The Capstone Experience

Investment in Safety

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Overview

- Alaska Aviation - Before Capstone
- Capstone Overview
- Yukon/Kuskokwim Delta – Phase I
- Southeast Alaska – Phase II
- “Capstone Process”
- What we learned
Alaska Operating Environment
Alaska Operating Environment

• From 1994 to 1996, there were 112 Air Carrier / Commercial Operator accidents in Alaska resulting in 19 fatalities

• During the same period, there were 58 business and private aviation accidents resulting in 66 fatalities
Alaska Operational Environment

• National Institute for Occupational Safety and Health (NIOSH)
  – Highest Occupational Fatality Rate in Nation (3X)
  – Aviation 2nd Leading Cause of Death
  – Alaska Pilots 5x (Pilots), 100x (all workers)
Alaska Operational Environment

• National Transportation Safety Board
    • Increase IFR Operations
    • Increase GPS Navigation
    • Increase Pilot Situational Awareness
Capstone Overview

• Program initiated in 1998
  – Designed to Improve Aviation Safety in Alaska
    • Deployment of Advanced Avionics System
      – GPS, GPS/WAAS
      – TAWS
      – ADS-B, TIS-B, FIS-B
      – Synthetic Vision
    • Improve Aviation Infrastructure
      – IFR Approaches and Routes (GPS, GPS/WAAS)
      – Weather Reporting Equipment
      – ADS-B Ground Stations
      – Communications
    – MITRE Reports a 47% improvement in Aviation Safety
Capstone Objectives

• Safety -
  – Improve pilot situational awareness: position - terrain - traffic
  – Improve access to weather and flight information
  – Improve IFR

• Provide “real world” data to validate safety benefits expected from modernization
Phase I – Yukon/Kuskokwim Delta

• Approx. 200 Airplanes/1 Helicopter
• VFR/Transition to IFR
• Equipment
  – GPS
  – Terrain data
  – ADS-B
  – FIS/AWOS
  – Approaches
• MITRE Report
  – 47% improvement in Aviation Safety
Phase II – Southeast Alaska

- Approx. 150 Airplanes/50 Helicopter
- IFR
- Equipment
  - GPS/WAAS
  - TAWS/HTAWS
  - ADS-B
  - FIS/AWOS
  - Approaches
- MITRE Report
  - 27% improvement in Aviation Safety
Capstone Process

• The “Capstone Process” leverages near term safety benefits from new and emerging technologies.
  – GPS
  – Terrain data
  – ADS-B
  – FIS
  – AWOS

• Measurable
Capstone Avionics

• Had to improve Situational Awareness and Reduce Pilot Workload.

• Had to be affordable.
Improving Situational Awareness
Terrain

Aerial view of Juneau, Alaska looking down Gastineau Channel to the east

Depictions in Capstone MFD
Improving Situational Awareness
Traffic
Improving Situational Awareness
Weather
Affordable Avionics

• 1999 RTCA Task Force 4 – Certification
• Reduce Certification Costs
  – Compliance Standards based on Aircraft Type
  – Approved Model List Supplemental Type Certificate
  – Partnership FAA/Industry
• Reduce Installation Costs
  – Approved Model List Supplemental Type Certificate
Tiered Compliance Standards

• Avionics certificated based on intended function and Type of Aircraft
  – VFR/IFR

VFR Display

IFR Display
Tiered Compliance Standards

- Avionics certificated based on intended function and Type of Aircraft
  - Small Single Engine to Transport Category Airplane
Tiered Compliance Standards

Transport Category Airplanes
- Fatal Accident Rate At Time Of Rule  $10^{-6}$
- Data Showed ~10% Caused By System Failures  $10^{-1}$
- Assume 100 Catastrophic Failure Conditions  $10^{-2}$
- Results In Probability  $10^{-9}$

Small Single-Engine Airplanes
- Fatal Accident Rate At Time Of Rule (IN IMC)  $10^{-4}$
- ~10% Caused By System Failures  $10^{-1}$
  - Assume 10 Catastrophic Failure Conditions  $10^{-1}$
  - Results In Probability  $10^{-6}$
Approved Model List STC

• Capstone 100+ aircraft models

• Standard Method of Installation
  – 1 STC then Field Approve everything else
  – Was not going to work
    • FAA/Industry resources
    • Time
Approved Model List STC

• **Needed a better way**
  – AML process
    • Based on the Standard Avionics Process (1 STC + Field Approvals)
  – AC 23-22: Guidance for Approved Model List (AML) Supplemental Type Certificated (STC) Approval of Part 23 Airplane Avionics Installations
What Worked – Tiered Certification

Transport Category Airplanes

Fatal Accident Rate At Time Of Rule $10^{-6}$
Data Showed ~10% Caused By System Failures $10^{-1}$
Assume 100 Catastrophic Failure Conditions $10^{-2}$
Results In Probability $10^{-9}$

Small Single-Engine Airplanes

Fatal Accident Rate At Time Of Rule (IN IMC) $10^{-4}$
~10% Caused By System Failures $10^{-1}$
- Assume 10 Catastrophic Failure Conditions $10^{-1}$
- Results In Probability $10^{-6}$
What Worked – Improvement in Aviation Safety

- **MITRE**
  - 47% improvement in Safety (Capstone Phase I)
    - Mitre/CAASD, *The Impact of Capstone Phase I Program*, September 2005
  - 27% improvement in Safety (Capstone Phase II) (preliminary)
- **NIOSH**
  - 57% Decrease in Fatal Accidents - Part 135
- **Alaska Aviation**
  - Prior to Capstone
    - Approx 130 Total Accidents/year
    - Approx 40 Fatalities/year
  - 2011
    - 97 Total Accidents
    - 13 Fatalities
For More Information
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