CONCEPTS and RATIONALE

Loren Rosenthal

The Unmet Data Need

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

After examining various possibilities, it was decided that a survey approach could best meet the unmet requirements

Features of the Survey Method

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

Users of Survey Research

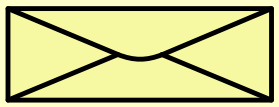
The advantages of the survey method have been demonstrated by its wide use in:

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

NAOMS Survey Approach

- **Regularly survey pilots, controllers, mechanics, flight attendants and others who operate the national aviation system (NAS)**
  - View the national aviation system through their eyes
  - Includes all types of operations (air carrier, regional, corporate, general aviation)
- **Collect data on respondents events (as operationally experienced)**
- **Guarantee confidentiality of data**
- **Normalize for risk exposure (hours, legs, etc.)**
- **Achieve scientific integrity by using well crafted survey instruments and statistical analysis methods**

NAOMS PROCESS



Pre-Survey Notifications,
Requests and Reminders

CONTROLLERS

FLIGHT ATTENDANTS

AIR CARRIER PILOTS

GENERAL AVIATION PILOTS

MECHANICS

OTHERS

NASA / NAOMS

DEIDENTIFIED SURVEY DATA

RESEARCH PRODUCTS

NAOMS Outputs

- **Safety Event Rates and Trends**
- **Quantitative Analyses of Safety Issues**

NAOMS EVENT RATE ESTIMATES

Preliminary Estimates for Internal Use Only

Equipment Problems

	Question	Risk Exposure Factor	Estimated Event Frequency per Million Exposure Units (COV)* SMA	MED	LRG	WDB
ER1	Diversion Due to Equipment Problem	Hours	2,197.5 (7.16%)	780.8 (6.9%)	496.7 (12.4%)	577.3 (6.9%)
ER2	Hazmat Spill, Fire, or Fumes	Legs		67.4 (32.9%)	53.4 (104.3%)	334.0 (25.2%)
ER3	Cargo Shift	Legs	262.1 (17.54%)	115.2 (29.7%)	2,159.6 (13.9%)	2,674.9 (9.8%)
ER4A	Uncommanded Movement of Elevators	Hours	578.7 (27.50%)	243.7 (15.4%)	115.5 (50.9%)	137.0 (17.8%)
ER4B	Uncommanded Movement of Rudder	Hours	219.5 (39.66%)	81.5 (19.7%)	46.3 (35.8%)	61.2 (29.3%)
ER4C	Uncommanded Movement of Ailerons	Hours	262.0 (53.84%)	103.3 (19.8%)	23.6 (66.2%)	67.6 (27.5%)
ER4D	Uncommanded Movement of Spoilers	Hours	85.2 (45.39%)	97.8 (24.6%)	72.5 (59.5%)	82.3 (24.7%)
ER4E	Uncommanded Movement of Speedbrakes	Hours	78.8 (58.24%)	54.0 (34.5%)	27.4 (48.0%)	37.6 (34.8%)
ER4F	Uncommanded Movement of Trimtabs	Hours	217.2 (43.99%)	53.6 (23.4%)	15.2 (75.3%)	19.9 (49.7%)
ER4G	Uncommanded Movement of Flaps	Hours	216.5 (37.93%)	44.6 (24.9%)	64.5 (34.7%)	50.1 (23.9%)
ER4H	Uncommanded Movement of Slats	Hours	12.2 (286.23%)	42.0 (26.6%)	53.5 (35.1%)	61.1 (29.1%)
ER4I	Uncommanded Movement of Other	Hours	475.6 (32.64%)	178.4 (12.7%)	193.6 (21.6%)	161.2 (13.3%)
ER5A	Fire, Smoke, or Fumes; Engine or Nacelle	Hours	177.8 (54.82%)	70.8 (24.1%)	65.0 (31.5%)	64.8 (28.5%)
ER5B	Fire, Smoke, or Fumes; Flight Deck	Hours	140.5 (48.84%)	50.7 (22.8%)	63.3 (29.6%)	66.1 (19.6%)
ER5C	Fire, Smoke, or Fumes; Cargo Hold	Hours		21.6 (37.8%)	20.2 (70.6%)	47.5 (28.6%)
ER5D	Fire, Smoke, or Fumes; Galley	Hours	116.9 (51.47%)	32.2 (9.8%)	199.7 (44.3%)	266.3 (10.2%)
ER5E	Fire, Smoke, or Fumes; Elsewhere in Pax Compart't	Hours	136.6 (44.9%)	231.5 (11.0%)	157.4 (17.5%)	230.1 (12.5%)
ER5F	Fire, Smoke, or Fumes; Elsewhere	Hours	92.5 (49.4%)	185.1 (13.2%)	88.4 (40.2%)	114.5 (18.6%)
ER6	Precautionary Engine Shutdown	Hours	570.3 (35.08%)	94.2 (17.2%)	50.9 (45.8%)	119.0 (16.9%)
ER7	Total Engine Failure	Hours	187.8 (90.02%)	24.8 (33.6%)	2.9 (126.1%)	43.1 (36.8%)

Protocol Development and Description

Jon Krosnick

Surveys Can Measure:

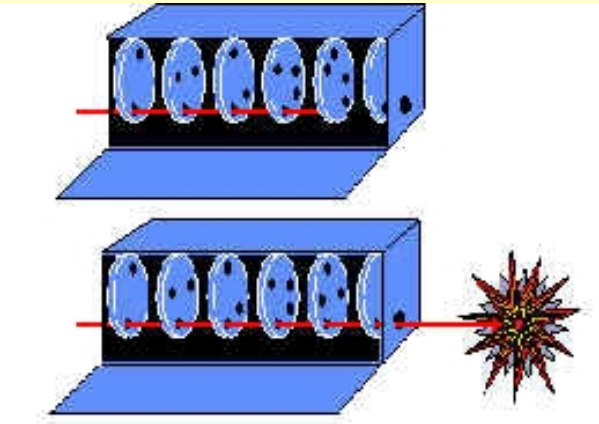
- **Attitudes**
- **Preferences**
- **Beliefs about the state of the world**
- **Predictions about the future**
- **Past behavioral experiences or events**

NAOMS will focus on
the measurement of events

NAOMS
Design Decisions

- **What events to address?**
- **What order of questions?**
- **How long of a recall period?**
- **What mode?**

Types of Events



Accidents

↑

Proximal Causal Events

↑

Distal Causal Events

↑

Static Contribution Factors

Mid-air collision

Incorrect altitude

Altitude clearance misunderstood by pilot

Microphone, earphones, radios, pilot's hearing, noise, etc

Building Lists of Events

- **Focus Groups with Active Professional Participants**
- **Consultation with Industry/Gov't Safety Group, e.g.**
  - CAST
  - FAA
  - ASRS Analysts
  - Workshops
- **Review of Aviation Databases, e.g.,**
  - ASRS
  - NTSB
  - NAIMS
  - BTS
- **Decision: Sample Events at Distal or Proximal Levels of Event Chain**

Question Ordering

Question Ordering Relates to Memory Organization:

- Records of experiences are organized systematically and thematically in memory
- Asking questions in clusters that match a person's memory organization improves measurement precision
- Various hypotheses about how pilots might organize their memories discussed, but no hard data.

Memory Organizations

- **Severity**
- **Causes**
- **Phase of Flight**

Identifying Memory Organization

- **Experiments**
- **Participants: Air carrier pilots**
- **Various tasks**
  - Order of Recall
  - Labeling of Clusters
  - Sorting of Events into Categories
- **Decision: A "hybrid" organization emerged: mostly causes with some phases**

Recall Period

Recall Period - The optimal time between event occurrence and survey

- Needs to maximize recall and balance survey logistics
- Memories fade over time
- Participants should not be asked to recall things from too far in the past
- Literature Review: A literature review resulted in data that we felt to be insufficient for our purposes
- Our own study of pilots' recall of mundane flight events: 7 days maximum
- We needed to determine how long more serious events can be remembered

Recall Period: Validity Analysis

- Association of hours flown with number of events witnessed
- Association of days in the recall period with number of events witnessed
- Strongest relationships for one month and two months
- Decision: Keep recall period less than four months (60 days chosen as recall period)

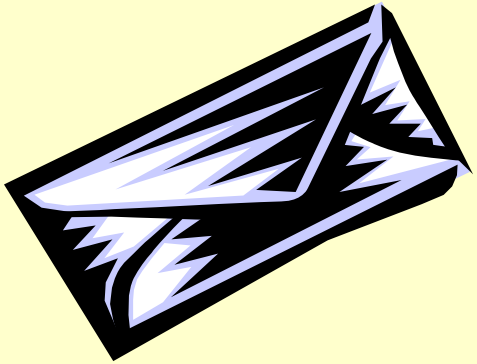
Data Collection Modes

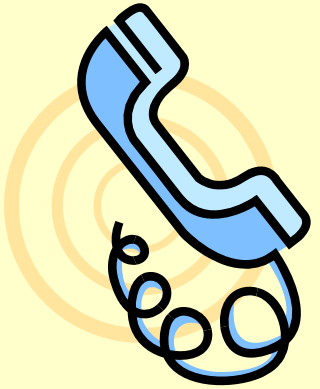
- **Mailed, Self-Administered (SAQ)**
- **Telephone (CATI)**
- **In-Person**

Each mode has positive and negative aspects related to a variety of considerations

Test Findings:

- **Response Rate**
  - Mail 73%
  - Telephone 81%
- **Completion Rate**
  (% missing responses)
  - Mail 4.8%
  - Telephone 0.0%
- **Confidence Rating**
  - Mail 80%
  - Telephone 91%





In-Person Interviewing Terminated Early d/t Time and Cost Investment

Mode: Selection and Validation

- **Validation results:**
  - 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
- **Mode selection:**
  - 30% stronger relationships for telephone than mail
- **Decision: Perform telephone interviewing (Computer Assisted Telephone Interview - CATI)**

Summary of Design Conclusions

- **Address as many safety events identified during preliminary investigations as practical**
- **Order questions to match hybrid clustering**
- **Use 60-day recall period to maximize documentation of rare events**
- **Use telephone interviewing to maximize measurement accuracy**

Data Collection

Joan Cwi

Sample Design

- **Sample source**
  - Airmen Certification Directory (N = 670,000)
  - Available online at FAA Oklahoma City
- **Samples are drawn among U.S.-based pilots**
  - Air Carrier (N = 55,000) currently available
- **Sample drawn on quarterly basis**
  - Sampling without replacement for 12 rolling months

Locating Pilots

- **Addresses updated, telephone numbers obtained**
  - National Change of Address
  - Telematch
  - Other sources, such as Directory Assistance, Web sites
- **Location results**
  - 80% of AC pilots

Interviewing Process

- Sending Advance Letter
- Screening for Eligibility
- Conducting the Interview

Sending Advance Letter

- **Sent to pilots about a week before calling**
- **On NASA letterhead / envelopes**
- **Explains**
  - purpose of study
  - what participation means
  - confidentiality
  - who will call
  - etc.

