



The National Aviation Operations Monitoring Service

Project Overview

NAOMS is an ongoing system-wide survey effort that continuously assesses NAS safety and the efficacy of government/industry safety interventions.

Rationale and General Approach

Expressed Need for Event Data



There have been many recommendations for improvements to aviation data systems . . .

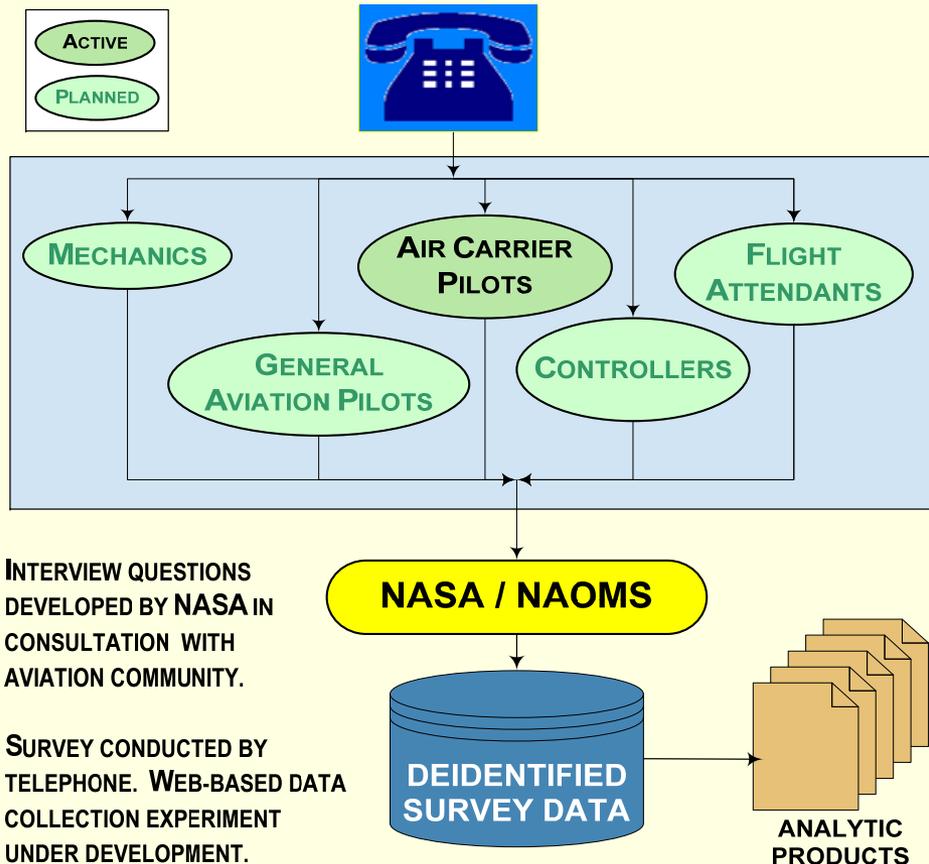
- **White House Commission on Avtn Safety and Security (“Gore Report” 1998) -**
 - “Most effective way to identify incidents and problems in aviation is for the people who operate the system (pilots, mechanics, controllers, dispatchers, etc) to self-disclose the information.” (Page 13)
- **GAO Evaluation (Safer Skies Review, June 2000) --**
 - Additional performance measures required
 - Use precursors associated with past accidents to track safety baseline and improvements from interventions
- **NTSB (Safety Report on Transportation Safety Databases, 2002) --**
 - Over 19 recommendations for improvements in safety event reporting (1968-2001)
 - Need to address problem of under-reporting in current aviation safety data systems
- **FAA (Internal Studies, 2004 Strategic Plan draft)**
 - Identify risks before they lead to accidents

The Unmet Data Need



- **Reliable, stable numbers with system-wide scope**
 - ▶▶ To inform policy and investment decisions
- **Providing better and more rapid feedback on system change, both technological and procedural**
- **Facilitating a truly data-driven basis for safety decisions**
 - ▶▶ An escape from the accident *du jour* policy-making syndrome

The NAOMS Solution



- Regularly survey those who operate the National Aviation System (NAS)
- Collect data on respondents' operational experiences
- Guarantee data confidentiality
- Achieve scientific integrity by
 - Using well-crafted survey instruments
 - And, rigorous analytic methods.

