Professionalism of Interviewers

- Experienced interviewers chosen
- Interviewers given 16 hours of training
- CATI (telephone) interviewers' work was silently monitored by a supervisor for accuracy and ability to effectively handle pilots
- In-person interviewers' work was validated by pilot filling out interviewer validation postcard

National Aviation Operations Monitoring Service
Field Trial

Quality Control Follow-Up

Interviewer Name: Harriet Gold

1. Place of interview: ☐ Airport ☑ Other
2. Approximately how long did the interview take? 40 minutes
3. Did the interviewer conduct the interview in a professional manner? ☑ Yes ☐ No
4. Do you have any other comments? HARRIET GOLD WAS VERY FRIENDLY & PROFESSIONAL. Hope the info gathered is helpful.

National Aviation Operations Monitoring Service
Field Trial

Quality Control Follow-Up

Interviewer Name: Ruth Epstein

1. Place of interview: ☐ Airport ☒ Other
2. Approximately how long did the interview take? 45 minutes
3. Did the interviewer conduct the interview in a professional manner? ☑ Yes ☐ No
4. Do you have any other comments? EXTREMELY PROFESSIONAL, VERY COURTEOUS, RESPECTFUL, AND PROFICIENT. AN ENJOYABLE INTERVIEW!

Completion Rates

- **Pilots completed 626 questionnaires**
- **Only referring to mail and telephone since In-Person was never completed**
- **Bad address / bad telephone number:**
  - Mail: 10%
  - Telephone: 14%
- **Ineligible (did not fly commercial fixed wing aircraft in assigned recall period) or deceased**
  - Mail: 16%
  - Telephone: 20%

Completion Rates

- **Based on national experience, we anticipated**
  - Mail: 20-60 %
  - Telephone: 65-70%
- **Achieved**
  - Mail: 73%
  - Telephone: 81%

Costs

- **Mail and telephone cost almost the same per completed questionnaire--telephone cost about 10% more**
- **In-person questionnaire costs about 4 times higher than telephone**
  - Includes longer questionnaire length
  - Travel to and from pilots' homes and office
  - Reimbursement for travel

Field Trial Quantitative Findings:

Sample Representatives, Mode, Bias, Accuracy

Jon Krosnick, Ph.D.

Ohio State University

Users of Survey Research

- Federal, State, and Local Government
- Academia
- Federal and State Courts
- Consumer Research

The Survey Approach to Data Gathering

- Human-centered
- Quantitative
- Flexible (versatile, topical)
- Comprehensive
- Well developed methods
- Statistically accurate
- Stable

Examples of Continuing Surveys

- Survey of Income and Program Participation (Census Bureau) 1984 -
- Consumer Expenditure Surveys (Census Bureau) 1968 -
- Annual Housing Surveys (Census Bureau) 1973 -
- Consumer Attitudes and Behavior (SRC) 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 -

You Can Measure:

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

NAOMS will be almost exclusively concerned with measuring events

You Can Learn:

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

Trade-offs Among Data Collection Methods

	Mail	Telephone	In-Person
Response Rate	○	◉	●
Following Instructions	○	●	●
Sense of Confidentiality	●	○	◉
Honesty	●	○	◉
Satisficing	○	◉	●
Costs	●	●	○

Key: ● Excellent ◉ Good ○ Fair

Types of Events

Accidents	**Mid-air collision**
Proximal Causal Events	**Incorrect altitude**
Distal Causal Events	**Altitude clearance misunderstood by pilot**
Static Contribution Factors	**Microphone, earphones, radios, pilot's hearing, noise, etc**

Recall Period

- **Memories Fade Over Time**
  - Important memories fade more slowly
- **Understanding recall is critical to survey design**
  - Participants should not be asked to recall things from too far in the past
- **Study of routine events recall**
- **We are less confident about how long more serious events can be remembered**
  - We know that more serious events will be remembered longer
  - We hope this will be a subject of further investigation