Screening for Eligibility

- **Attempt to screen all pilots by telephone**
- **AC screener**
  - Determines pilot has flow in last 60 days as air carrier pilot

Conducting the Interview

- Conduct screening and interviewing using computer-assisted telephone interviewing (CATI)
- Interviewer administers questionnaire from telephone center
- Questionnaire pre-programmed into computer so data entered immediately--no additional data entry
- CATI has most error checks built into the programs--requires little editing
- 10% of each interviewer's work is validated

Air Carrier Interviewing Effort

- **Yearly interviewing effort**
  - Sample size (N = 14,300)
  - Screening (N = 10,700)
  - Interview (N = 8,000)
  - Interview length averages 18 minutes
- **Non- completes**
  - No locates (N = 18%)
  - Not eligible (N = 19%)
- **Progress to date (1.5 years)**
  - 11,800 completed interviews

Air Carrier Survey Overview

Linda Connell

Air Carrier Questionnaire Structure*

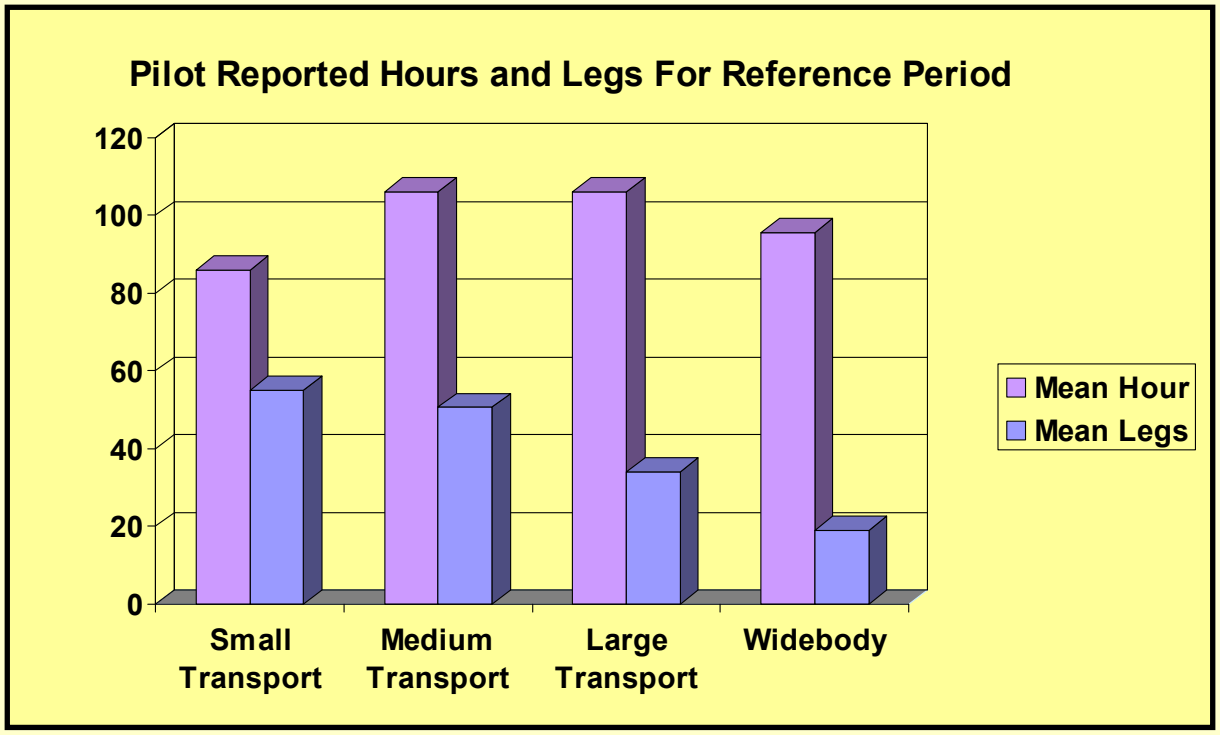
- **Section A: Descriptive Demographic Information**
  - Information suitable for exposure determination: Lifetime hours flown, hours and legs flown last 60 days, aircraft make/model, type flights, crew position and more
- **Section B: Safety Related Events**
  - Consistent data set over time
- **Section C: Focus Questions**
  - Specific topics driven by government/industry high-priority needs
- **Section D: Questionnaire Feedback**

*** Data collection started April, 2001; over 11,800 completed interviews to date**

Air Carrier Results
Section A - Demographics

Respondent Flight Experience	Mean Value
Total Life-Time **Flight Hours**	**10,094 hours**
Last 60 Days **Flight Hours**	**97.8 hours**
Last 60 Days **Departures**	**37 Departures**

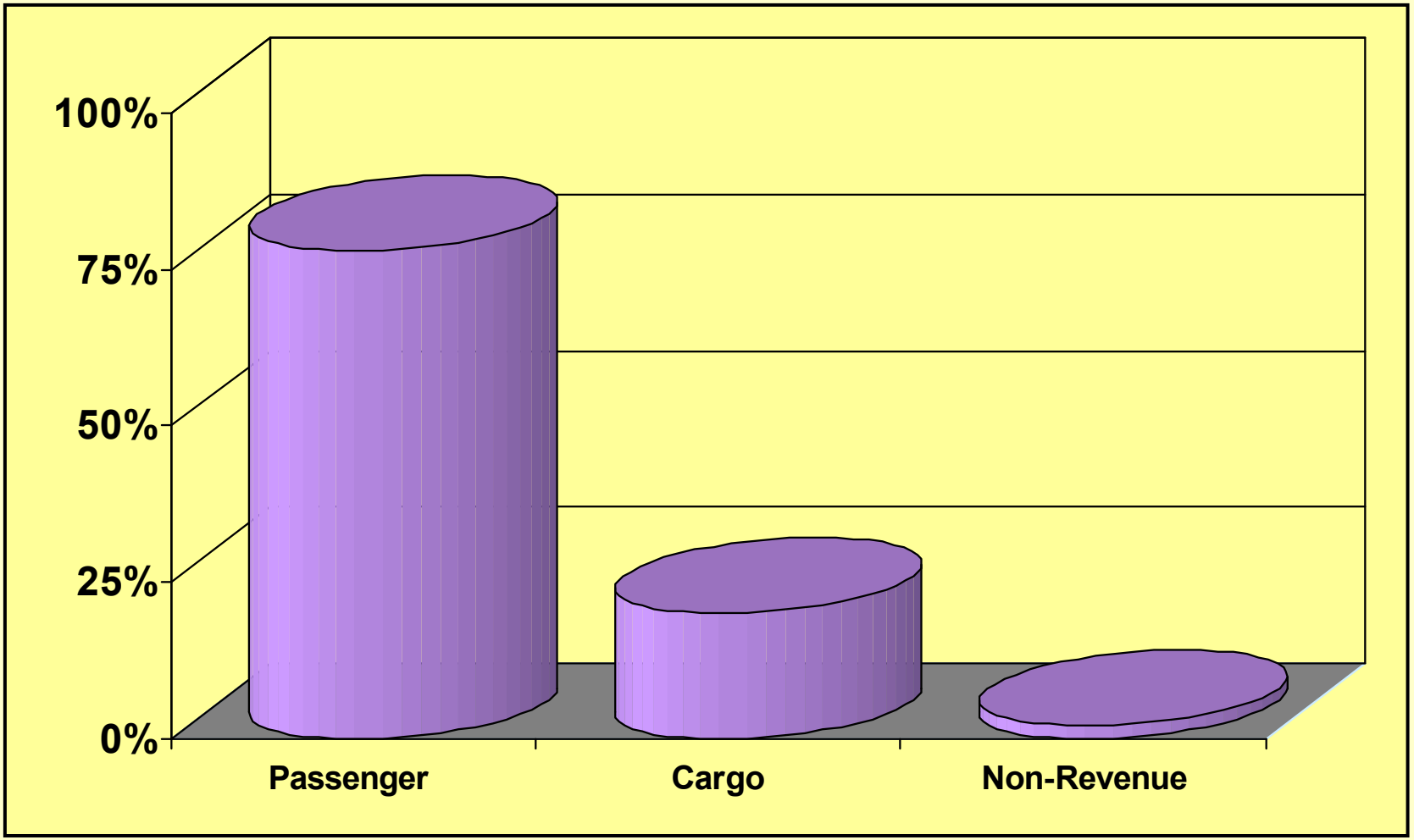
Hours and Legs by Aircraft Size



Aircraft Size	Mean Hours Per Leg
Small Transport	1.5
Medium Transport	2.1
Large Transport	3.1
Widebody	4.9

