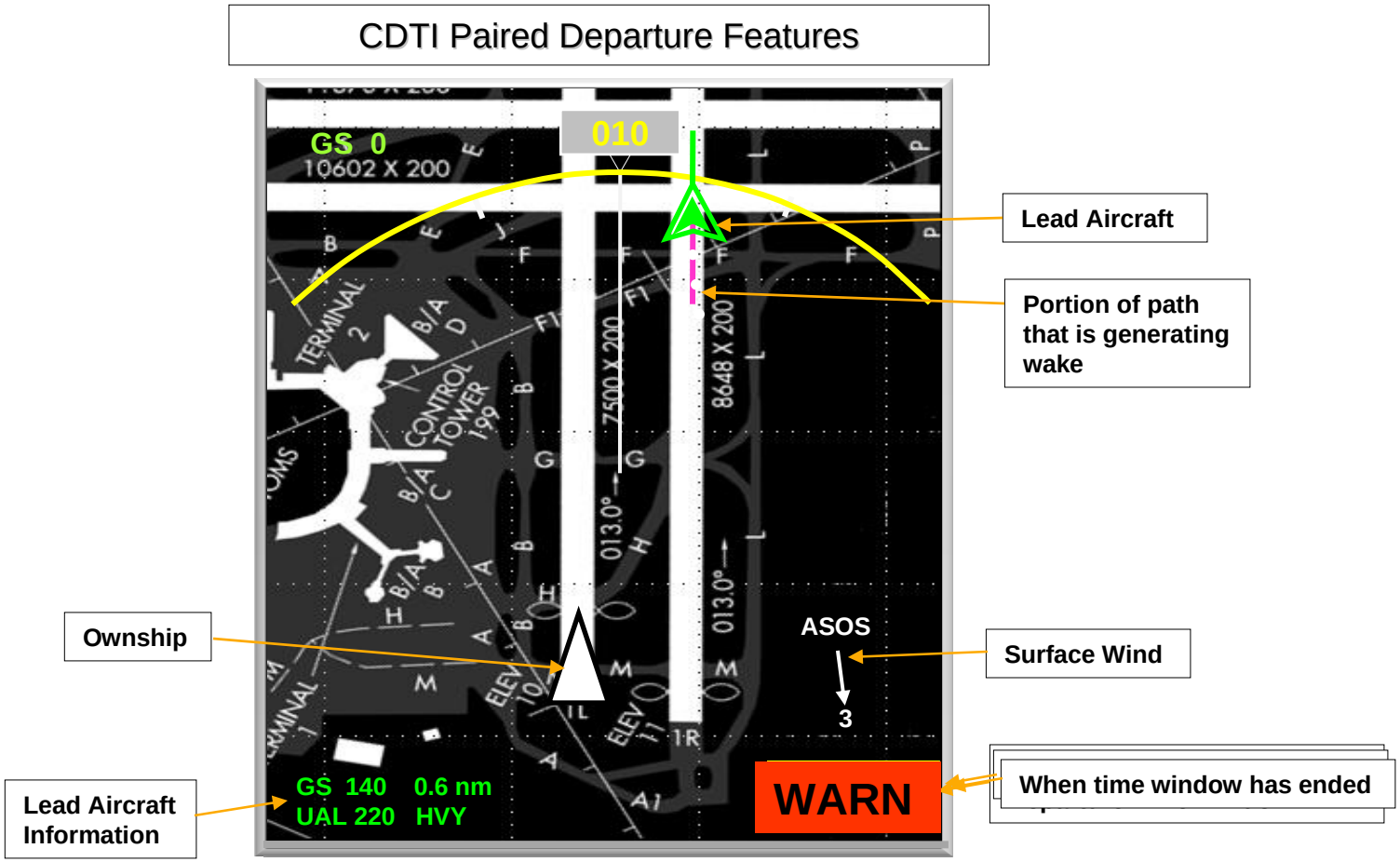
Paired Departure Procedure

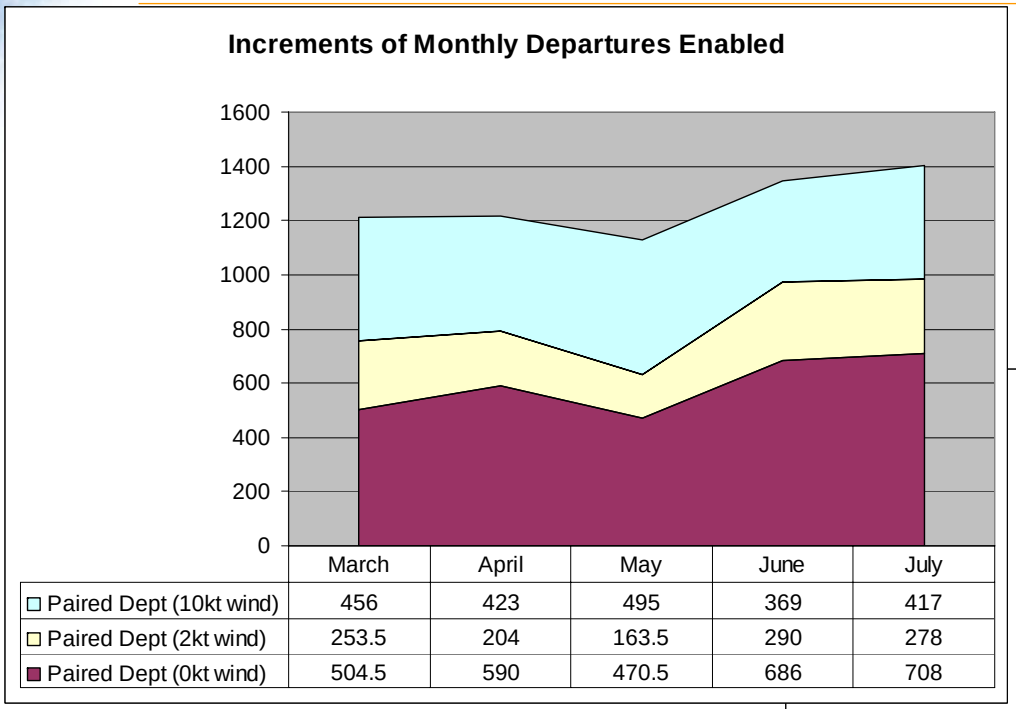
Local Controller Display Features

- **Tower Display indicates when Paired Departure operations can be approved**
  - **Wind meets criteria**
- **Visual and audible alert when wind no longer meets Paired Departure criteria**

