Operational Evaluation of FAROS

Final Approach Runway Occupancy Signal

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Outline

- Background and basic concept
- Road to operational evaluation
- Operational evaluation objectives
- Next steps

Background

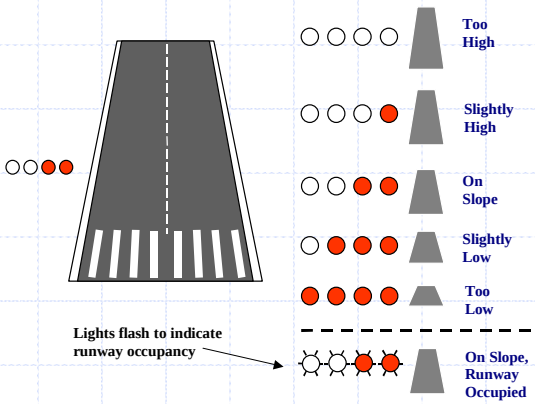
- LAX accident (c. 1991) – 34 lives lost
- NTSB safety recommendation A-00-66:
  - "Require, at all airports with scheduled passenger service, a ground movement safety system .....provide a direct warning capability to flight crews."
- 2002 – 2004 FAA Runway Safety Blueprint
  - "…develop and evaluate 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 Concept

- Provides a direct indication of runway occupancy status to flight crews on final approach, increasing their situational awareness
- Notifies them of potentially dangerous situations
- Augments other information, e.g. CTAF broadcasts
- Requires no controller or other human input
- Signal could be visual (lights) or aural (e.g. via CTAF)

FAROS using Precision Approach Path Indicator (PAPI)

- Standard PAPI, modified light controller
- Direct warning to the flight crew on approach
- No aircraft equipage required
- Glide slope information unaffected
- Existing component of the runway environment
- Minimal impact on existing pilot procedures



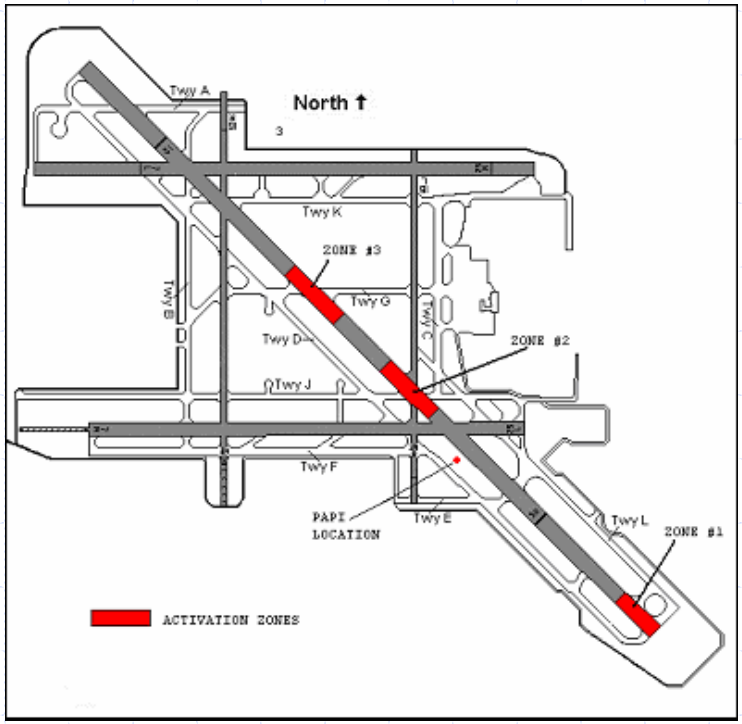
FAROS System at LGB

- FAROS monitors three zones on Runway 30

Zone 1: Standard RWY 30 full-length departure position

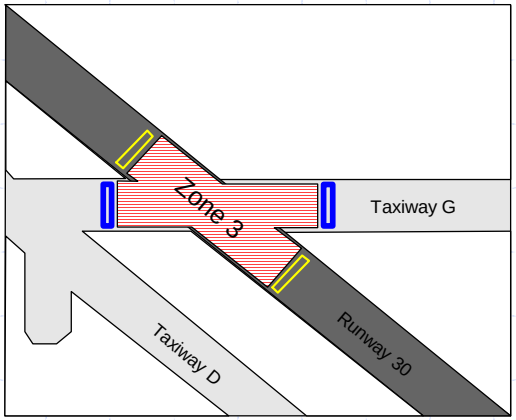
Zone 2: Common intersection departure position at RWY 30 and TWY J

