

Applying the Final Approach Runway Occupancy Signal (FAROS) Concept to the High- Density Airport Environment

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Federal Aviation
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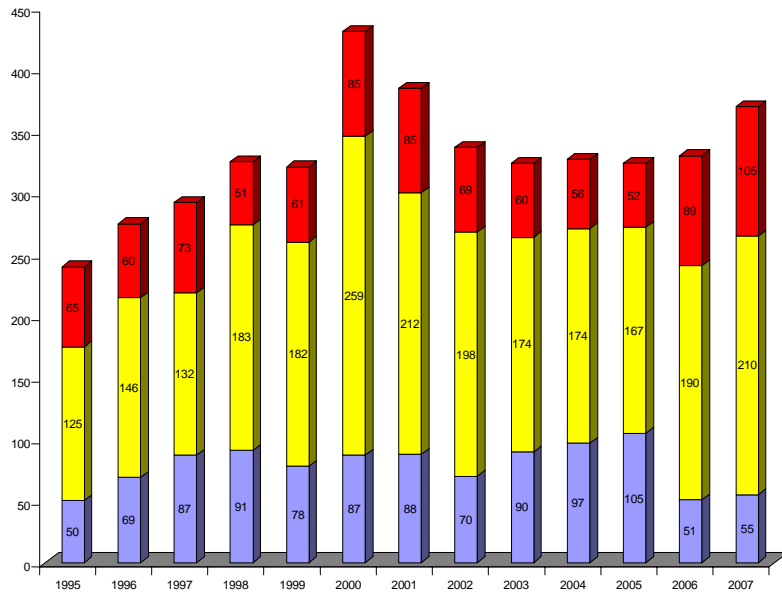
Background

- **NTSB safety recommendation A-00-66:**
 - “Require, at all airports with scheduled passenger service, a ground movement safety systemprovide a direct warning capability to flight crews.”
- **2002 – 2004 FAA Runway Safety Blueprint**
 - “...develop and evaluate a visual signal that provides direct warning to flight crews on final approach when the runway is occupied;”
- **FY2006 ATO Operations Planning Business Plan**
 - “Continue development of surface technologies and operational solutions.....”