Survey Benefits



- Surveys have been used to shape national policy for many decades
- This use is extensive in areas such as public health policy and economics
- Aviation safety is a natural topic for survey data collection
- Survey methods are mature and well understood

Surveys Can Measure



■ Potential Scope

- Attitudes
- Preferences
- Beliefs about the state of the world
- Predictions about the future
- Past behavioral experiences or events

■ Potential Results

- Frequency of occurrences
- Changes over time
- Similarities and differences among groups

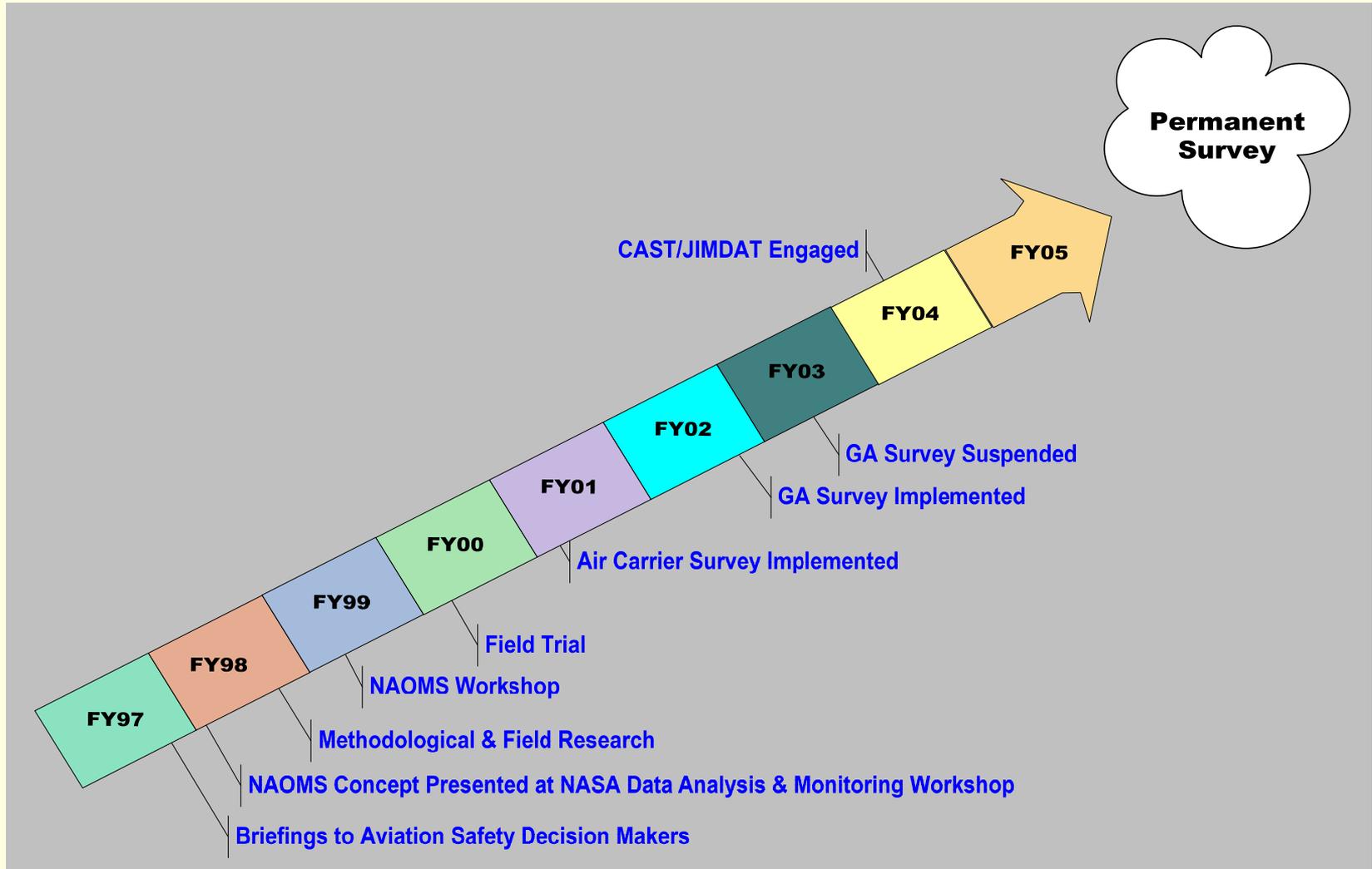
NAOMS is mainly concerned with quantifying NAS safety events