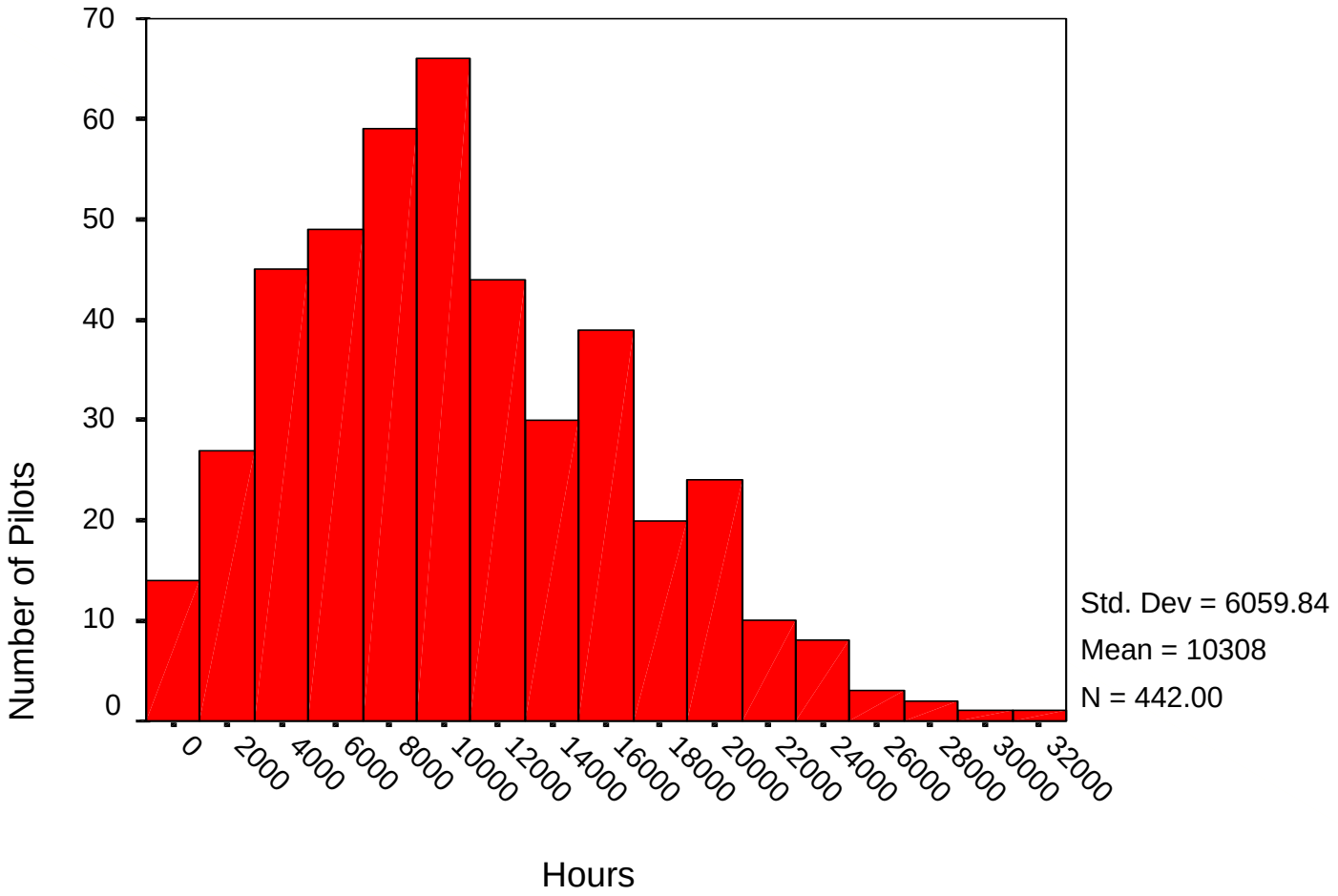
Survey Benefits

- 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
- Best results are achieved with careful design and high response rates, but design must be tailored to the purpose of the study.
- The NAOMS field trial was designed to optimize design

Findings

- **The field trial was very successful**
- **Information was gathered that allowed us to evaluate**
  - Response rates
  - The best mode for application
  - The best recall period
  - Pilot accuracy in responding
  - Pilot willingness to report events in meaningful numbers
  - Cost of applying the surveys

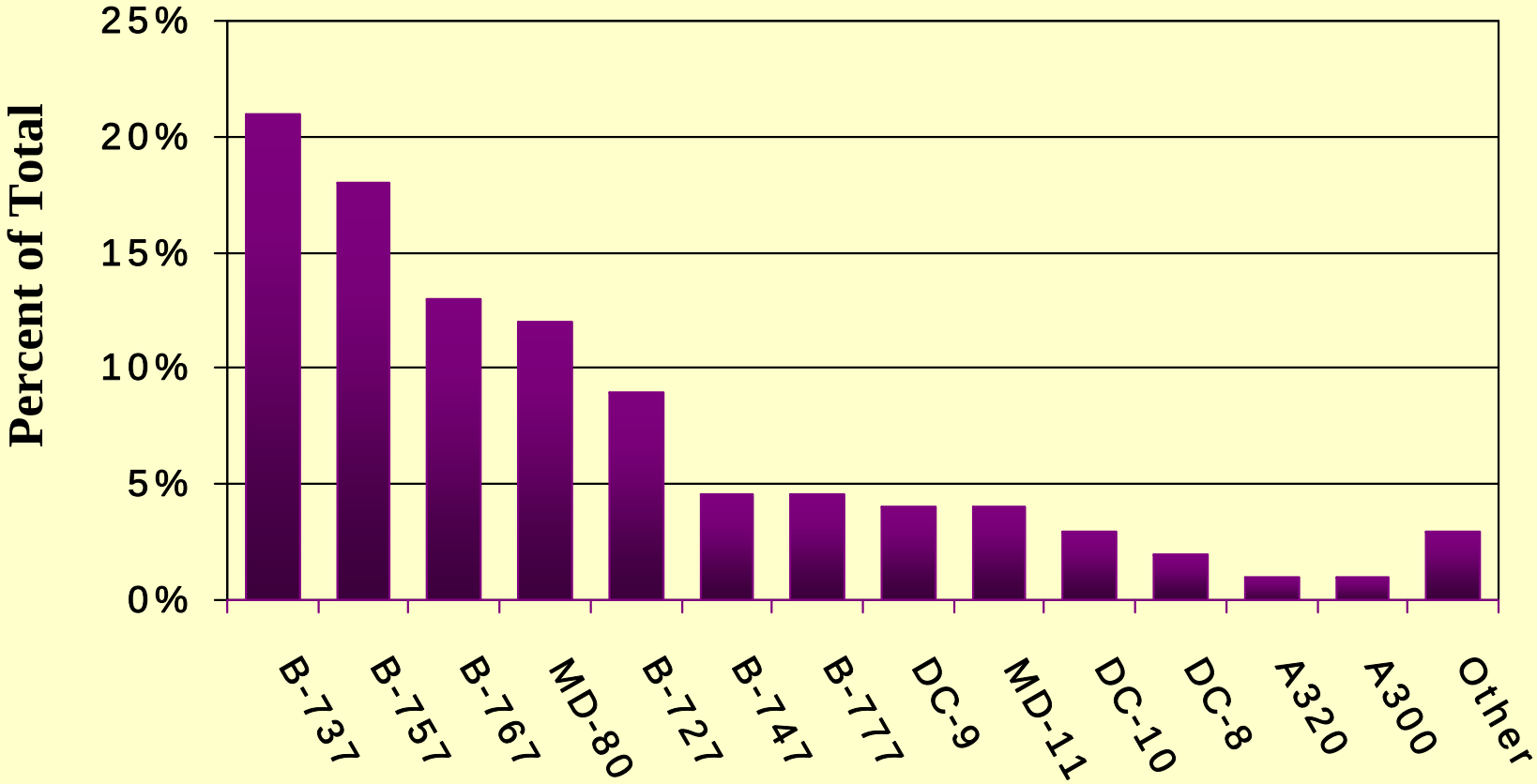
Total Pilot Career Flying Hours



Sample Selection and Pilot Distribution

- **Majority of pilots flew major air carrier aircraft**
- **3% of the sample were commercial pilots who did not fly air carrier airplanes**
  - Pilatus Porter
  - Cessna Citation
  - Cessna 210
  - Others
- **These individuals flew professionally but did not meet the intent of the sampling frame.**

Aircraft Flown Distribution



Pilot Flight Crew Position

Position	Percentage
Captain	62%
First Officer	40%
Flight Engineer	4%
Relief Pilot	10%

Uneven distribution of captain and first officers due to sampling procedures since the sample was limited to individuals with first class medical certificates.