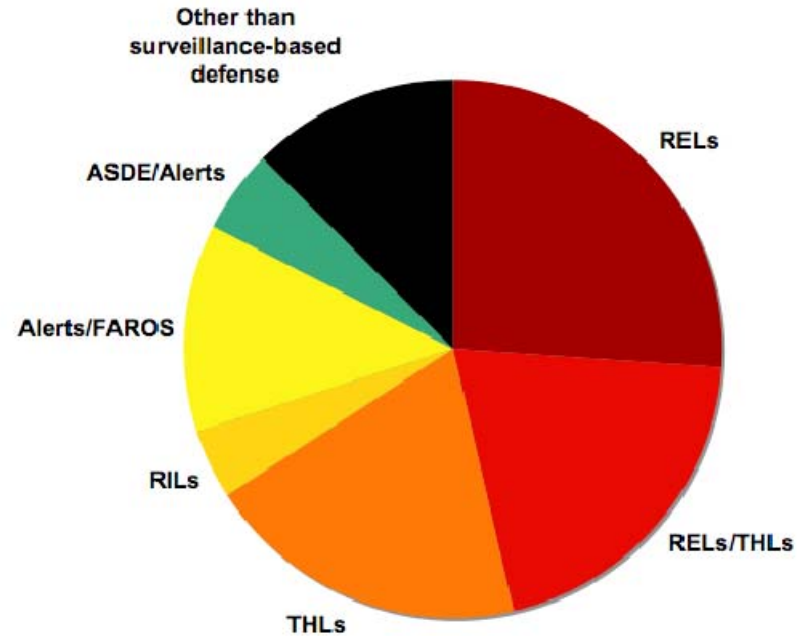


Runway Incursions Remain an Issue

Runway Incursion Statistics FY1995-2007



Best Defense Against Critical Runway Conflicts

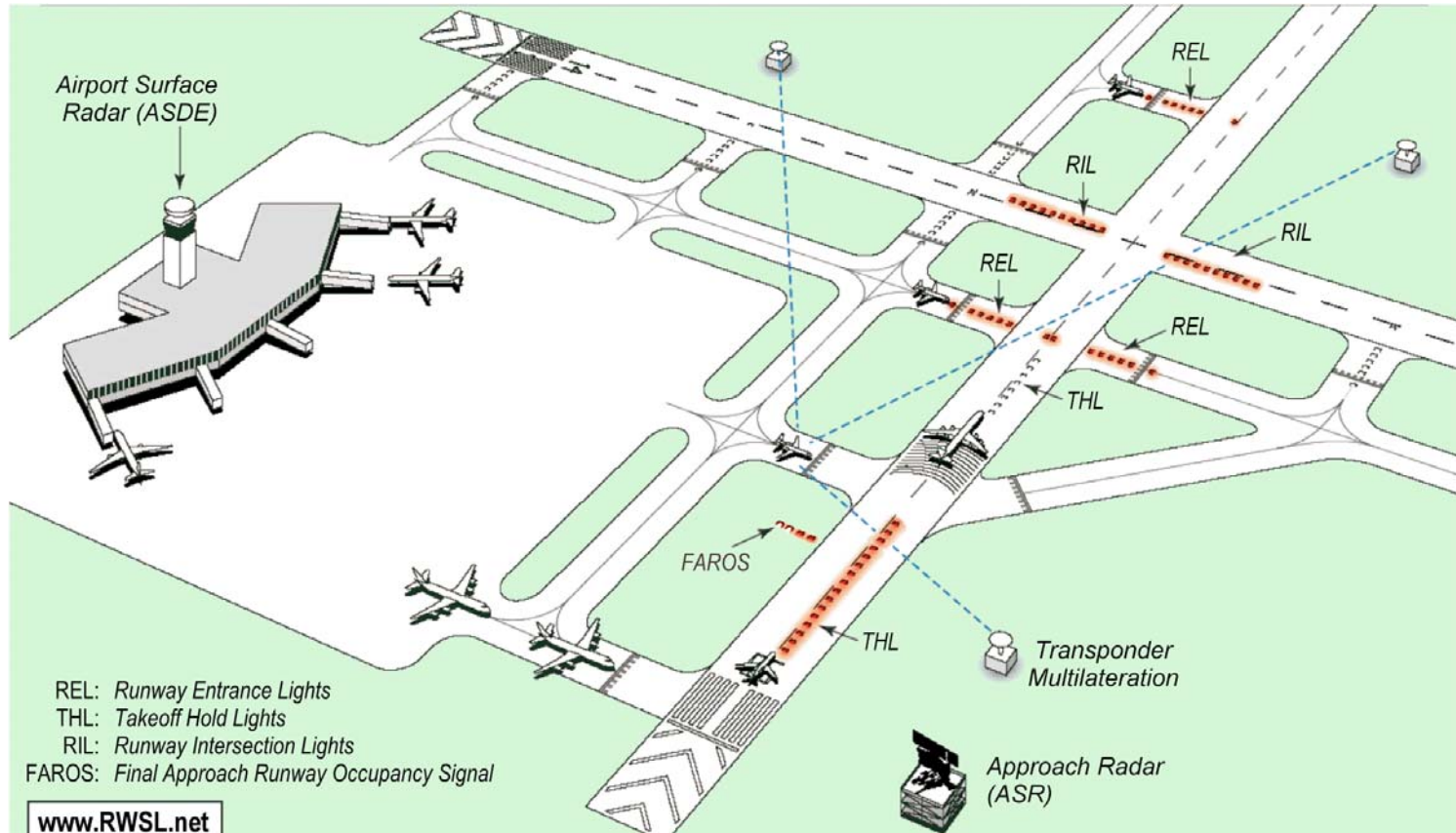


¹ Runway Conflicts at Major US Airports 1997–2000: Patterns and Prevention, MITLL, October 2002