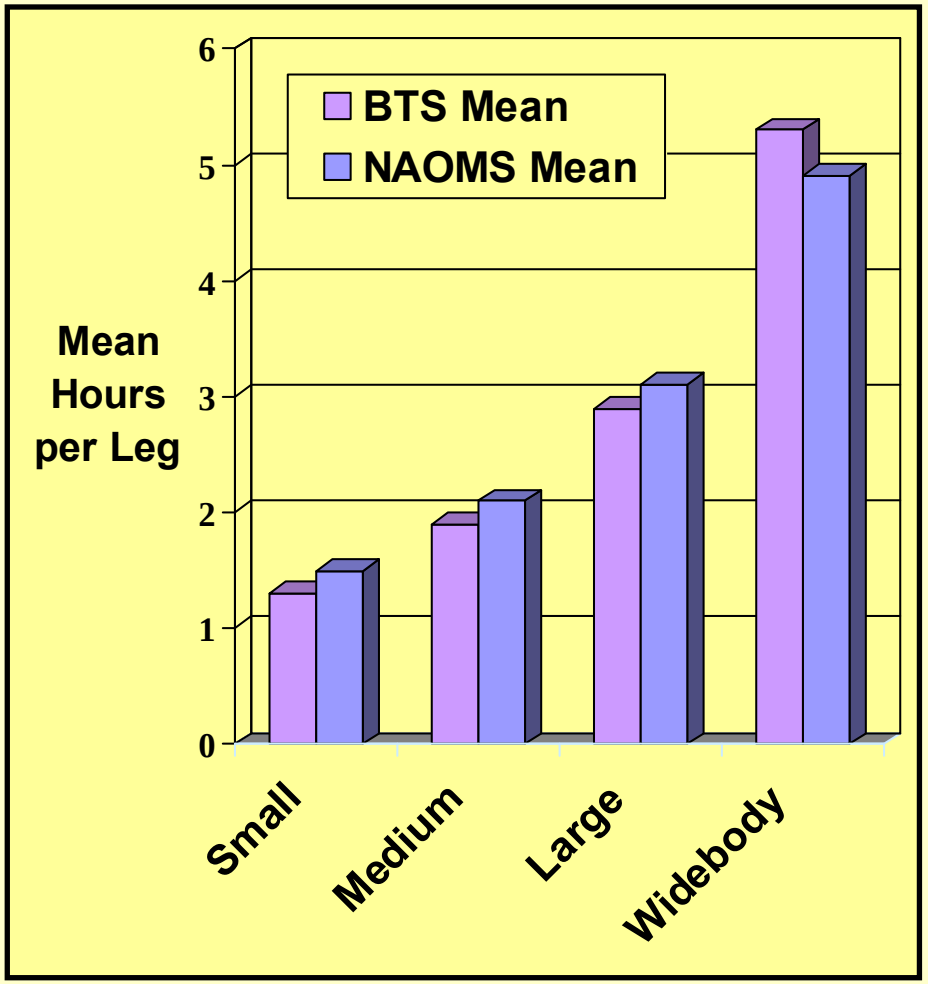
- Small Transport < 100 k lbs GTOW
- Medium Transport ≥ 100 k lbs and < 200 k lbs GTOW
- Large Transport > 200 k lbs GTOW with single aisle
- Widebody > 300k lbs GTOW with two aisles

Type of Flight

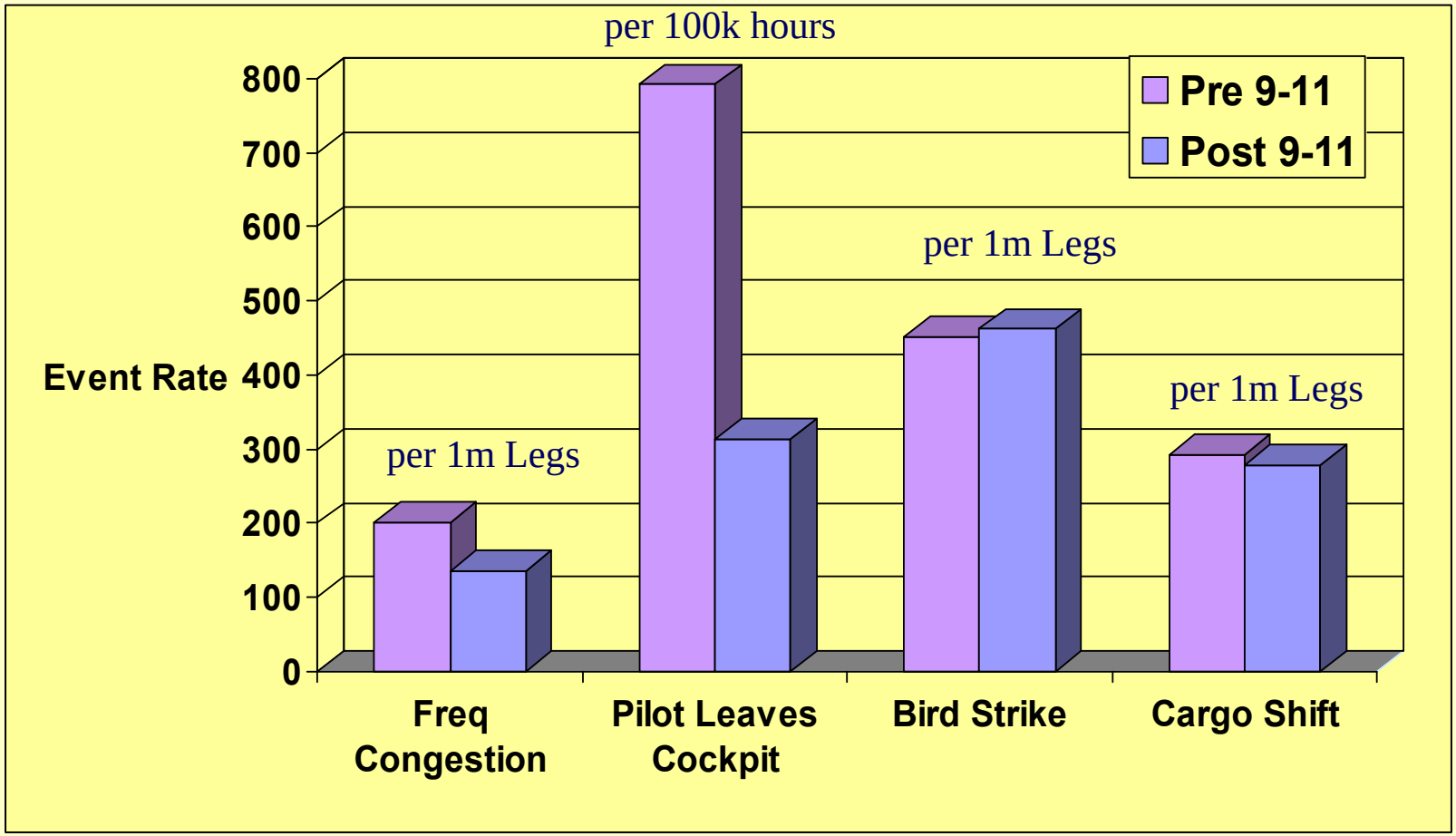


NAOMS Flight Time per Leg Estimates Compared to BTS Census Data

Aircraft Category	Estimate Source	Mean Hours Per Leg
Small Transport	NAOMS	1.5
	BTS	1.3
Medium Transport	NAOMS	2.1
	BTS	1.9
Large Transport	NAOMS	3.1
	BTS	2.9
Widebody	NAOMS	4.9
	BTS	5.3



Pre and Post 9-11
Evaluation of Sample Events



Example
Air Carrier Results

Robert Dodd

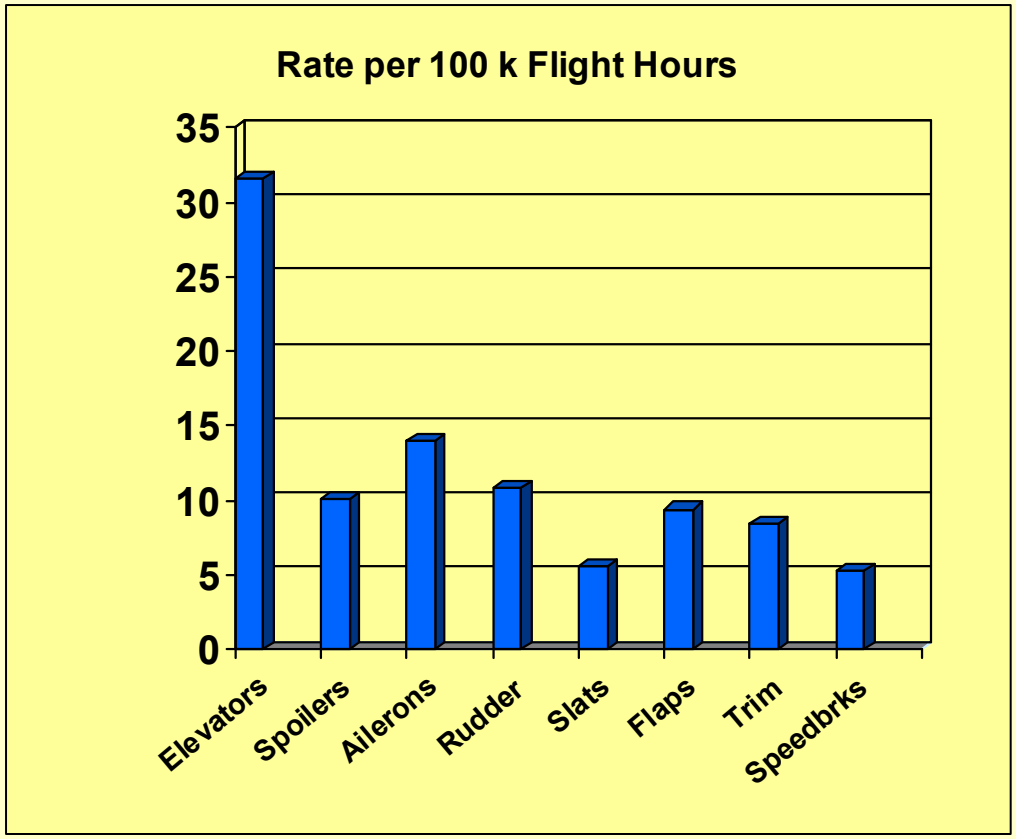
Section B: Safety Related Events

- Equipment Problems
- Turbulence
- Weather Events While Airborne
- Passenger Related Events
- Airborne Conflicts
- Ground Operations
- Aircraft Handling Events
- Altitude Deviations
- Air Traffic Control Interactions

Equipment-Related Events

This section addresses aircraft related equipment failures such as equipment-related diversions, engine problems, uncommanded movements etc.

