

# Operational Evaluation of the Final Approach Runway Occupancy Signal (FAROS)

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May 2, 2007



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# Background

- **NTSB safety recommendation A-00-66:**
  - “Require, at all airports with scheduled passenger service, a ground movement safety system .....provide 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.....”



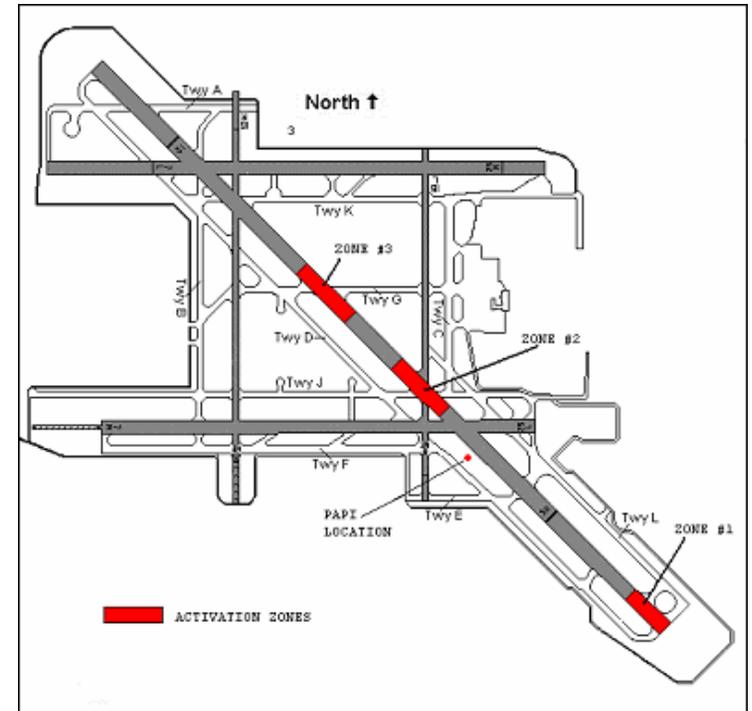
# FAROS Overview

- **Originally suggested by the Air Safety Foundation as part of the Joint Safety Implementation Team**
- **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



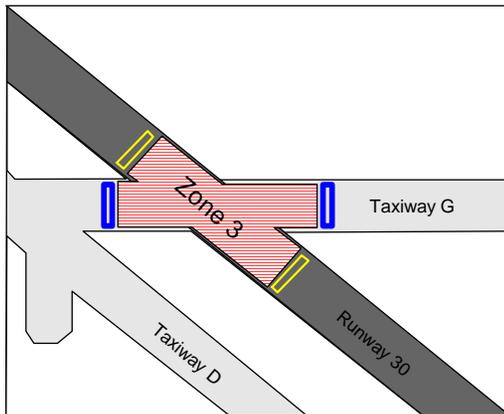
# FAROS Concept of Operation

- FAROS monitors runway to determine occupancy
- Provides alert to pilots on approach when monitored region is occupied
- **At LGB**
  - Three activation zones on Runway 30 were defined
    - Full-length departure position
    - Mid-field departure position
    - Frequently crossed taxiway intersection
  - Flashing PAPI used as signaling method

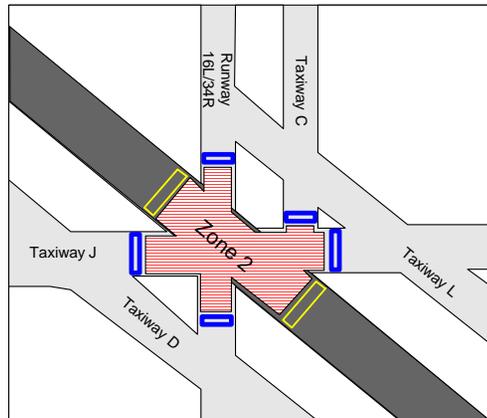


# Sensors Define the Zones

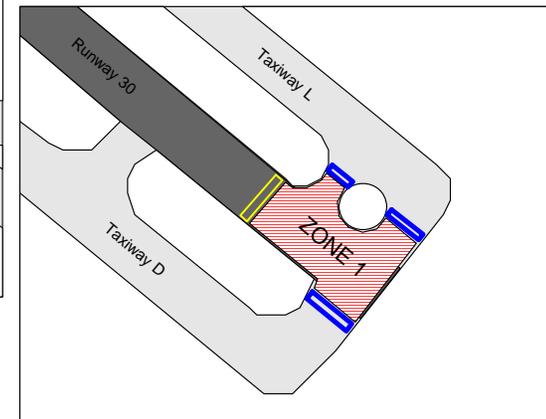
- Inductive loop sensors bound and define the monitored zones



Frequent crossing intersection



Common midfield departure position



Normal full-length departure position

# FAROS PAPI Installation

FAROS PAPIs installed near Operational unit



Side View

Front View



# Why LGB ?

- **Runway safety research projects previously conducted at LGB**
- **Runway occupancy infrastructure installed at LGB (loop sensors, computers, and communications)**
- **LGB eager for additional safety solutions**
- **Controllers and management provide excellent assistance and cooperation**