Zone 3: Intersection of RWW 30 and TWY G

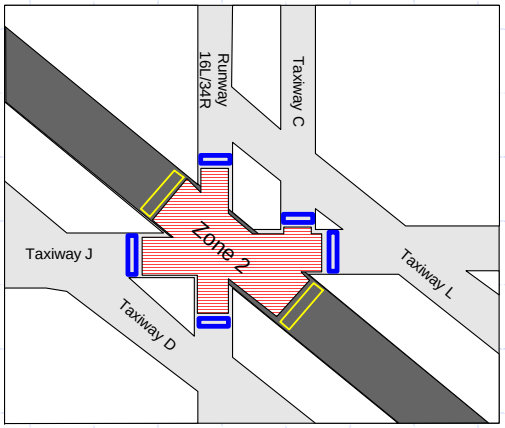


Sensors Define the Zones

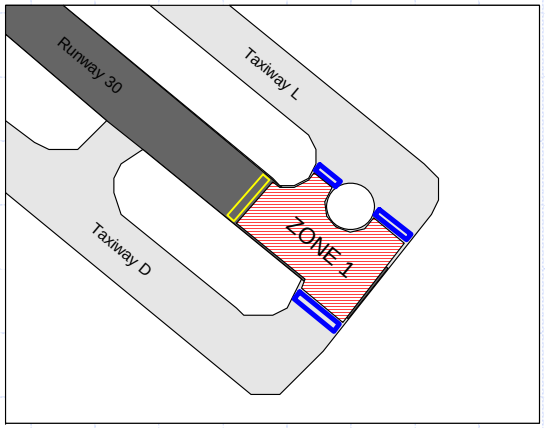
- Inductive loop sensors define three monitored zones



Frequent crossing intersection

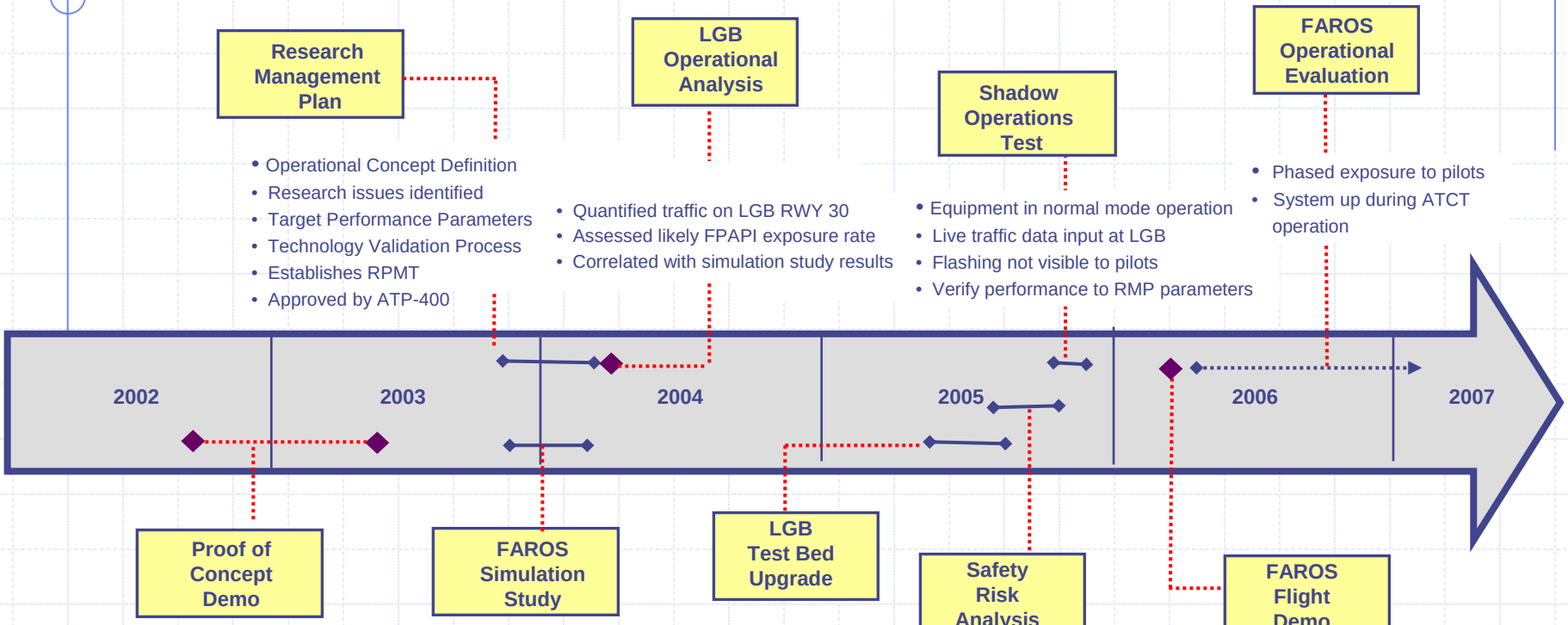


Common midfield departure position



Normal full-length departure position

FAROS Roadmap



Research Management Plan

- Operational Concept Definition
- Research issues identified
- Target Performance Parameters
- Technology Validation Process
- Establishes RPMT
- Approved by ATP-400