Uncommanded Control Surface Movements



Control System	Event #	Extrapolated Annual Events
Elevators	263	3,153 estimated
Spoilers	83	1,005 estimated
Ailerons	109	1,393 estimated
Rudder	95	1,085 estimated
Slats	43	549 estimated
Flaps	81	936 estimated
Trim	74	835 estimated
Spdbrakes	44	521 estimated

Recent accidents have highlighted importance of the risk of uncommanded movements

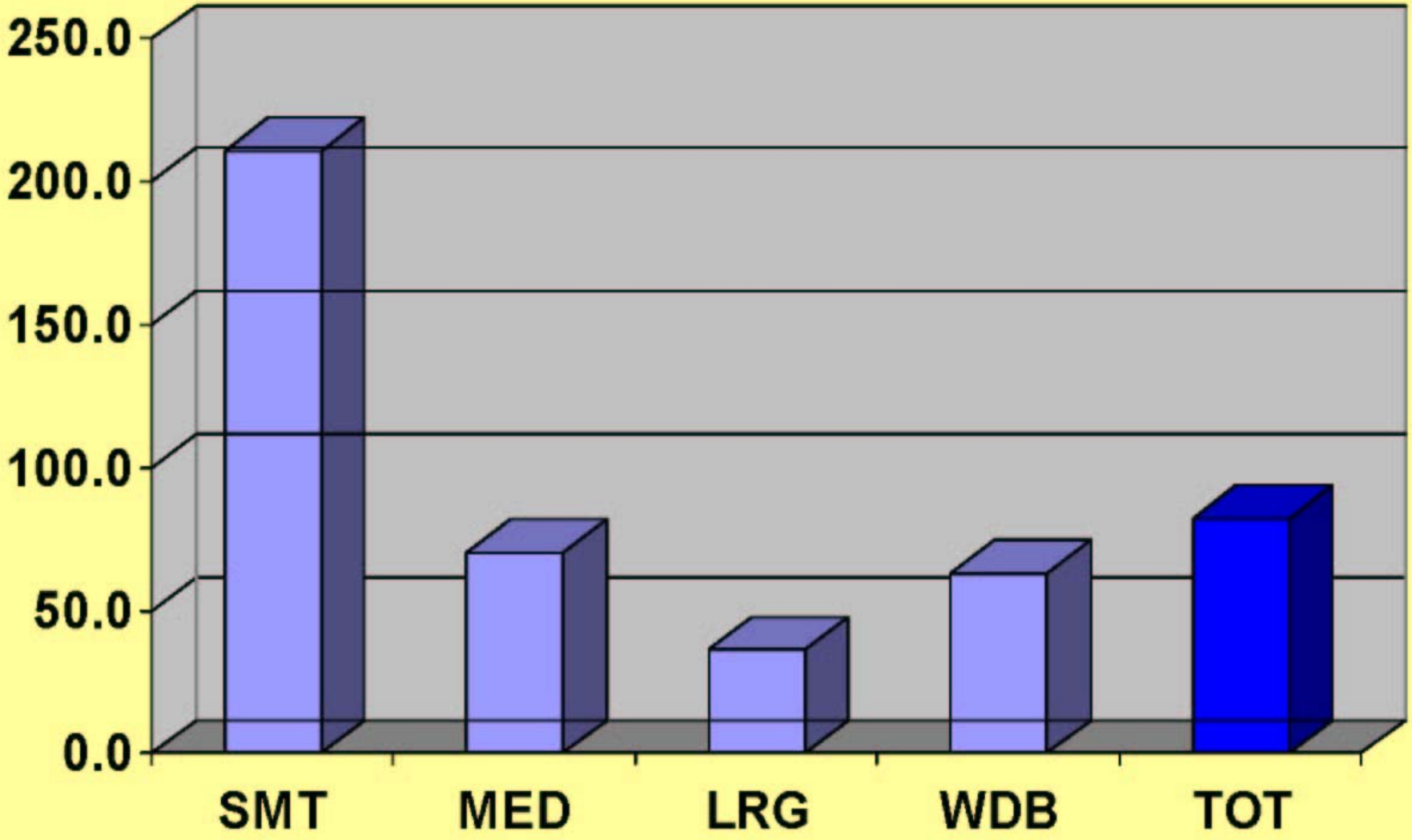
Estimated Air Carrier Event Rates

Diversion Due to Equipment Problem

Question: **Equipment Problems (ER1)**

Exposure Factor: **Events per 100k Hours**

Rate estimates based on all data collected through October, 2002.



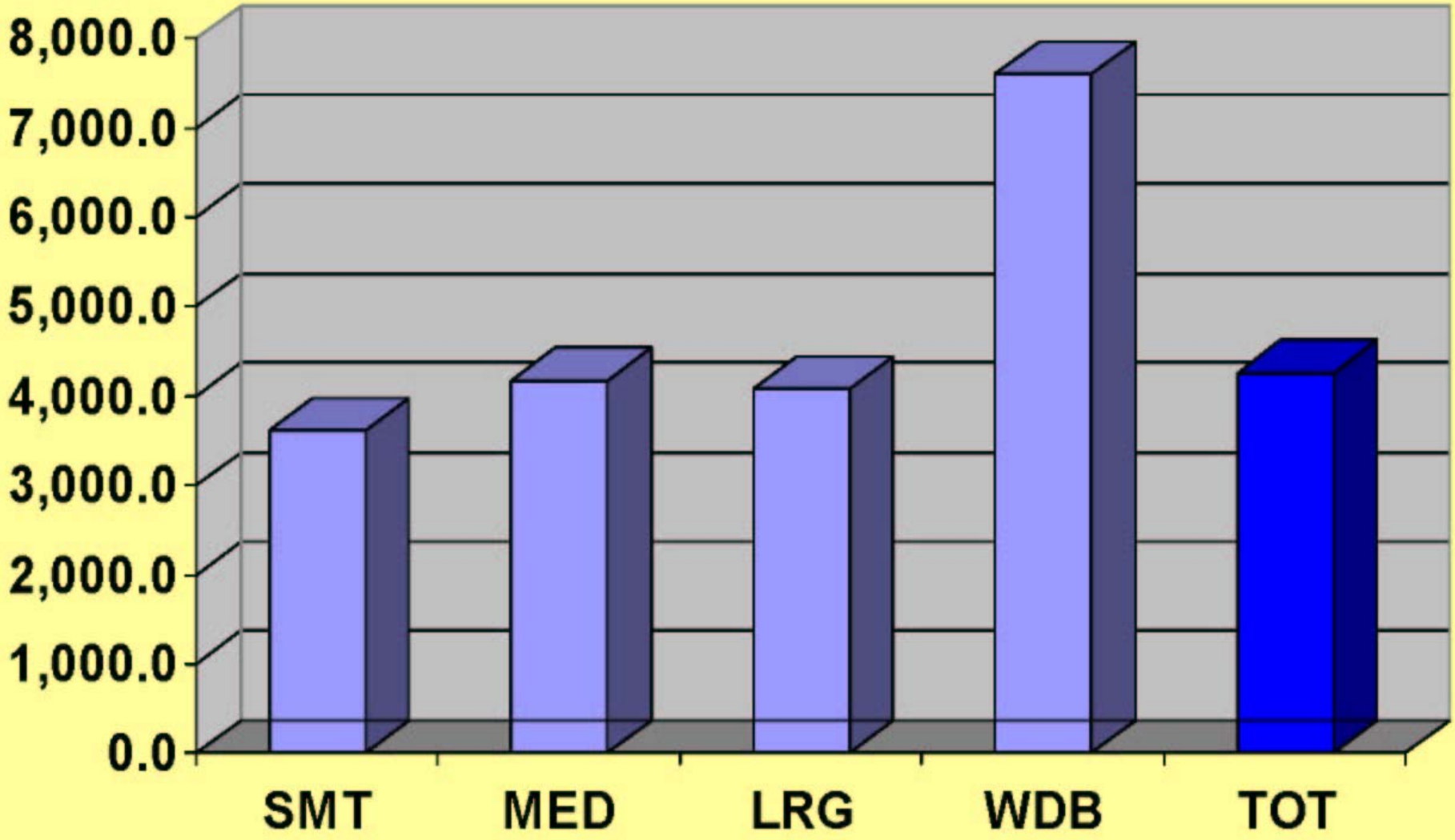
Estimated Air Carrier Event Rates

Bird Strike

Question: **Airborne Conflicts (AC1)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



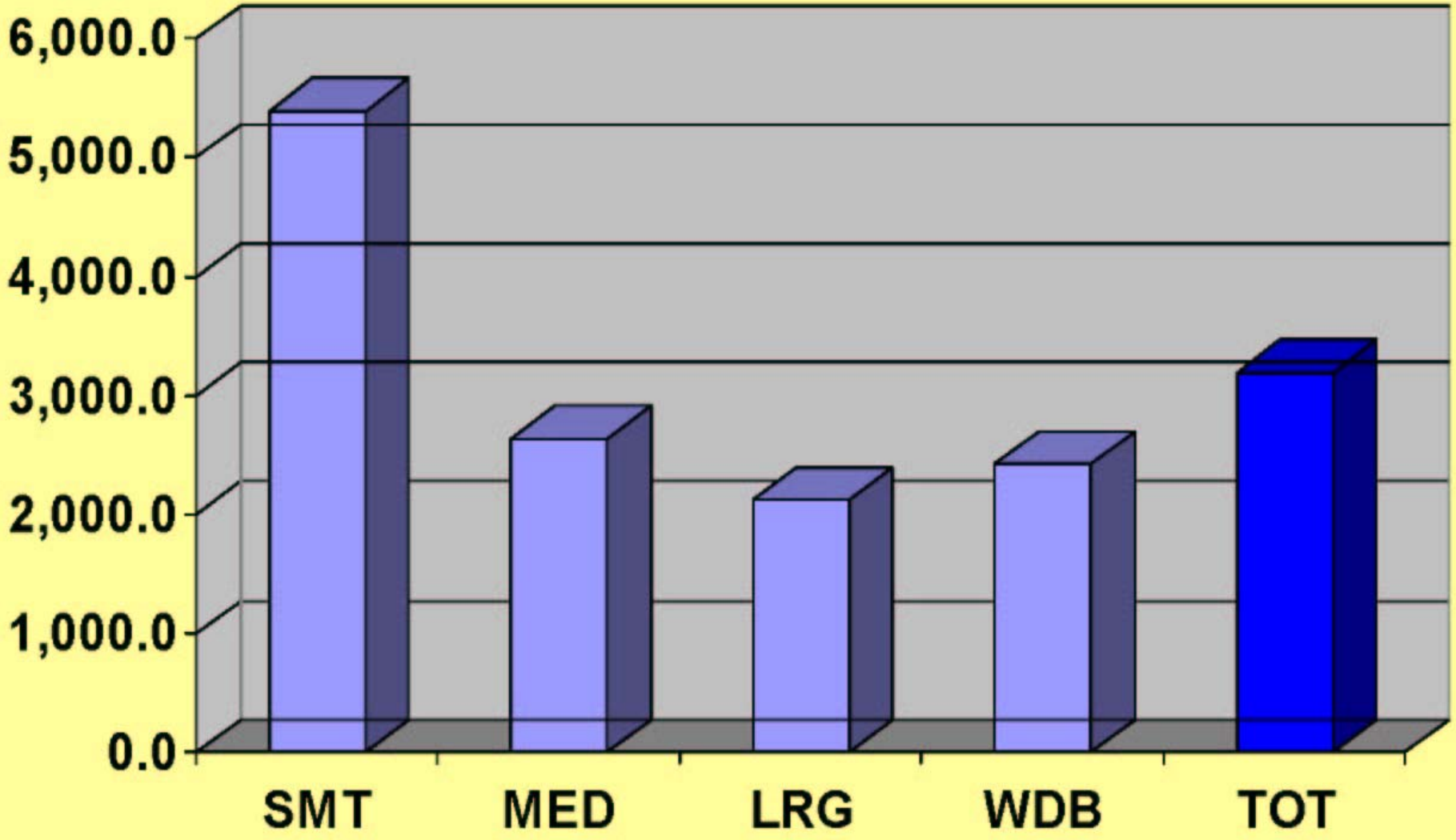
Estimated Air Carrier Event Rates

Evasive Action; >500 ft Separation

Question: **Airborne Conflicts (AC2)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