Examples of Federal Surveys



- **Survey of Income and Program Participation (Census Bureau) 1984 -**
- **Consumer Expenditure Surveys (Census Bureau) 1968 -**
- **Annual Housing Surveys (Census Bureau) 1973 -**
- **Survey of Consumer Attitudes (NSF) 1953 –**
- **Health and Nutrition Examination Surveys (NCHS) 1959 -**
- **National Health Interview Surveys (NCHS) 1970 -**
- **American National Election Studies (NSF) 1948 -**
- **Panel Study of Income Dynamics (NSF) 1968 –**
- **National Longitudinal Surveys (BLS) 1964 -**
- **Behavioral Risk Factor Surveillance System (CDC) 1984 –**
- **Monitoring the Future (NIDA) 1975 -**

NAOMS Development Timeline



Government & Industry Groups Briefed



- FAA
- HAI
- GAMA
- AOPA
- ALPA
- CAST-JIMDAT
- NTSB
- NATCA
- NATA
- Boeing
- NBAA
- SWAPA
- ASRS Advisory Subcommittee
- ATA

Workshops

Preliminary NAOMS workshop, 5/11/99, Alexandria, VA, 60 attendees

NAOMS field study briefing 3/1/00, D.C., 75 attendees

Methodological Decisions

Questionnaire Structure



- **Section A: Operational Exposure**
 - Measures operational activity levels (risk exposure)

- **Section B: Safety Event Experiences (Core Questions)**
 - Counts standard event frequencies with long-term trends in mind

- **Section C: Focus Topics**
 - Provides a moving “searchlight” that can be redirected as needed to topics of interest

- **Section D: Participant Feedback**
 - Seeks continuing feedback on the validity of the NAOMS survey process and survey questions

NAOMS Design Decisions



- Events to address
- Question grouping and order
- Length of recall period
- Sample source and size
- Data collection mode

Events to Address



- **Consultation with Industry/Gov't Safety Group**
 - ▶▶ FAA, ASRS Analysts, Workshops
- **Review of Aviation Databases**
 - ▶▶ ASRS, NTSB, NAIMS, BTS
- **Focus Groups with Active Professional Participants**
- **Resulting NAOMS questionnaire covers:**
 - ▶▶ Aircraft equipment failures
 - ▶▶ Turbulence encounters
 - ▶▶ Weather encounters
 - ▶▶ Passenger-related events
 - ▶▶ Ground events
 - ▶▶ (Pilot) aircraft handling events (exc. altitude deviations and CFTT)
 - ▶▶ Altitude deviations and CFTT
 - ▶▶ Pilot-ATC interactions

Question Grouping & Order



- Conducted ALPA-supported experimental research with active line pilots to determine how pilots organized memories of safety events
 - ▶▶ It is desirable to sequence questions in a way that is consistent with memory organization

- Conducted “talk-aloud” tests
 - ▶▶ Individual pilots provide real-time criticism of questionnaire content and structure

- NAOMS concluded that a hybrid ordering* was best based on
 - Flight phase at event time, and
 - Proximate event cause

* As shown in the preceding slide.

Length of Recall Period



- Reviewed literature
- Conducted ALPA-supported experimental research with active line pilots to determine how well pilots remembered routine events (landings and takeoffs)
 - Recall accuracy starts to decline after seven days
 - Events are forgotten
 - Non-existent events are “remembered”
- Developed further data on recall accuracy during Field Trial
- Ultimately decide on a 60-day recall period for the non-routine events NAOMS respondents are asked to recall

Sample Source and Size



- Source: Airmen's Registry
- Main selection criteria
 - ATP rating
 - Flight Engineer certificate
- Sample Size: 8000 per year (air carrier pilots)
 - Driven by relative rareness of events, and
 - Trend sensitivity requirements
- Sampling approach tilted towards
 - Wide-bodies (augmented crews)
 - Senior pilots (ratings)
- Data rebalanced at analysis time to neutralize known sample biases

Data Collection Mode



- Options
 - Face-to-Face
 - Self-administered (paper)
 - Self-administered (Internet)
 - Telephone
- No single option is optimal
- Trades among accuracy, completeness, quality, and cost
- Field Trial evaluated alternatives
- NAOMS chose computer-aided telephone interview (CATI) as its best option
 - Medium-high quality (face-to-face is optimal)
 - Medium cost (self-administered is least expensive)