LGB Operational Analysis

- Quantified traffic on LGB RWY 30
- Assessed likely FPAPI exposure rate
- Correlated with simulation study results

Shadow Operations Test

- Equipment in normal mode operation
- Live traffic data input at LGB
- Flashing not visible to pilots
- Verify performance to RMP parameters

FAROS Operational Evaluation

- Phased exposure to pilots
- System up during ATCT operation

Proof of Concept Demo

- Prototype established @ LGB
- FPAPI exposed in day/night sorties
- Multiple scripted incursion scenarios
- 26 test observers

FAROS Simulation Study

- Assessment of operational and HF issues identified in RMP
- 18 test subjects (GA & ATP)
- 576 Experimental trials
- Qualitative and quantitative performance measures

LGB Test Bed Upgrade

Safety Risk Analysis

- Analyzed 13 potential hazards
- Likelihood, severity, mitigation

FAROS Flight Demo

- Qualitative system check
- Verify training material
- Assess system interference
- System functional readiness

Program Activities

Program Activity	Results
Proof of concept demonstrations: September 2002/June 2003	◆ Qualitative attributes verified ▪ FPAPI visual signal acquired 5 to 10 miles ▪ Flash period/duty cycle appropriate ▪ Glide slope information retained ◆ Strong support for concept; impetus for field trials
Research Management Plan February – December 2003	◆ Reviewed Concept of Operations ◆ Developed research issues ◆ Established performance measures ◆ Mapped out test objectives
FAROS Modeling & Simulation Study: March 2004	◆ Answered key operational and HF issues ◆ Pilots generally positive about FPAPI concept ◆ Pilot education is essential to system effectiveness
Long Beach Operational Data Analysis: March 2004	◆ Simulation study results projected to LGB ▪ Rwy 30 workload ~ 250 ops/day (15 ops/hour) ▪ Likely exposure within 5 miles ~ 40 viewers/day, within 2 miles ~ 5 viewers/day

Program Activities (cont'd)

Program Activity	Results
Safety Risk Analysis: October 2005	◆ Likelihood/severity of 13 potential hazards analyzed ▪ All considered remote or extremely remote ◆ Pilot information dissemination is key mitigation
Pilot information program: March 2006	◆ Direct contact ◆ General coverage
Shadow Operations Tests: November 2005 - now	◆ System data recording and video truth data ◆ Initial two weeks of real-time data input at LGB ◆ System performs within RMP parameters ◆ Shadow operations data continues to be collected
Flight Demonstration: I – February 2006 II – March 27-28, 2006 III – April 19-20, 2006	◆ Software configuration problem found and fixed ◆ Weather is unpredictable ◆ Flashing PAPI not distracting to A/C approaching adjacent runways ◆ Training materials were effective ◆ Variety of aircraft and pilots

Pilot Familiarization

- Direct contact with potential runway 30 landers
  - Presentation and handouts provided to air carriers
  - Brochures, pilot data sheets, DVDs, and posters delivered to surrounding airports, FSDOs and FBOs
  - Brochures, pilot data sheets mailed to area pilots
  - Presentations made to local pilot meetings
- General coverage
  - FAA web site established: faros.faa.gov
  - Magazine interviews given
  - FAA Public Affairs

Operational Evaluation

- Assess
  - Potential for decreasing land-overs (esp. in light of TIPH)
  - Impact on ATC communications
  - Increase in unnecessary go-arounds
  - False alarm and missed detection rates
- Collect subjective feedback from pilots and controllers

System Ready for Pilot Exposure

- System is meeting Shadow Operations exit criteria
- Safety analysis has been performed
- Flight demonstrations have shown pilot response to system is acceptable
- Familiarization materials have been distributed and have been shown to be effective

- Meeting imminent to make decision to go ahead with Operational Evaluation at LGB

Next Steps

- Begin/conduct Operational Evaluation of baseline system
- Examine and evaluate at LGB and other airports
  - Enhancements to the baseline system
  - Integration with Runway Status Lights
  - Alternative surveillance technologies (e.g., radar, multi-lat)
  - Alternative signaling techniques (e.g., special lights, aural)

Questions?