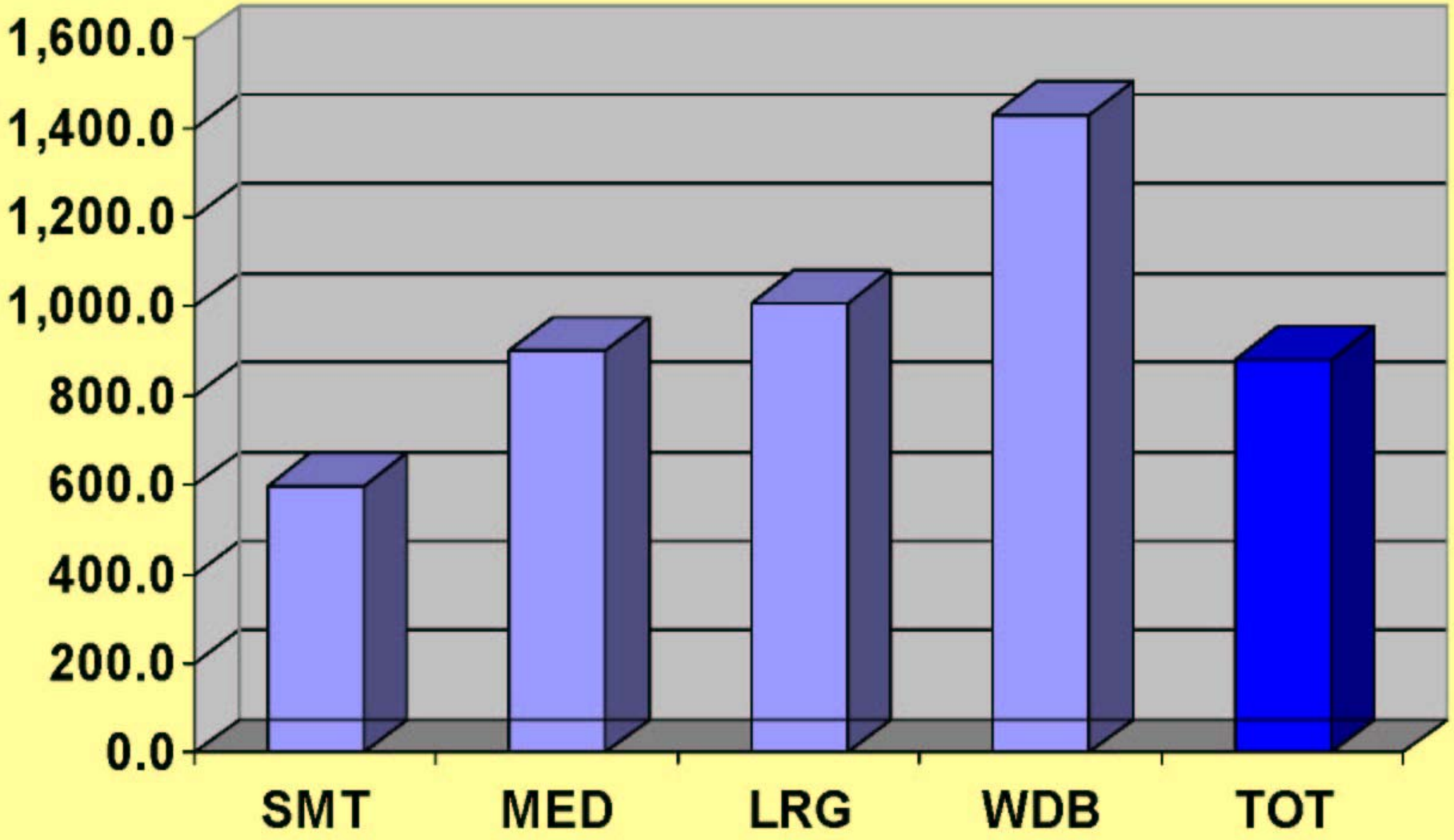
Estimated Air Carrier Event Rates

Ground Conflict with Vehicle

Question: Ground Events (GE2)

Exposure Factor: Events per 1 million Legs

Rate estimates based on all data collected through October, 2002.



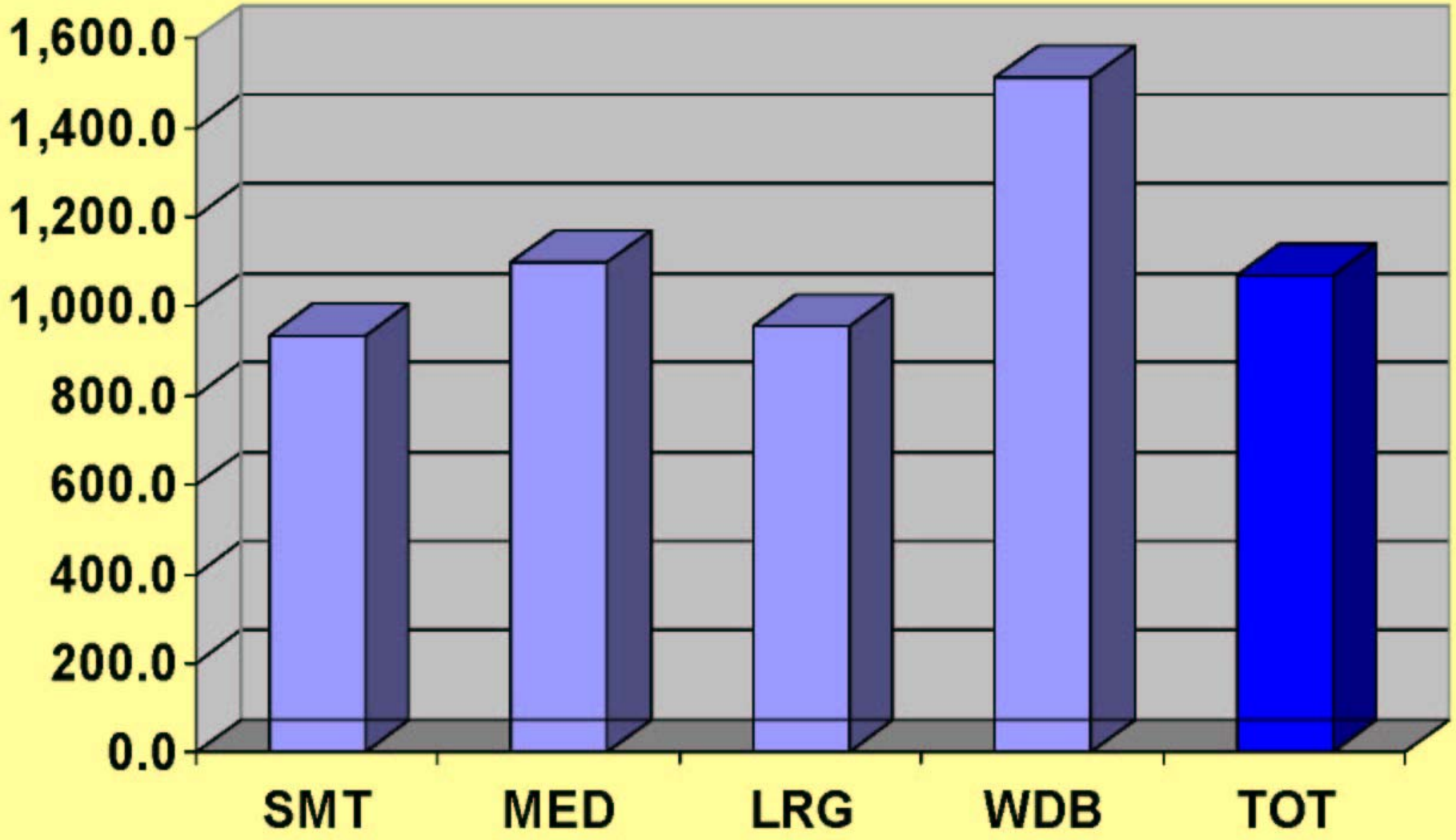
Estimated Air Carrier Event Rates

Landing Skid

Question: **Ground Events (GE3)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