# FAROS Timeline

- **Proof of concept demo at LGB: September 2002**
- **MITRE/CAASD Simulation Study: November 2003**
- **LGB Evaluation System Installation: August 2005**
- **Engineering Testing and Shadow Operations: September 2005 – January 2006**
- **Flight Checks and Demonstrations: February – April 2006**
- **Operational Evaluation: August 2006 – present**

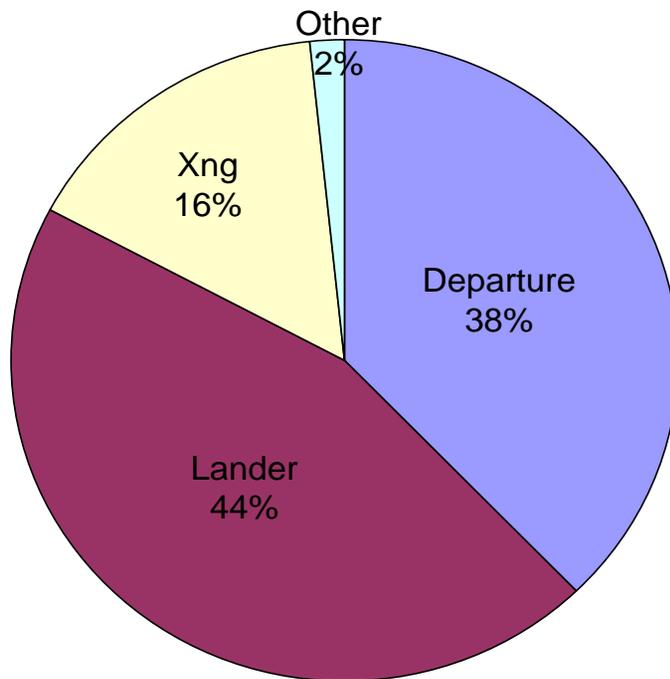


# Operational Evaluation Objectives

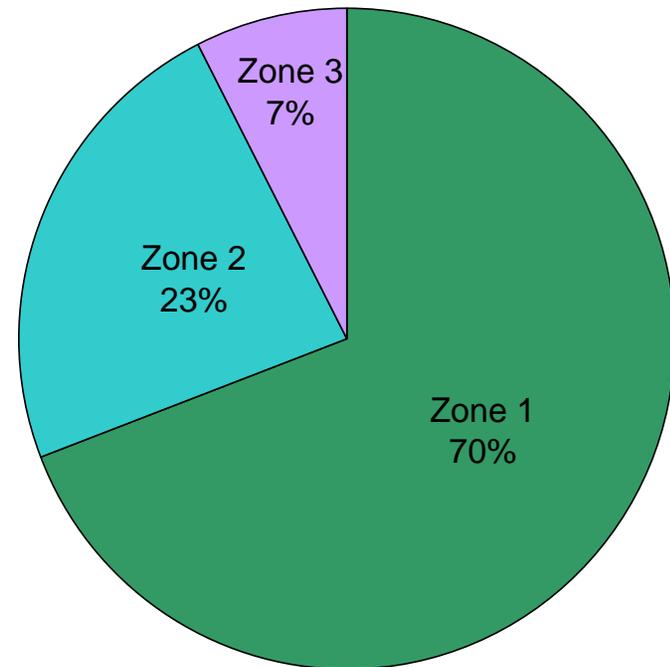
- **Evaluate the FAROS concept at LGB in an operational environment**
  - Objective data collection with instrumentation
  - Subjective data collection with surveys
  - Evaluate system technical performance
  - Determine Operational Impact of FAROS system
    - FAROS-related communications
    - FAROS-related go-arounds
- **Provide justification to move FAROS concept towards implementation and deployment into the National Airspace System**

# Operational Evaluation Results (1 of 3)

- **August 1, 2006 – March 31, 2007 (243 days)**
  - 50,257 Operations on Rwy 30 (average of 205/day)
  - 21,815 Flash Activations (average of 90/day)