Implementation

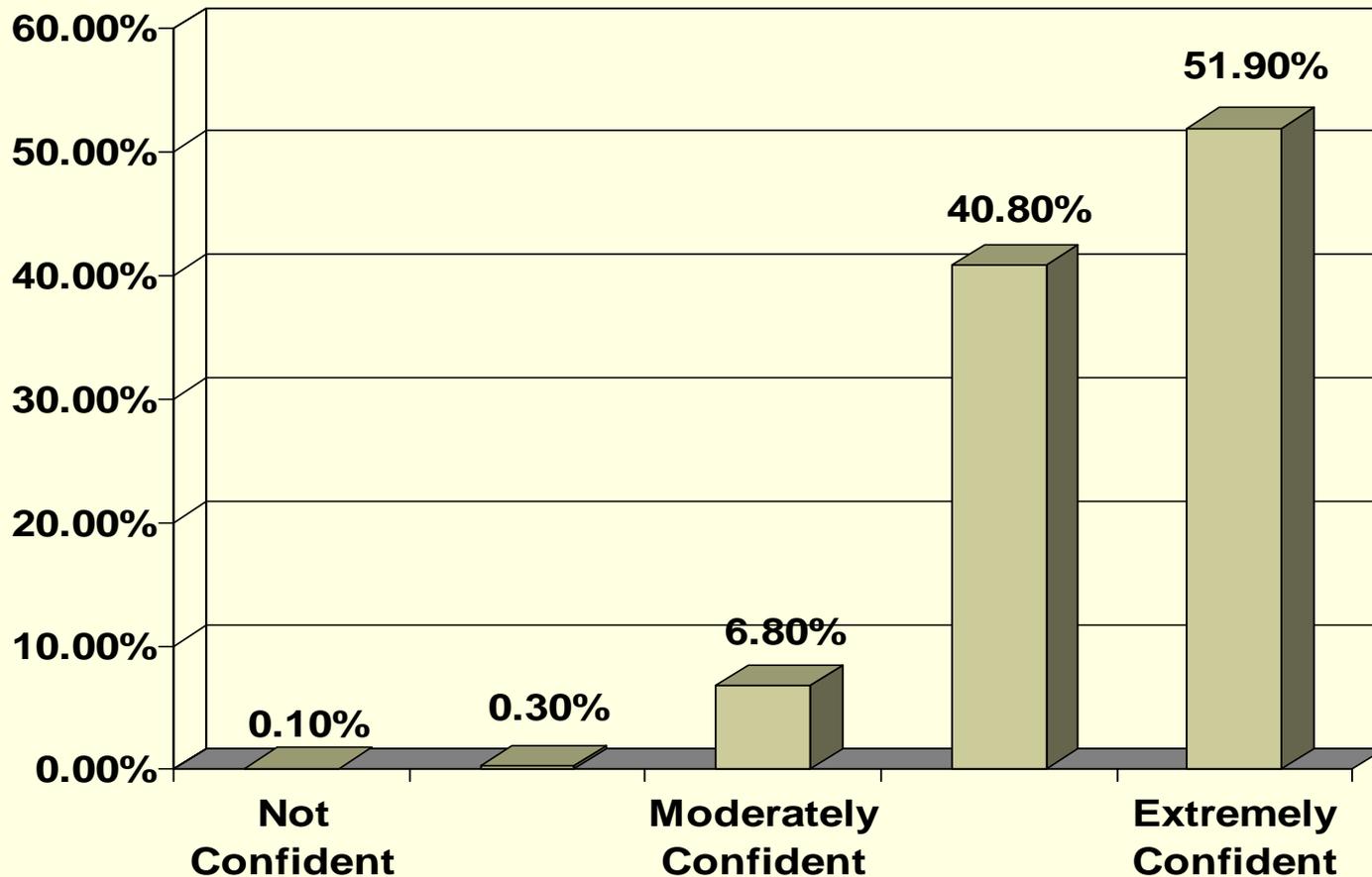
Data Collection



- Battelle CPHRE (Center for Public Health Research and Evaluation)
 - CATI
 - Sample Selection (without replacement for one year)
 - Locating pilots
 - Mailing Letter (NASA letterhead)
 - Interview process
 - Report of response rates

- Response Rates
 - Not located = 18% to 25%
 - Not eligible = 19%
 - Located and eligible = 85% completion rate
 - Over 23,000 interviews completed to date

Confidence in Accuracy of Answers (Q. D1)



Summary

NAOMS . . .



- **Was developed in consultation with the aviation community**
- **Measures NAS safety and the effects of safety interventions**
- **Follows best survey methodological practices**
 - **Deliberate and thorough instrument development**
 - **Robust statistical methods**
- **Produces statistically defensible measures of event trends**
- **Complements other data resources used to drive aviation policy and investment decisions.**