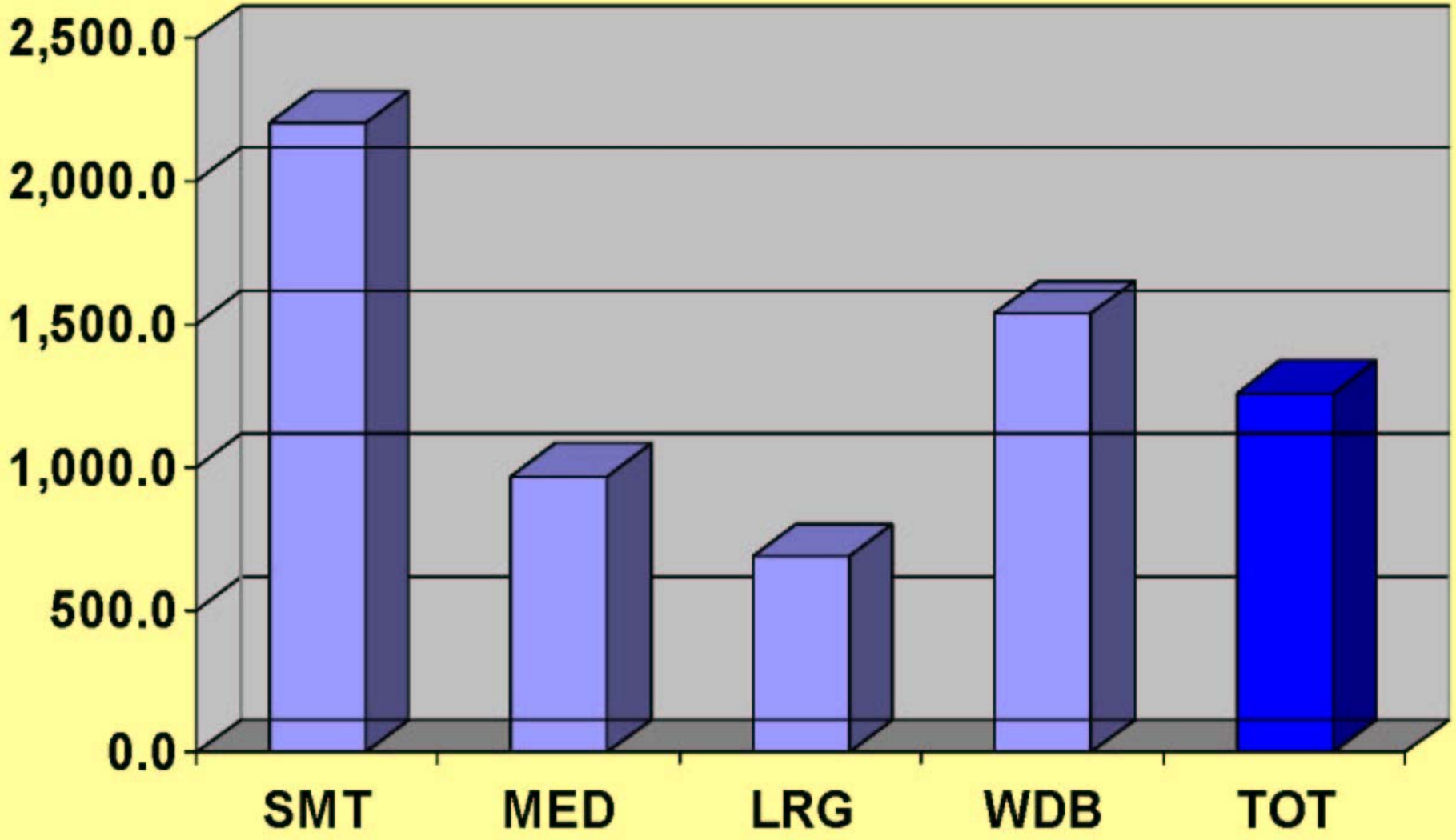
Estimated Air Carrier Event Rates

Rejected Takeoff

Question: **Ground Events (GE4)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



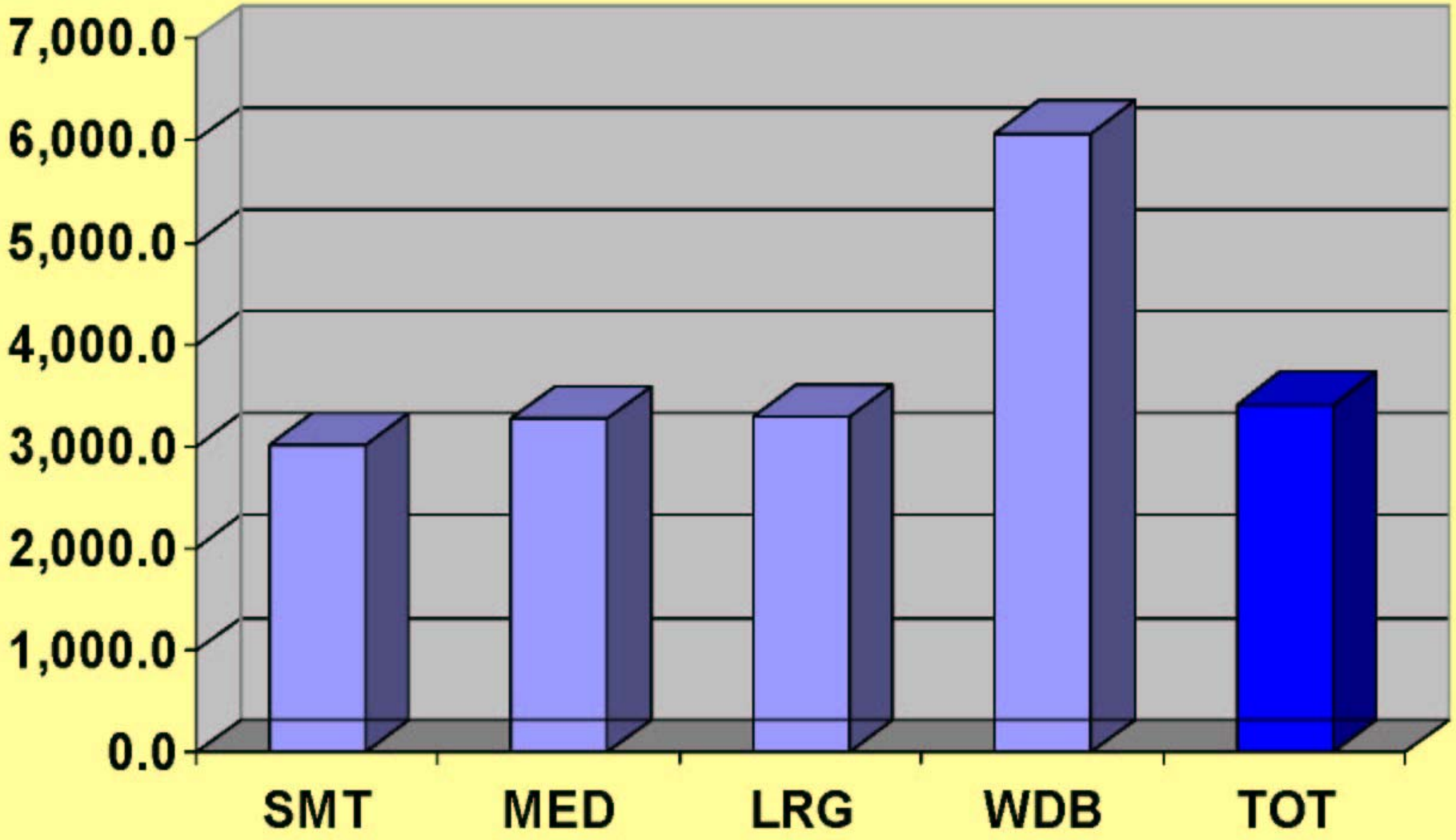
Estimated Air Carrier Event Rates

Used Reserve Fuel

Question: **Aircraft Handling Events (AH1)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



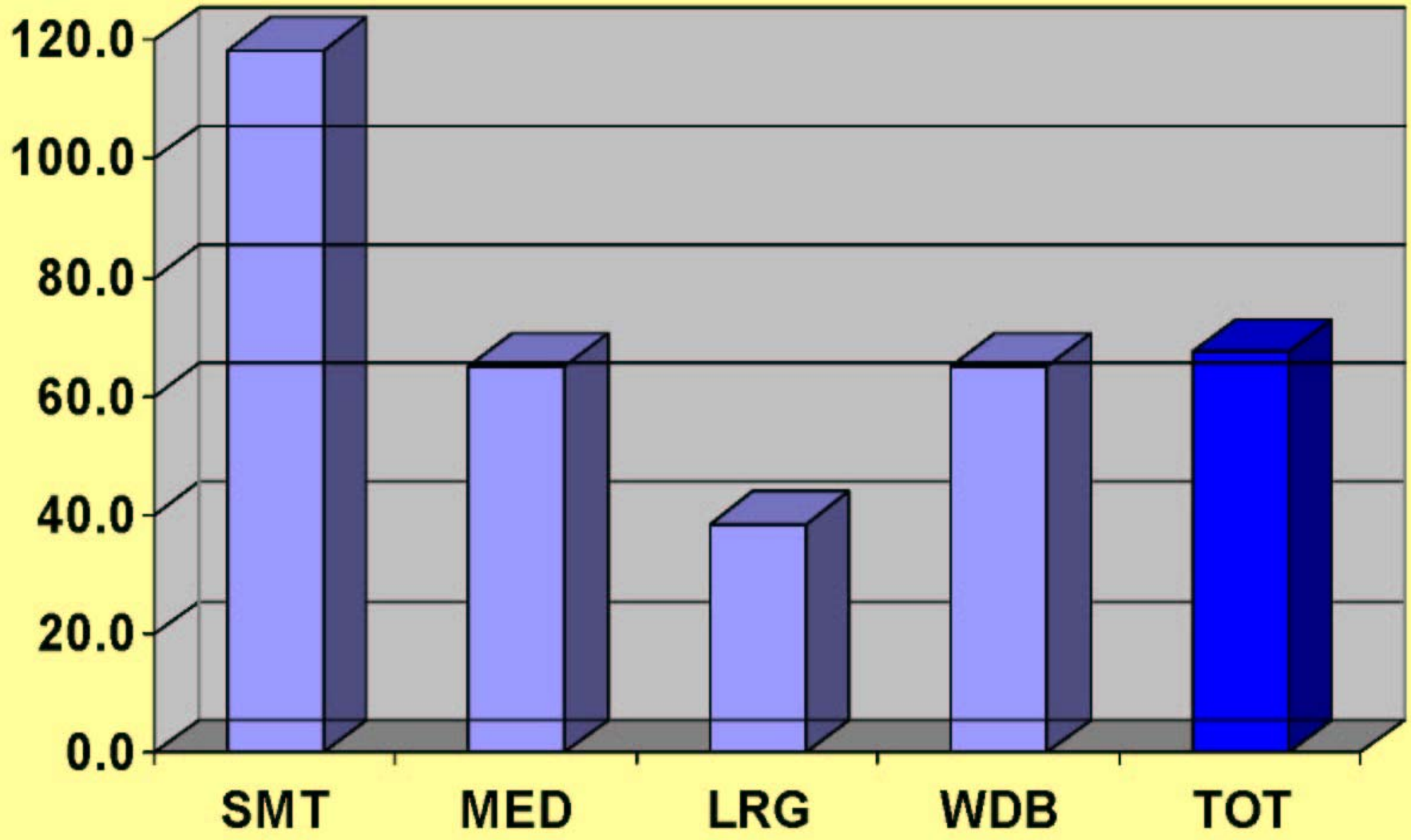
Estimated Air Carrier Event Rates

Accepted Clearance; Could Not Comply

Question: Aircraft Handling Events (AH2)

Exposure Factor: Events per 100k Hours

Rate estimates based on all data collected through October, 2002.