Percentages exceed 100% since some pilots served in two positions during the reference period

Average Pilot Flight Hours by Mode

Mode	Average Total Flying Hours
Self-administered	10,695
Telephone	9,825

These results indicate there are no significant differences between these two modes.

Average Pilot Flight Hours by Recall Period

Recall Period	Average Flight Hours
1 Week	10,048
2 Weeks	10,738
4 Weeks	10,249
2 Months	9,942
4 Months	9,698
6 Months	10,742

These results indicate there are no significant differences between these recall periods.

Average Flight Hours Flown During Recall Period

Recall Period	Mean Hours Flown During Recall Period
1 Week	20
2 Weeks	30
4 Weeks	58
2 Months	111
4 Months	231
6 Months	341

Except for week one, the average hours flown increase as expected.

Percent of Pilots with at Least One Missing Response

Mode	Missing Responses, %
Self-Administered	4.8%
Telephone	0.0%

Time to Complete Questionnaire

Mode	Minutes
Self-Administered	17
Telephone	29

Target time for survey was 30 minutes or less.

Pilot Confidence in Reporting Accuracy

	Confidence				
Mode	Extremely	Very	Rather	Moderately	None
Mail	41%	39%	10%	9%	0%
Telephone	46%	45%	8%	2%	0%

Pilot Confidence in Reporting Accuracy

Recall Period	Percent Extremely Confident
1 Week	68%
2 Weeks	64%
4 Weeks	54%
2 Months	40%
4 Months	37%
6 Months	31%

Pilot Questionnaire Completion Time

Recall Period	Minutes to Complete
1 Week	20
2 Weeks	29
4 Weeks	27
2 Months	31
4 Months	33
6 Months	29

Recall Period

- More hours flown should be associated with more events witnessed
- More days in the recall period should be associated with more events witnessed
- Stronger relationships indicate more accurate reporting
- Strongest relationships for one month and two months
- No relationships for four and six months.

Question Order

- **Two instrument variations**
  - One variant had Event questions placed towards the beginning of the questionnaire
  - The other variant placed Event questions late in the instrument
- **Questions asked later often receive a less accurate response**
  - Because attention may decrease during the interview
- **Question order did not appear to affect the NAOMS response accuracy**

Quality of Data: Bias Concerns

- **Possible biases**
  - Unwillingness to report some types of events
  - Tendency to exaggerate other types of events
- **Changing data collection modes will often reveal biases**
  - If they are present
- **But NAOMS reporting rates did not show a mode effect**
- **This suggests that there was no detectable bias**

Required Sample Size

- **Sensitivity criteria set by NAOMS**
  - Recognize a 10% change in the rate
  - Of events that occur very infrequently
  - With 95% certainty
- **Required sample size:**
  8,000 to 9,000 respondents per year

Conclusions
Quantitative Analysis

- **Telephone is the optimal method**
  - Better accuracy
  - Better completion rates
  - Better response rates
  - Avoids under-reporting and over-reporting
- **One month to two months is the ideal recall period**
- **Question order not relevant to quality**
- **Sample size of approximately 8000 to 9000 respondents per year will provide sufficient sensitivity**

Questionnaire Feedback

Elisa Ingebretson

Research Scientist, Battelle

Section D: Questionnaire Feedback

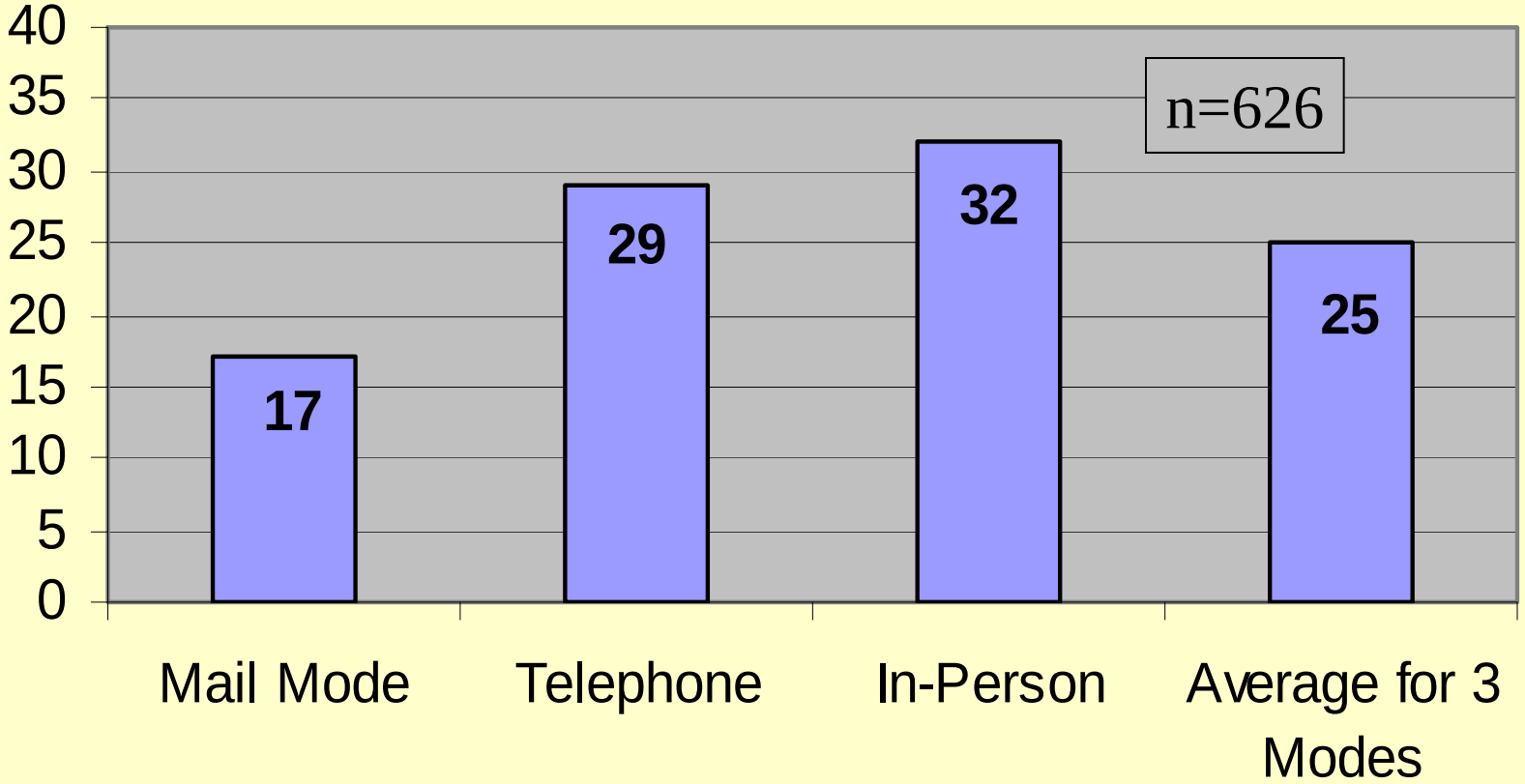
How many minutes did it take you to complete the questionnaire up to this point?	**MINS**
How confident are you that you reported accurately all the significant safety-related events that you experienced for the time period specified in the survey? *(Please check the appropriate box.)*	☐ not confident at all ☐ moderately confident ☐ rather confident ☐ very confident ☐ extremely confident
In your opinion, were the questions asked in Section B of this survey relevant to tracking long-term trends in aviation safety?	Yes No
Did you find any of the questions in this questionnaire to be confusing, poorly worded, or ambiguous? (*Please circle yes or no.*)	Yes No **SKIP TO D5.**