Runway incursion rates dominated by pilot deviations



Runway Status Lights and FAROS



Complete surface “picture” includes pilot on approach

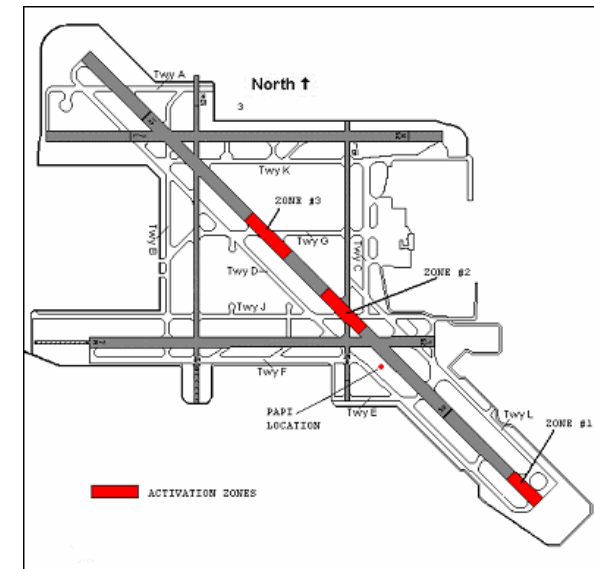
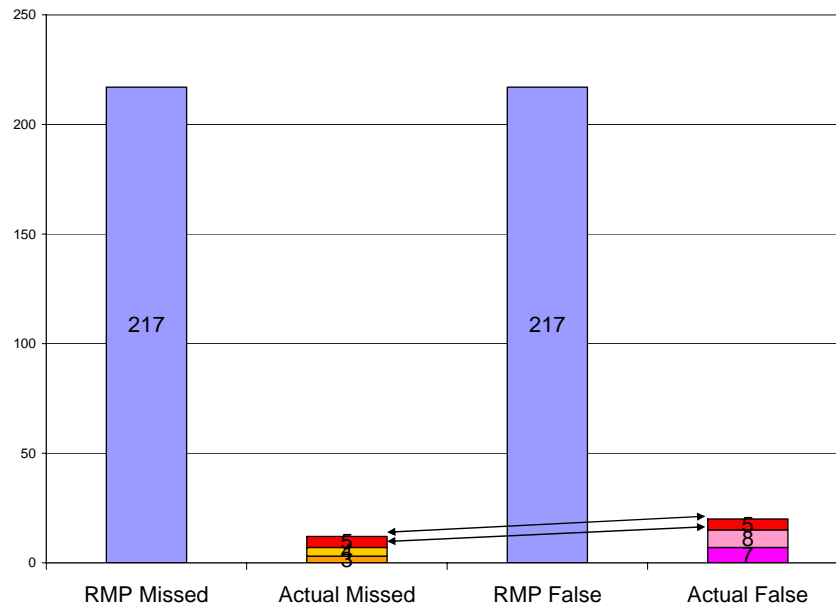
Final Approach Runway Occupancy Signal (FAROS)

- **Suggested by the Air Safety Foundation**
- **Provides direct notification to pilots on approach that a runway is occupied**
 - Potentially unsafe to land
 - Pilot should increase vigilance
 - Advisory only
- **Advantages**
 - Direct and immediate notification to pilot
 - Existing controller procedures unchanged
 - No aircraft equipage required



FAROS OpEval @ LGB

- On-going since August 2006
- Aviation community receptive to system
- Notifies pilots when zone is occupied
- Meeting operational requirements