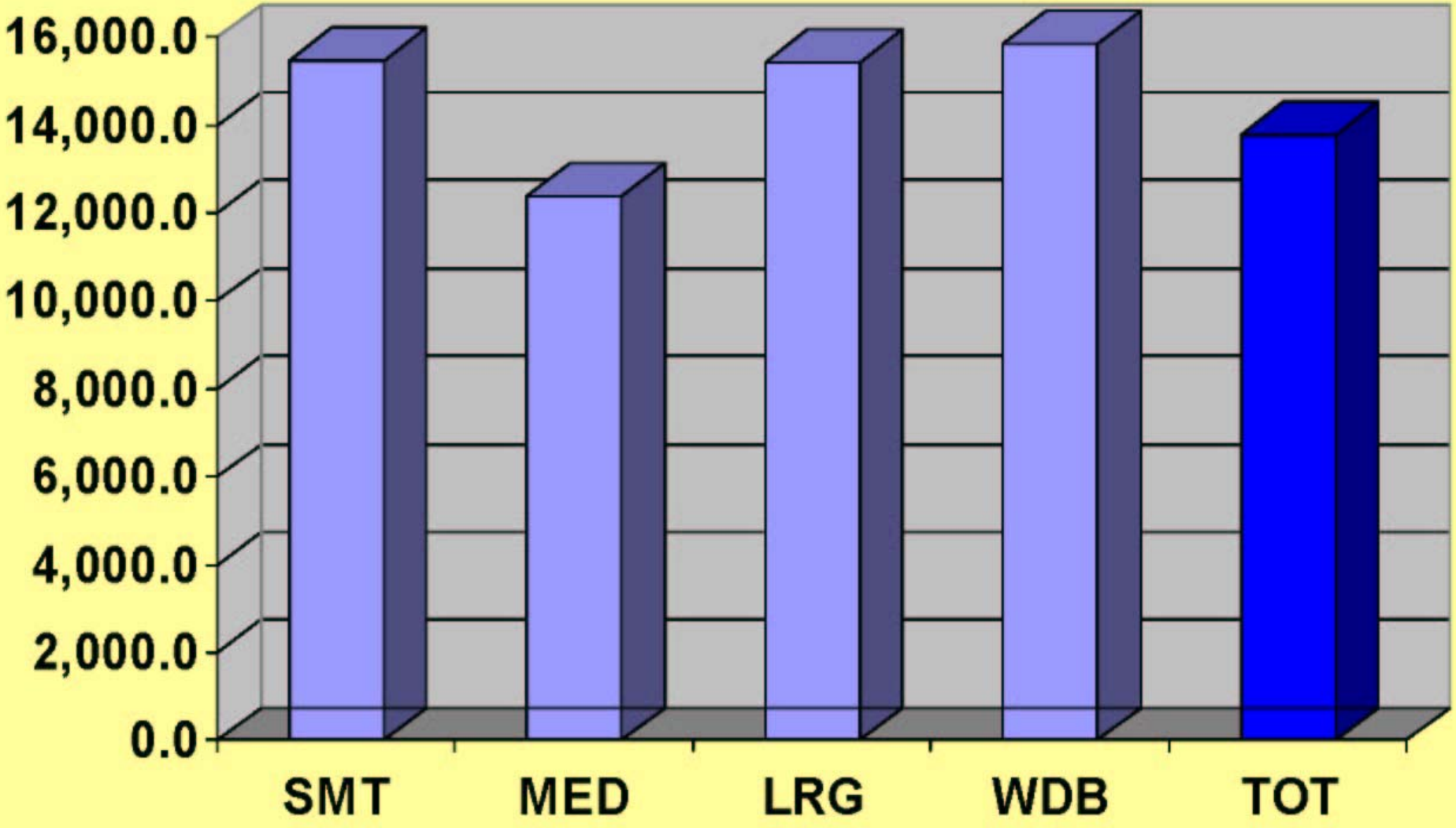
Estimated Air Carrier Event Rates

Lost Sight of Visually Separated Acft

Question: **Aircraft Handling Events (AH3)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



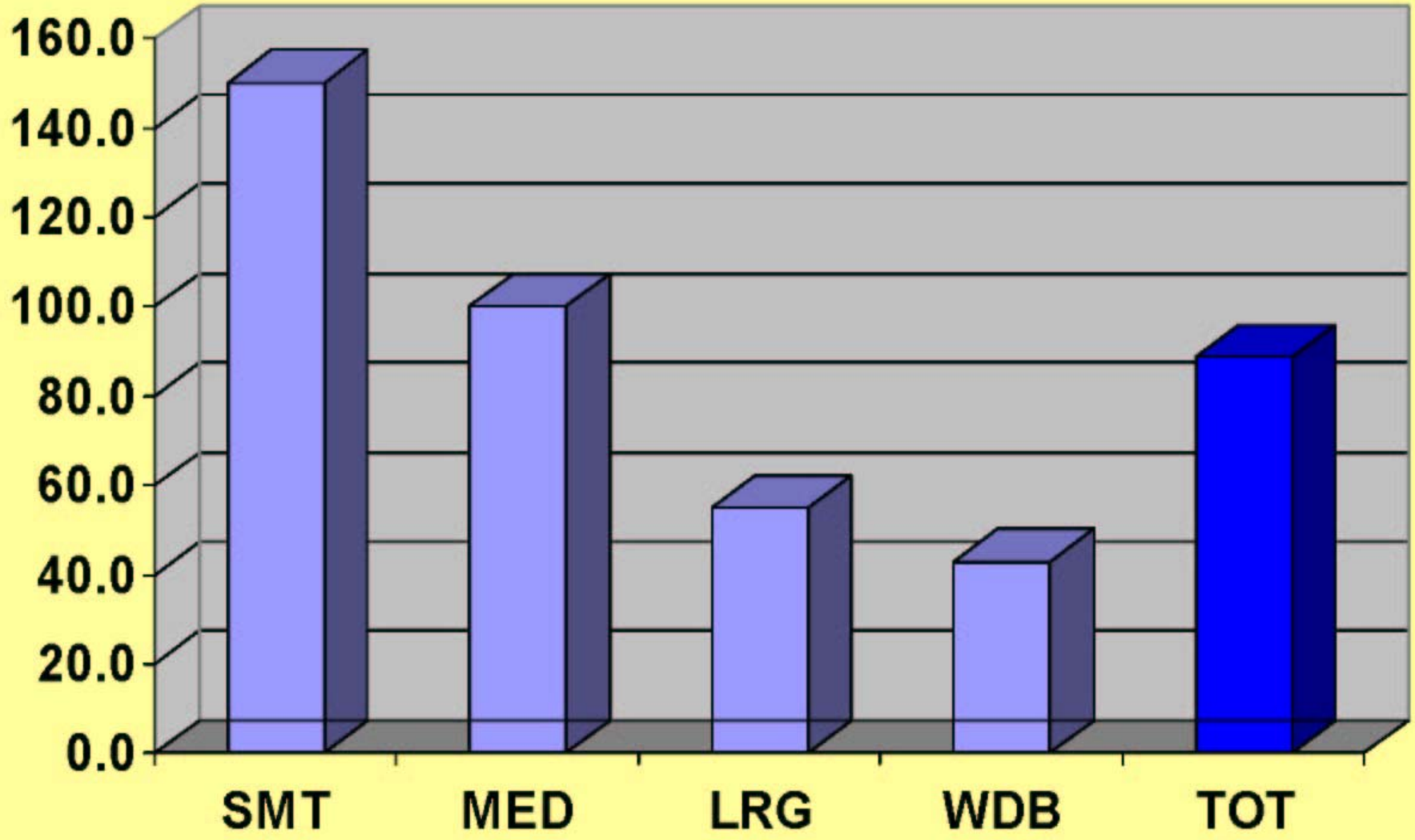
Estimated Air Carrier Event Rates

Track Deviation

Question: **Aircraft Handling Events (AH6)**

Exposure Factor: **Events per 100k Hours**

Rate estimates based on all data collected through October, 2002.