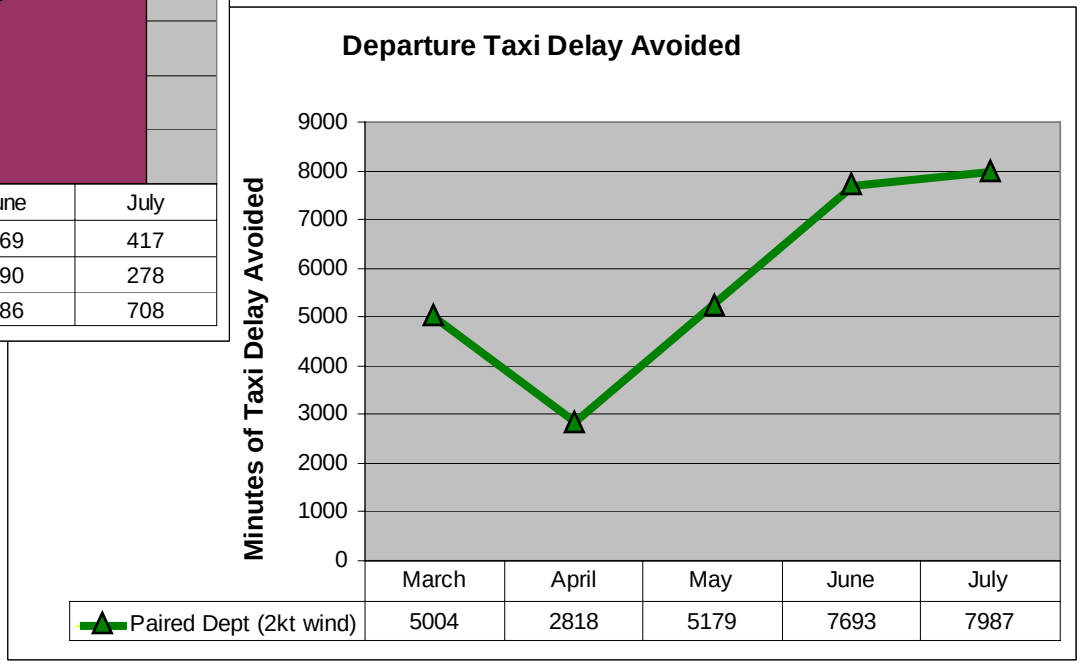
Paired Departure Procedure



Benefits Estimate for Sample Airport (IAH)



	March	April	May	June	July
Paired Dept (10kt wind)	456	423	495	369	417
Paired Dept (2kt wind)	253.5	204	163.5	290	278
Paired Dept (0kt wind)	504.5	590	470.5	686	708