If YES, please write each question number (e.g., SD1) below and describe any suggestions you might have for improving the question. (*Continue on the back if necessary.*)

Question Number	**Suggestion for improving the question:**
_____	_____

Questionnaire Completion Time

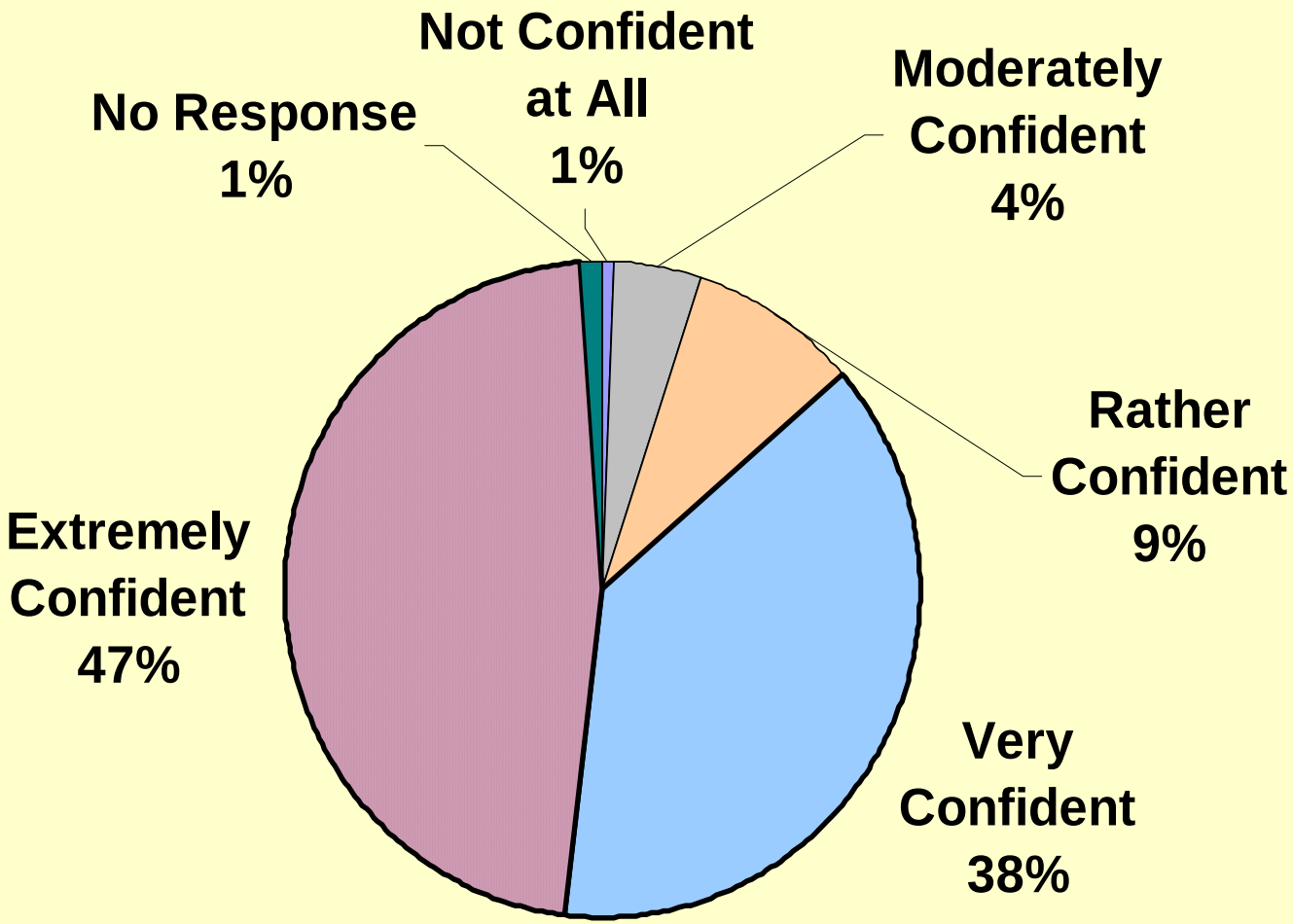
- **D1. How many minutes did it take to complete the questionnaire?**