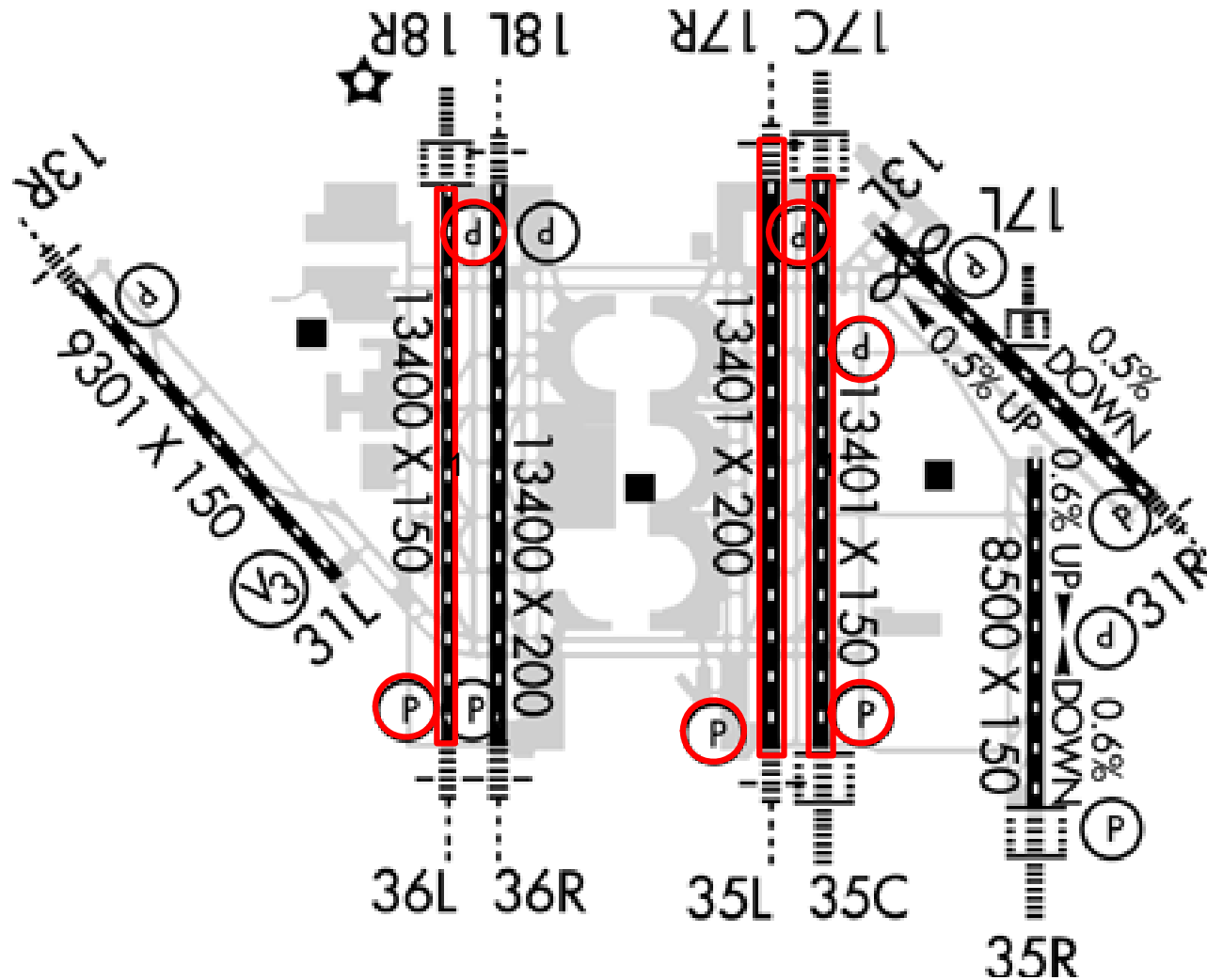


FAROS OpEval @ DFW

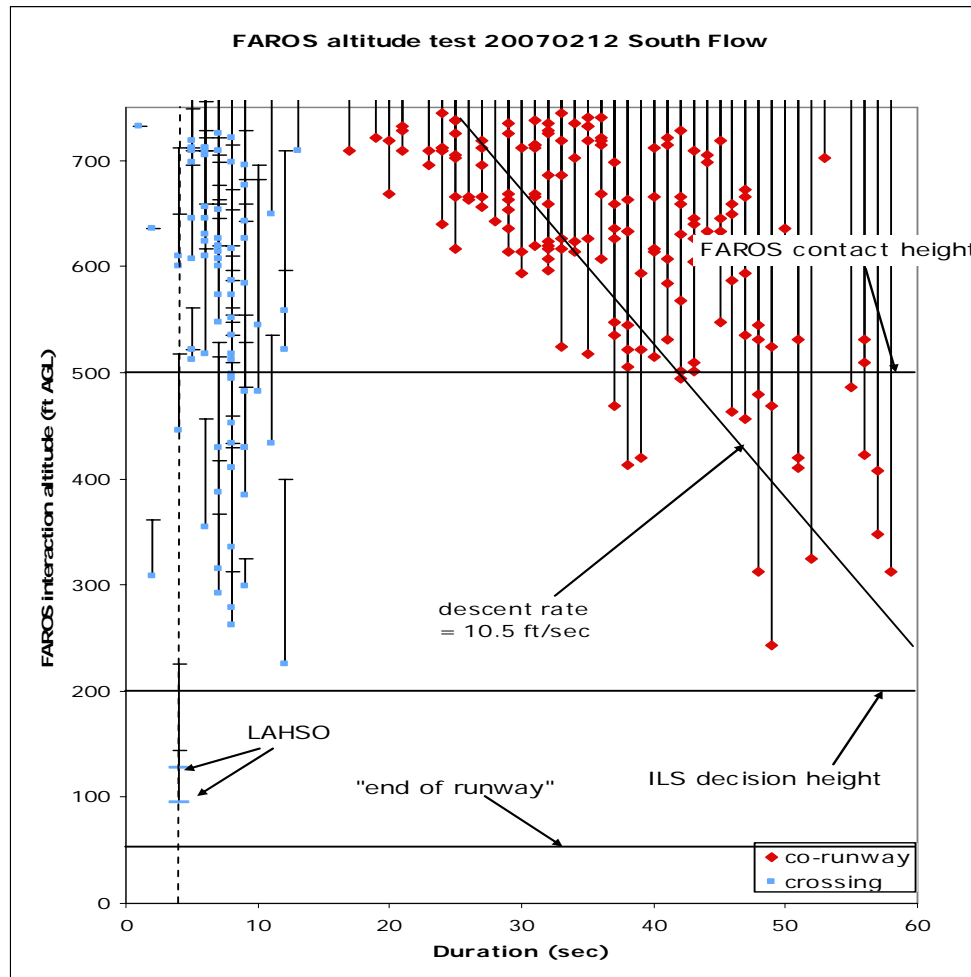
- **Monitor entire runway**
- **Consider modifying the Concept of Operations and activation logic for high-density operations**
- **Use the “flashing PAPI” as the notification system**
- **Current Schedule**
 - 12/06 Initial DFW Discussions
 - 04/07 DFW Operational Analysis
 - 10/07 Safety Logic Development
 - 03/08 High Density ConOps
 - 06/08 Hardware Installation/Testing
 - 07/08 Shadow Operations
 - 09/08 Flight Check, Operational Evaluation