	March	April	May	June	July
Paired Dept (2kt wind)	5004	2818	5179	7693	7987

- **Fills gap when winds do not meet criteria for Wake Turbulence Mitigation for Departures**

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Conclusion

- The Paired Departure Concept is being explored in this year's Enhanced Visual Operations research project
- Further work will be conducted in refining the concept in the following areas:
  - Establishing the basic parameters for the procedure with respect to expected wake behavior and developing the window concept in a manner most likely to be implemented operationally
  - Establishing operationally viable altitude limits for the procedure with respect to wind prognosis
  - Implications for navigation procedures, especially the potential of using RNAV procedures
  - ATC and flight crew procedures
  - Tower cab and cockpit displays and cues
  - Feasibility studies with real-time simulations
  - Developing and refining the benefit potential for the NAS

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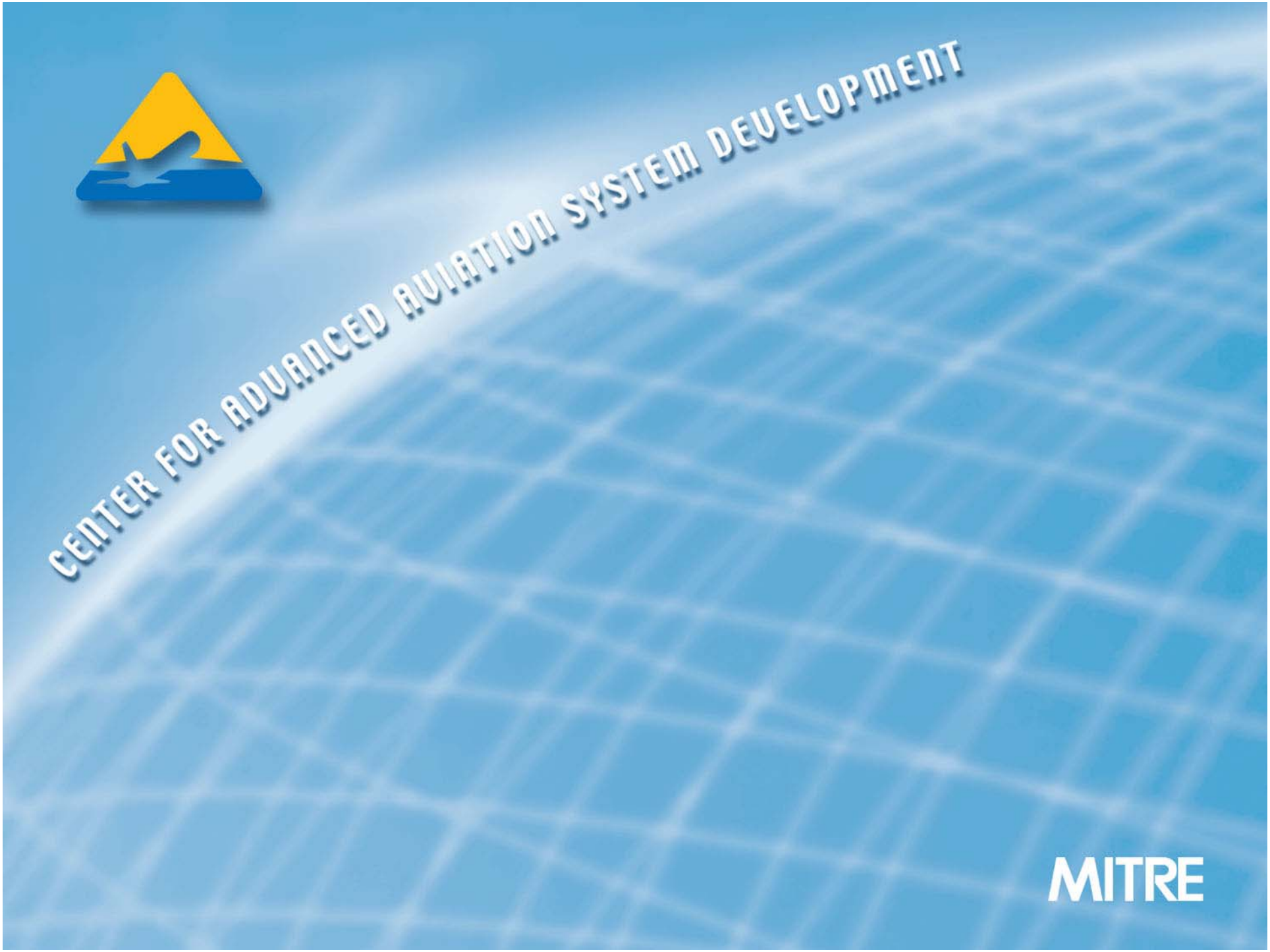
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