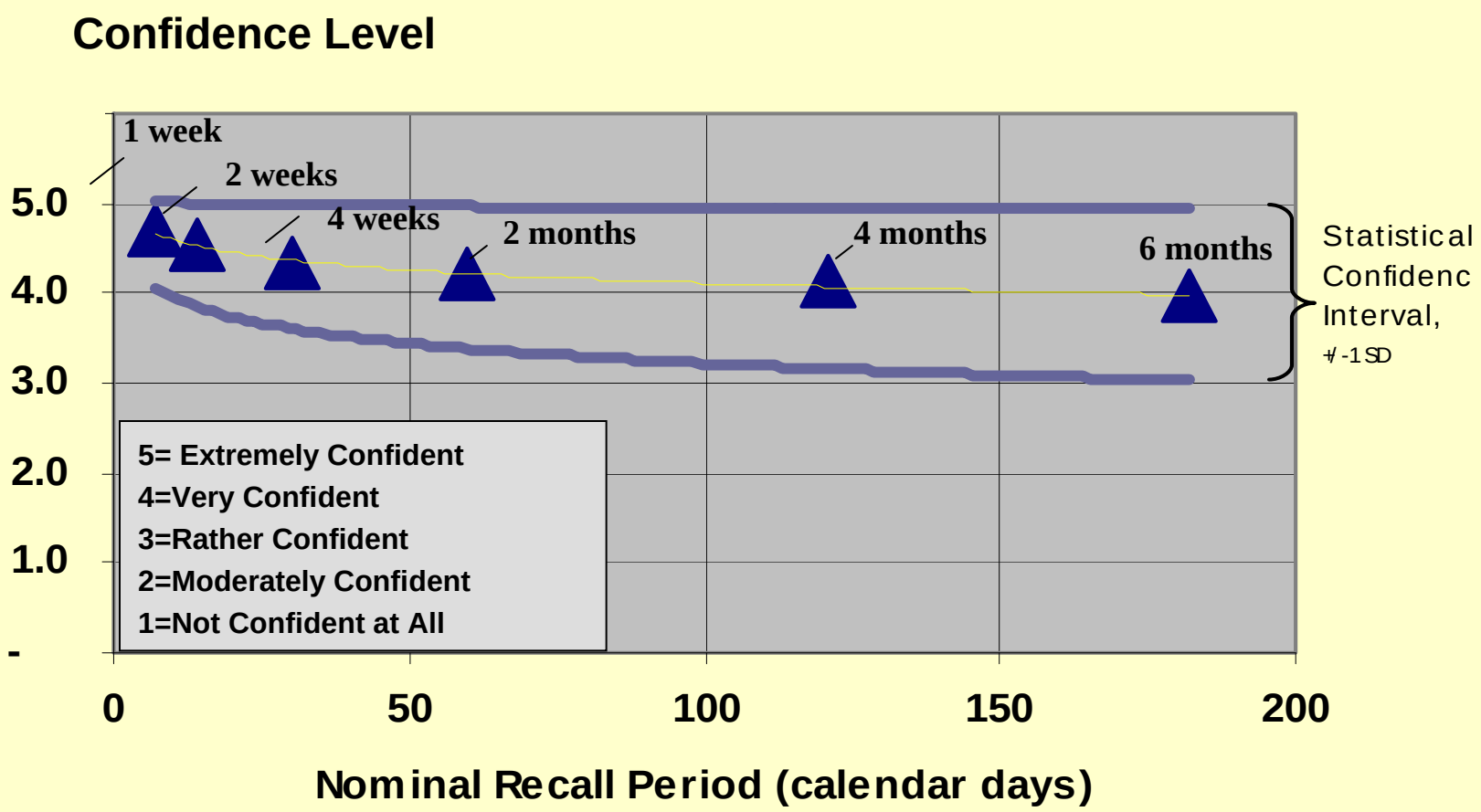
Confidence Regarding Accuracy

- **D2. How confident are you that you reported accurately all the significant safety-related events that you experienced for the time period specified in the survey?**

Confidence Regarding Accuracy (cont'd)



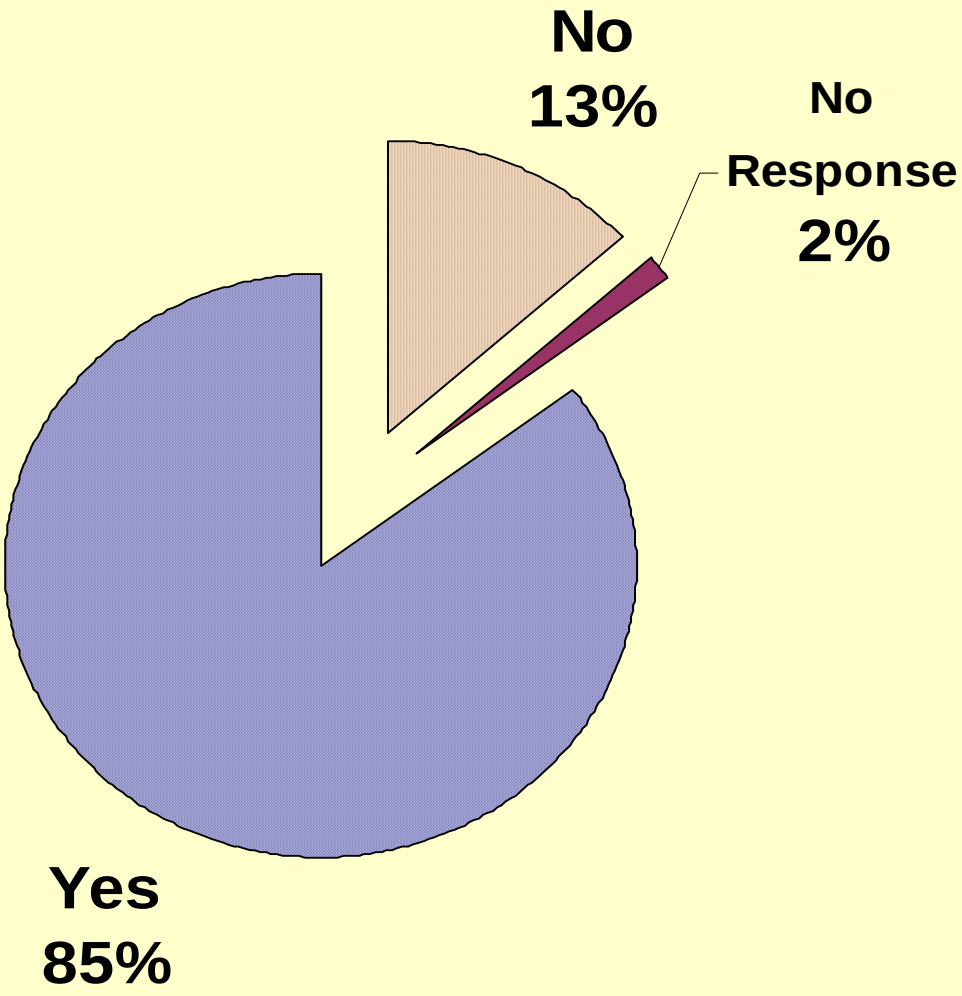
Confidence Regarding Accuracy vs. Recall Period (cont'd)