Operations by Type



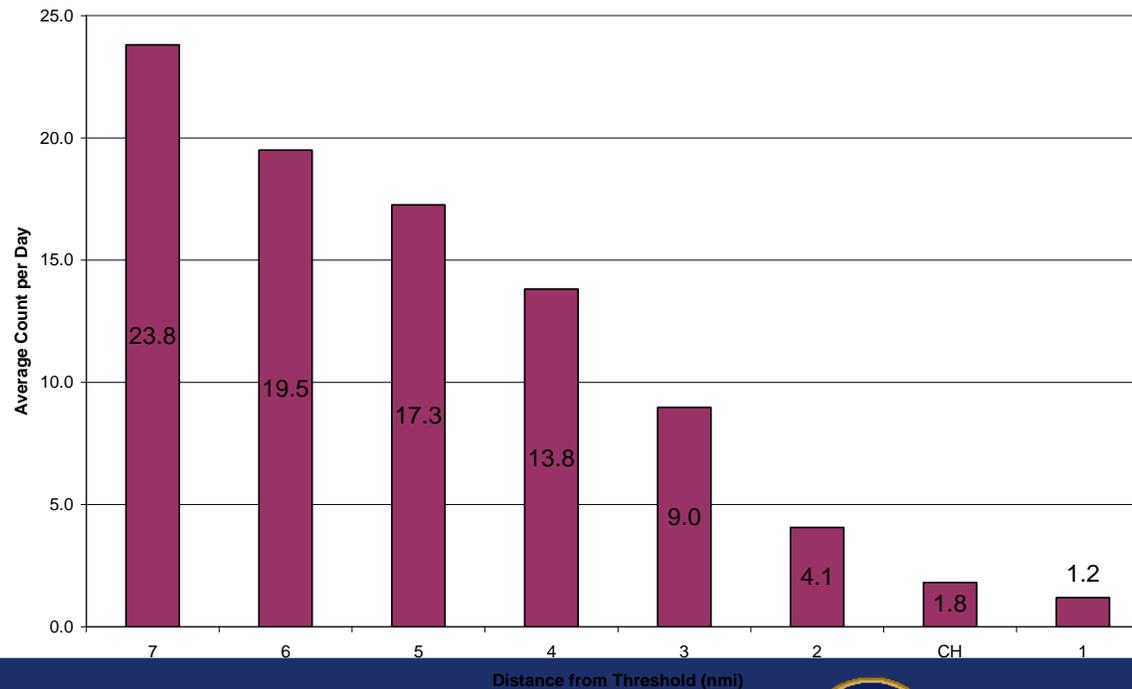
Activations by Zone

# Operational Evaluation Results (2 of 3)

- **Flash Viewers**

- Any distance (out to 7 nmi from threshold): ~24/day
- Within 3 nmi: ~9/day
- Within Contact Height (1.5 nmi): 1.8/day

Average Daily FAROS Viewers



# Operational Evaluation Results (3 of 3)

- **Operational Impact:**
  - FAROS Related Communications:
    - 59 total over period
    - Average of 0.25/day (1 communication every 4 days)
  - FAROS Related Go-Arounds:
    - 0 over period

## Pilot Reaction

A/C: What's it mean when the PAPIs flash?

Tower: That's just JetBlue in front of you making them flash.

A/C: It was actually when he was in position and hold.

Tower: Yes.

A/C: Cool.

2nd A/C: That's called FAROS, isn't it?

Tower: Affirmative.

A/C: Tower, just to let you know, the PAPIs are flashing at me.

Tower: Cessna 8RJ, traffic's departing ahead of you. That's why they're flashing. You're number one, runway 30, cleared to land. Thank you for the report.

A/C: Clear to land, 30, 8RJ.

A/C: 3EJ, FAROS is working.

Tower: Cessna 3EJ, roger.

A/C: Yeah, that FAROS is nice.

Tower: Cessna 3EJ, say again.

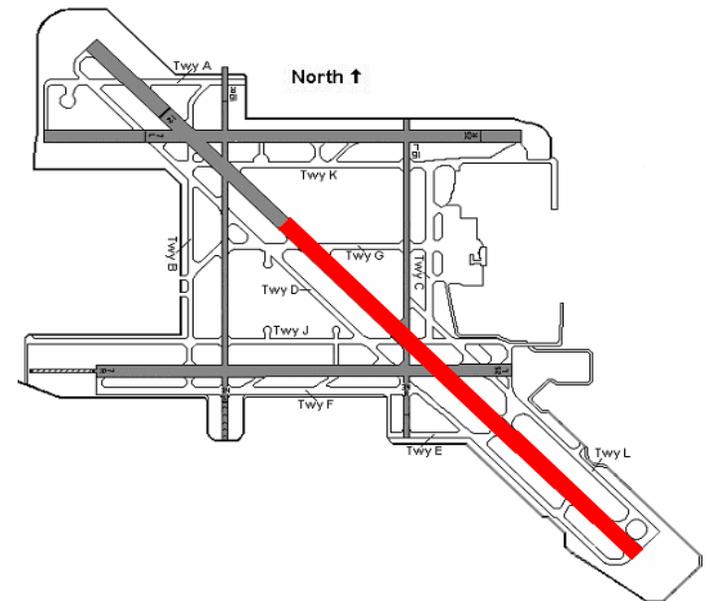
A/C: I like the blinking PAPI, FAROS. I thought that's FAROS, right?

Tower: Cessna 3EJ, affirmative.

A/C: It works. It's nice.

# Future FAROS Activities

- **High-Density FAROS**
  - Concept of Operations currently under development for FAROS at High-Density Airport
  - Working with DFW to implement Operational Evaluation
- **Possible Modifications at LGB**
  - Examine implementation of contiguous coverage from Zone 1 through Zone 3
  - Examine implementation of modifications resulting from High-Density concepts



# Conclusions

- **FAROS meets a safety need by providing direct notification to pilots on approach that the runway is occupied**
- **Operational Evaluation of FAROS at LGB is ongoing**
  - Successfully meeting program goals
  - Preparing for next steps and future implementation
- **Future of FAROS includes evaluation at additional airport(s) on the road to eventual implementation in the NAS**