FAROS at DFW



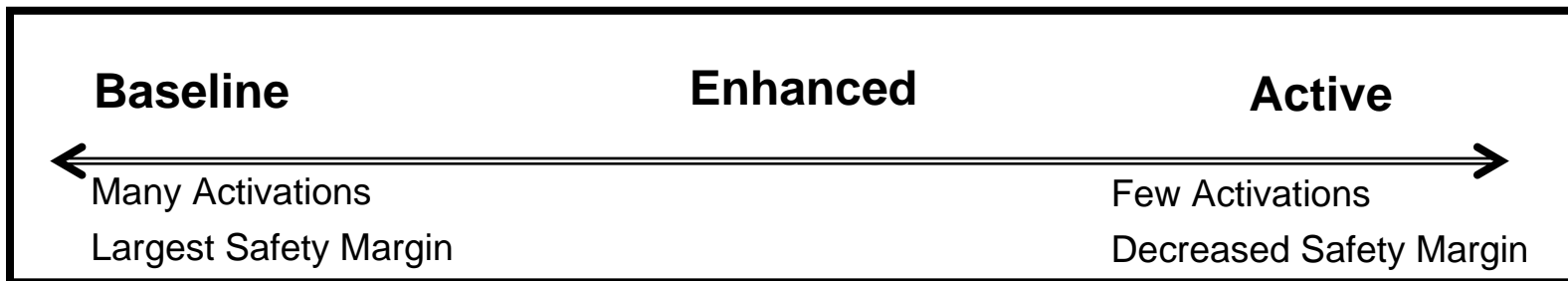
Estimating FAROS Activations



- Tracks sorted by duration of FAROS activation
- **Blue** – activations due to runway crossings
- **Red** – activations due to co-runway operations (departures or arrivals)
- Typical day's traffic – no safety violations

High-Density Concept of Operations

- **Baseline** - 585 Activations
 - Activates based on runway occupancy
 - No sensitivity to approach corridor
- **Enhanced** - 51 Activations
 - Activates based on runway occupancy AND presence of aircraft within activation distance (e.g. 1.5 nmi from threshold)
- **Active** - 0 Activations
 - Activates based on determination of potential conflict between arriving aircraft and surface traffic



Active FAROS Safety Logic States

1. Taxiing Traffic Across Runway
2. Arrivals in Trail
3. Arrival-Departure Tail Chase
4. Stopped Traffic on Runway
5. Traffic Taxiing on Runway
6. Opposite Direction Traffic on Runway
7. Opposite Direction Arrival
8. Crossing Runways
9. Closed Runways



Proposed FAROS Pilot Protocol

- Flight crews on approach to an equipped runway who observe a FAROS activation (flashing PAPI signal) should **attempt to visually acquire** the triggering vehicle or aircraft.
- Flight crews visually acquiring the triggering vehicle or aircraft should **proceed** with their approach, **as directed**, maintaining safe separation at all times.
- Flight crews NOT visually acquiring the triggering vehicle or aircraft should intensify their scan for surface traffic.
- Upon reaching the **FAROS Contact Height** (currently 500' AGL):
 - If the triggering vehicle or aircraft has been visually acquired, proceed with approach as cleared maintaining safe separation at all times.
 - If the triggering vehicle or aircraft has NOT been visually acquired, the flight crew should:
 - Contact the tower, e.g., **“DFW tower, AAL123, short final runway 17C, with FAROS, verify clearance to land.”**
 - Prepare for a possible go around.
 - If the tower cancels landing clearance or does not verify landing clearance promptly, the flight crew should execute a go around.



FAROS Shadow Operations

- **Will include representatives from both controller and pilot communities**
- **Initial presentation (03/08) produced interesting results**
 - Pilots expressed interest in Enhanced – “Give us the information as soon as you can, let us integrate it with the other information we have.”
 - Controllers expressed interest in Active – “Don’t alert us unless there is potential problem, but with sufficient time to resolve it.”
- **ConOps to be refined during Shadow Operations**



Conclusions

- **FAROS meets a safety need by providing direct notification to pilots on approach**
- **LGB FAROS Operational Evaluation is ongoing**
 - Successfully meeting program goals
 - Preparing for next steps and future implementation
- **DFW FAROS System to be installed this summer, Operational Evaluation scheduled for this fall**