Note: The trendline and the confidence bounds were derived by regression using an exponential form. The lower confidence bound is 1 standard deviation. The upper bound is 1 standard deviation truncated at the maximum possible value of 5.

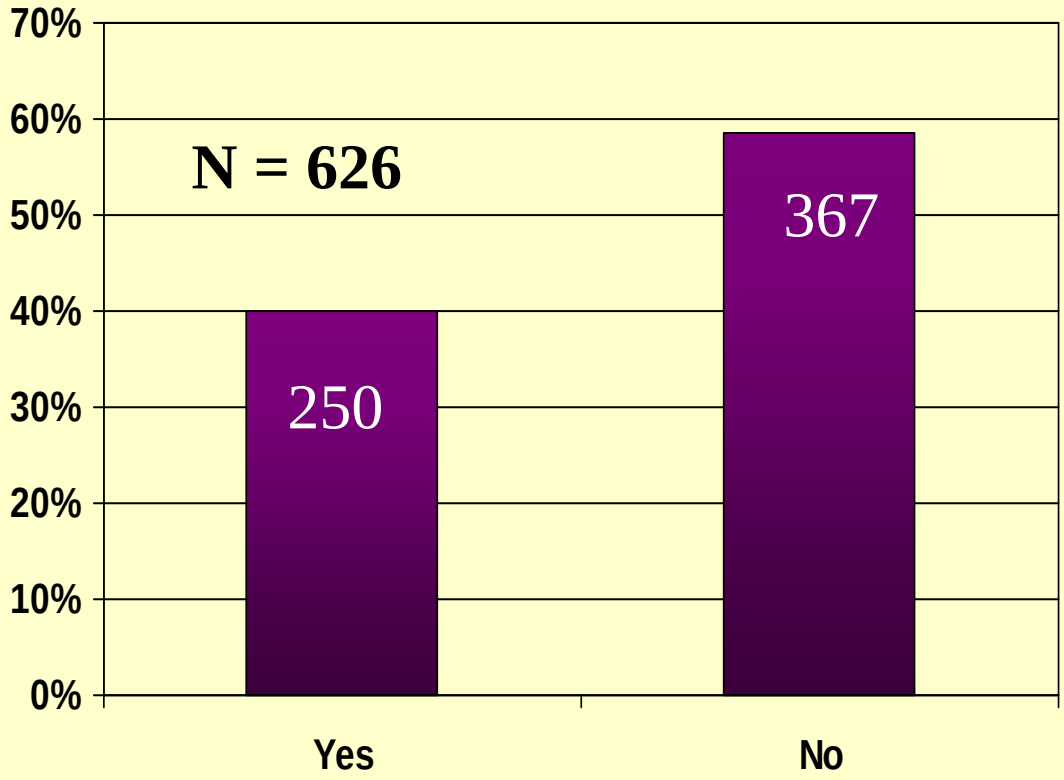
Relevancy

- **D3. In your opinion, were the questions asked in Section B of this survey relevant to tracking long-term trends in aviation safety?**



Refining the Questions

D4. Did you find any of the questions to be confusing, poorly worded, or ambiguous?



*** 9 Pilots did not answer this question**

Confusing, Poorly Worded or Ambiguous Questions

- **The 626 respondents were each asked 135 questions which yielded roughly 80,000 responses.**
- **Just 399 of these (0.5%) elicited comments.**
- **Topics of concern include*:**
  - MEL questions (Section C) = 27%
  - Equipment questions (ER) = 26%
  - ATC questions (AT) = 10%
  - In close approaches (Section C) = 8%
  - Spatial deviations (SD) = 7%
  - Other = 22%

* Percentages based on 399 reports of confusing questions.

Qualitative Feedback on Section B

Standard Safety-Related Events

SD6.
Route / Vector Deviation

QUESTION

During the last [recall period], how many times did an aircraft in which you were a crewmember <u>deviate from a route or vector heading for one minute or more?</u>

COMMENTS

- **This occurs all the time when weather is encountered**
- **Add “not because of weather”**
- **Or, add “an assigned” before “route or vector”**

WE5.
Windshear / Microburst

QUESTION

During the last [recall period], how many times did an aircraft in which you were a crewmember <u>encounter windshear or a microburst condition that resulted in an airspeed deviation of 15 knots or greater or required a windshear avoidance maneuver?</u>

COMMENTS

- **Airspeed deviations should be treated separately from situations requiring a windshear avoidance maneuver.**
- **Add a question relating to mountain waves.**

FC1.
Visual Mistake

QUESTION

During the last [recall period], how many times did an aircraft in which you were a crewmember <u>visually mistake one aircraft for another?</u>

COMMENTS

- **Add ...in the ground and in the air**
- **Too broad, unclear**
- **Be more specific with an example such as "reporting the wrong traffic in sight"**

FC4.
Sterile Cockpit

QUESTION

During the last [recall period], how many times did an aircraft in which you were a crewmember <u>experience</u> <u>a violation of the sterile cockpit rule?</u>

COMMENTS

- **Add "which led to a deviation"**
- **Pilots noted that airlines often have added restrictions to this ruling**

ER1-ER5.
Equipment Related Events

QUESTION

During the last [recall period], how many times did an aircraft in which you were a crewmember <u>how many times did an aircraft in which you were a crewmember experience a significant malfunction or failure of any of the following aircraft systems and/or components?</u>

COMMENTS

- **Pilots noted the list was overly general and should be refined**
- **Add "on the ground", "in the air", and/or "MEL'd"**

AT7.
Frequency Congestion

QUESTION

During the last [recall period], how many times did an aircraft in which you were a crewmember <u>find that you were unable to communicate with ATC because of frequency congestion?</u>

COMMENTS

- **Add “on the ground” and/or “in the air”**

Gaps in Safety Event Questions Identified

- Crew Rest / Fatigue and errors related to fatigue
- Crew Interaction / CRM
- Crew Training
- Cockpit Automation
- Flight Dispatch Issues
- Airport Security
- ATC Readback
- Night Flying

Qualitative Feedback on Section C – Topical Sections

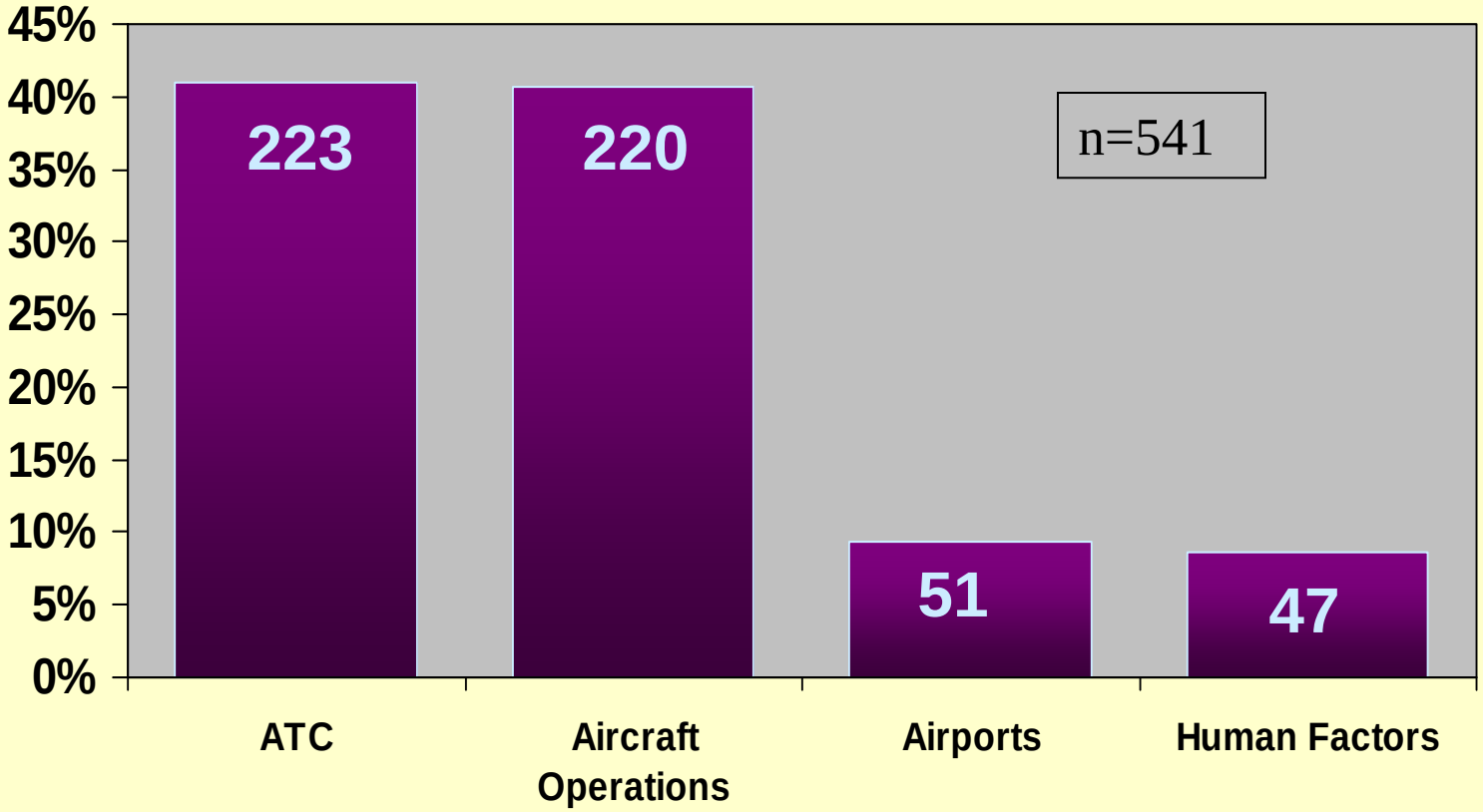
Section C – Topical Sections

- **Minimum Equipment Lists**
  - Over 60 respondents gave suggestions
  - In general, the respondents felt these questions were too detailed

- **In-Close Approach Changes**
  - Over 20 respondents gave suggestions
  - Many related to providing a definition of “in-close”

Suggestions for Future Topical Sections

D5. Distribution of Suggestions for Future Topical Sections



Suggestions for Future Topical Sections

- **ATC**
  - ATC Communication
  - ATC Communications-phraseology; Readback / Hearback
  - ATC Delays during reduced weather
  - ATC Frequency Congestion
- **Aircraft Operations**
  - Checklist Usage
  - Cockpit Automation
  - LAHSO
  - Portable Electronic Devices / Interference
  - TCAS

Suggestions for Future Topical Sections (cont'd)

- **Human Factors**
  - Crew Fatigue
  - Crew Pairing
  - Crew Resource Management / Interaction
  - Crew Rest - Cargo
  - Crew Rest - International Flights
  - Crew Training
  - Flight Duty Time Limitations
- **Airport**
  - Airport Congestion
  - Airport Security

Other Comments or Suggestions

Summary of Other Comments

QUESTION D6

- **Do you have any other comments or suggestions about this survey?**

COMMENTS

- **246 Respondents gave comments to D6**
- **Less than 5 negative general comments**
- **Majority of Other Comments:**
  - Recall Periods
  - Feedback on improving specific questions / questionnaire overall
- **4 out of 626 respondents said the survey was too long**

Highlights of Positive Comments

- *“I would just like to thank you for your efforts to improve aviation safety. Keep up the good work!”*
- *“I found this survey interesting / thought-provoking/ and to a limited extent/ educational. I'd like to see the compiled results and analysis.”*
- *“I have always found NASA to be one of the most important agencies in promoting safety in this business.”*
- *“I think it’s good to do the surveys-I think that people are more willing to speak on a confidential basis.”*

Highlights of Positive Comments (cont'd)

- *"I feel this is an excellent idea and look forward to participating in more surveys in the future."*
- *"This survey is a great idea and every pilot should receive a survey quarterly to keep track of events and you'd get a full picture of airline operations."*
- *"I hope that the results of the survey can get to the decision makers to create improvements."*
- *"Keep it on. Your are asking the right kind of questions. Gathering this kind of info is more art than science."*

Discussion

Discussion Questions

- **What are your opinions about the methodological approach that we intend to follow?**
- **Panel design discussions**
- **What would be valuable issues for future topical sections?**
- **How can your organization help make NAOMS a success?**
- **What would be a workable approach for obtaining aviation community input into the NAOMS survey process?**
  - Policy level
  - Subject of topical sections
  - Questionnaire consultation, validation and review

Summary
and
Closing Comments

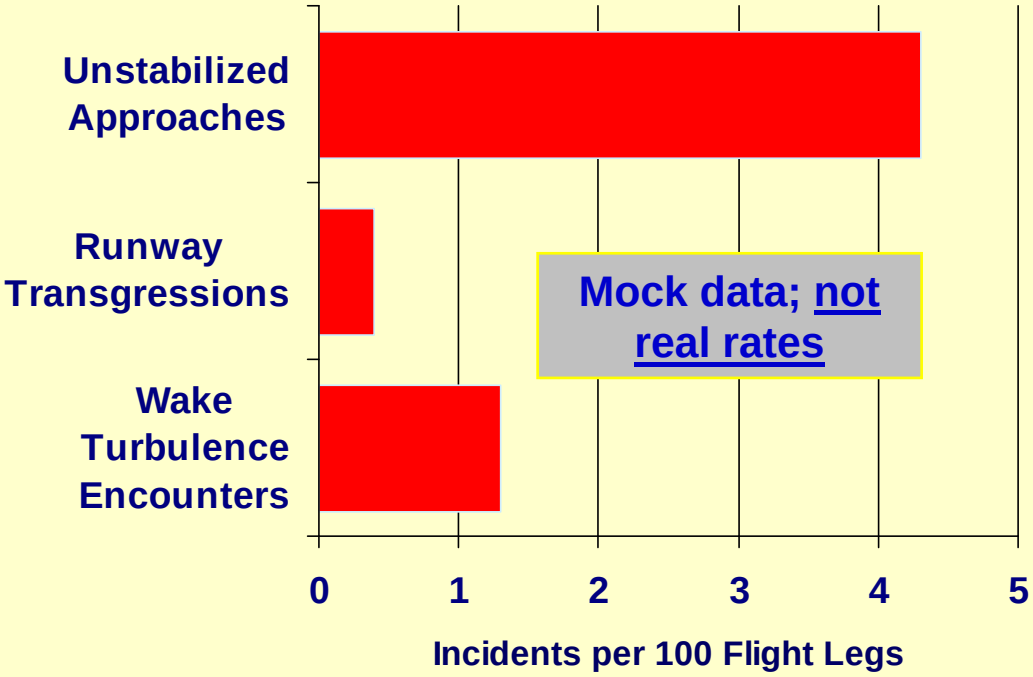
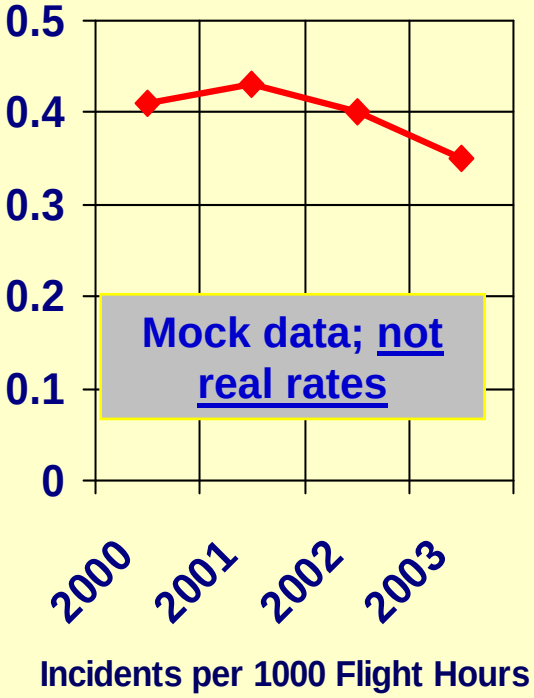
Linda Connell
NASA Project Manager, Level III

Existing Capabilities

- **A number of valuable publicly available data collection programs already exist**
  - SDR / OpError / AIDS
  - ASRS
  - NTSB database
  - And others
- **These data collection efforts satisfy many needs**
- **But they do not provide**
  - An adequate top down view of long-term NAS safety trends
  - An effective means of measuring the impacts of new aviation technologies and procedures

Examples of Possible NAOMS Safety Outputs

SAFETY EVENTS
(CY 2001)



CRITICAL GROUND CONFLICTS
(CY 2000-03)