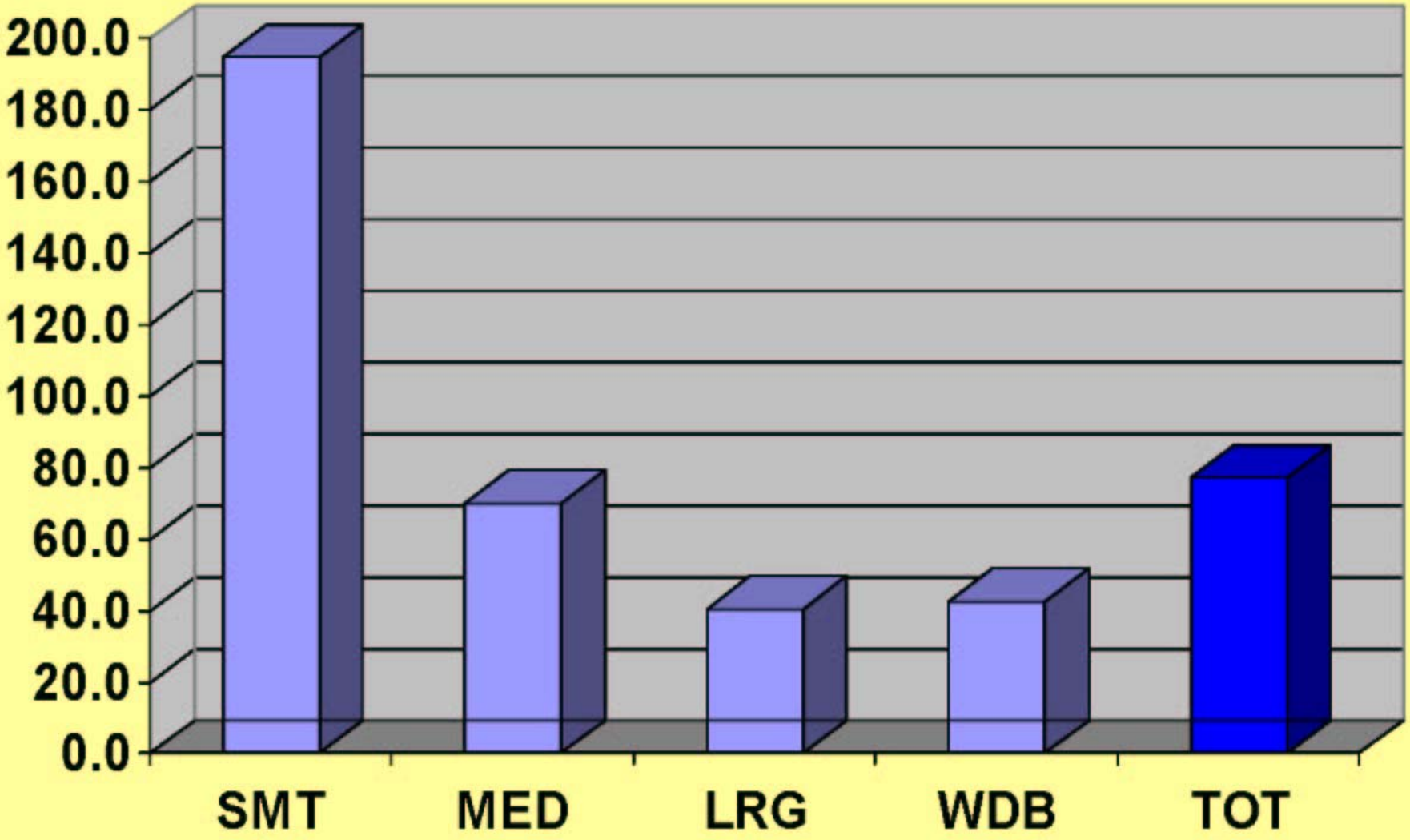
Estimated Air Carrier Event Rates

Altitude Deviation; >300 ft

Question: **Altitude Deviations (AD1)**

Exposure Factor: **Events per 100k Hours**

Rate estimates based on all data collected through October, 2002.



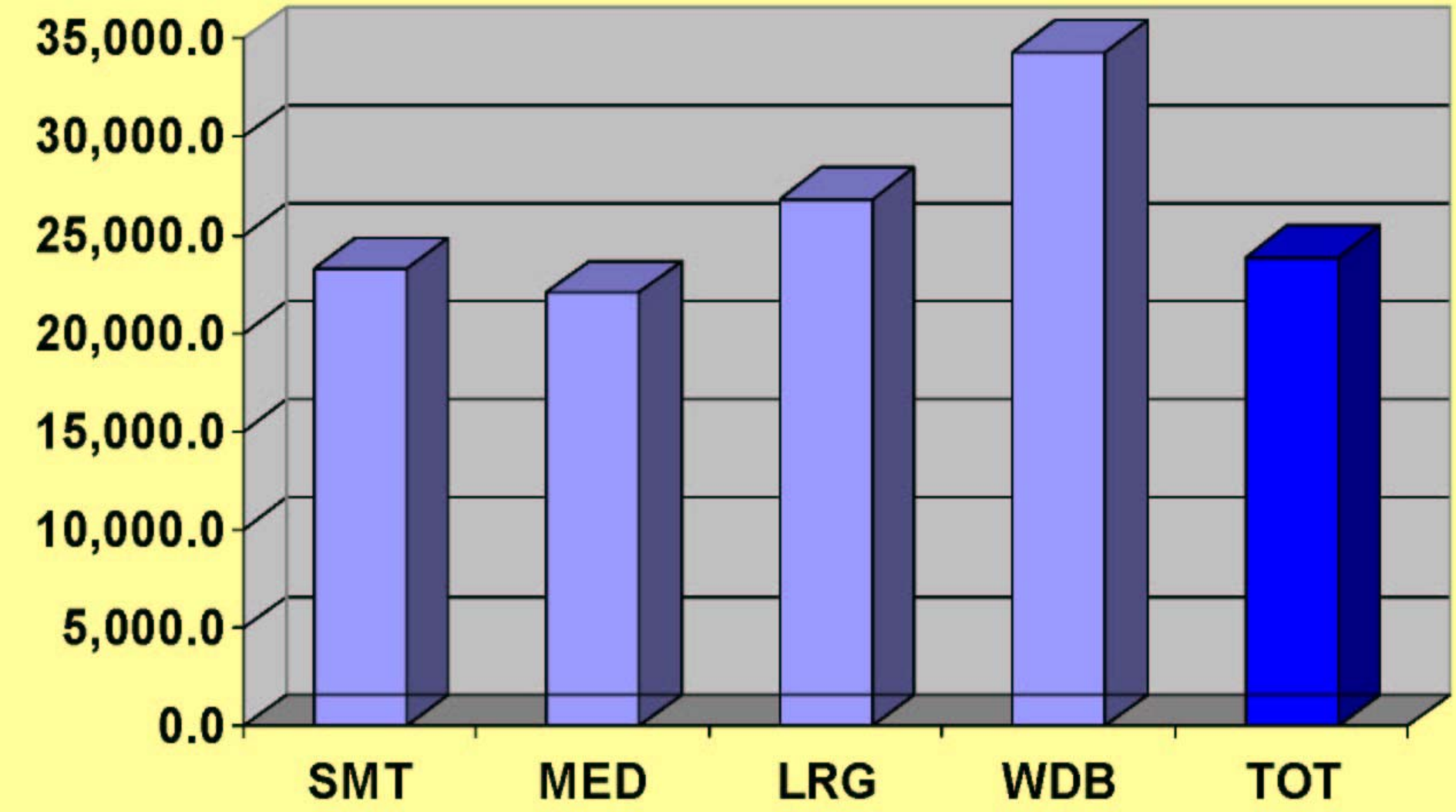
Estimated Air Carrier Event Rates

Unable Time-Critical Com with ATC

Question: ATC-Interaction Events (AT1)

Exposure Factor: Events per 1 million Legs

Rate estimates based on all data collected through October, 2002.



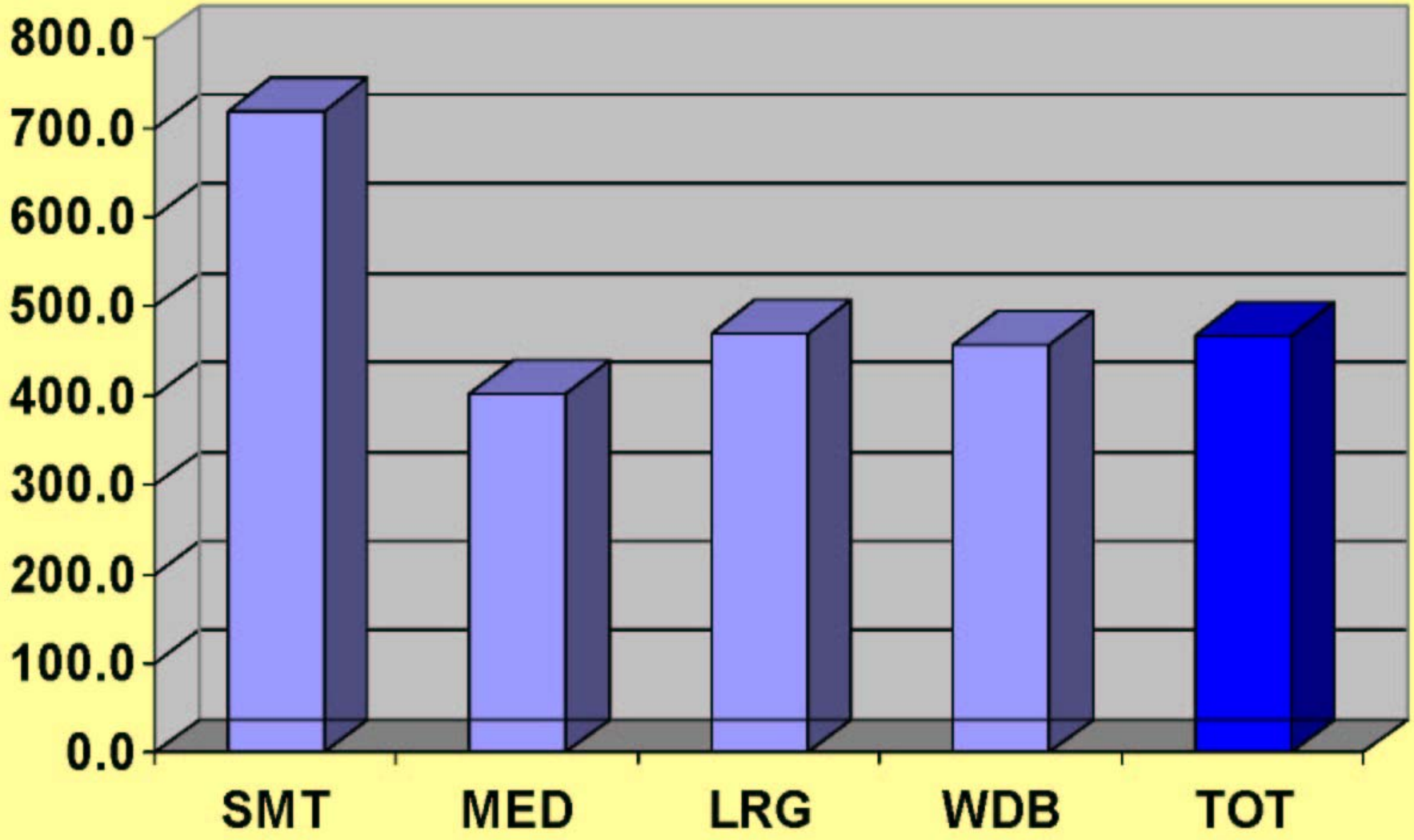
Estimated Air Carrier Event Rates

Lacked Good Wx Info while Airborne

Question: Weather-Related Events (WE1)

Exposure Factor: Events per 100k Hours

Rate estimates based on all data collected through October, 2002.



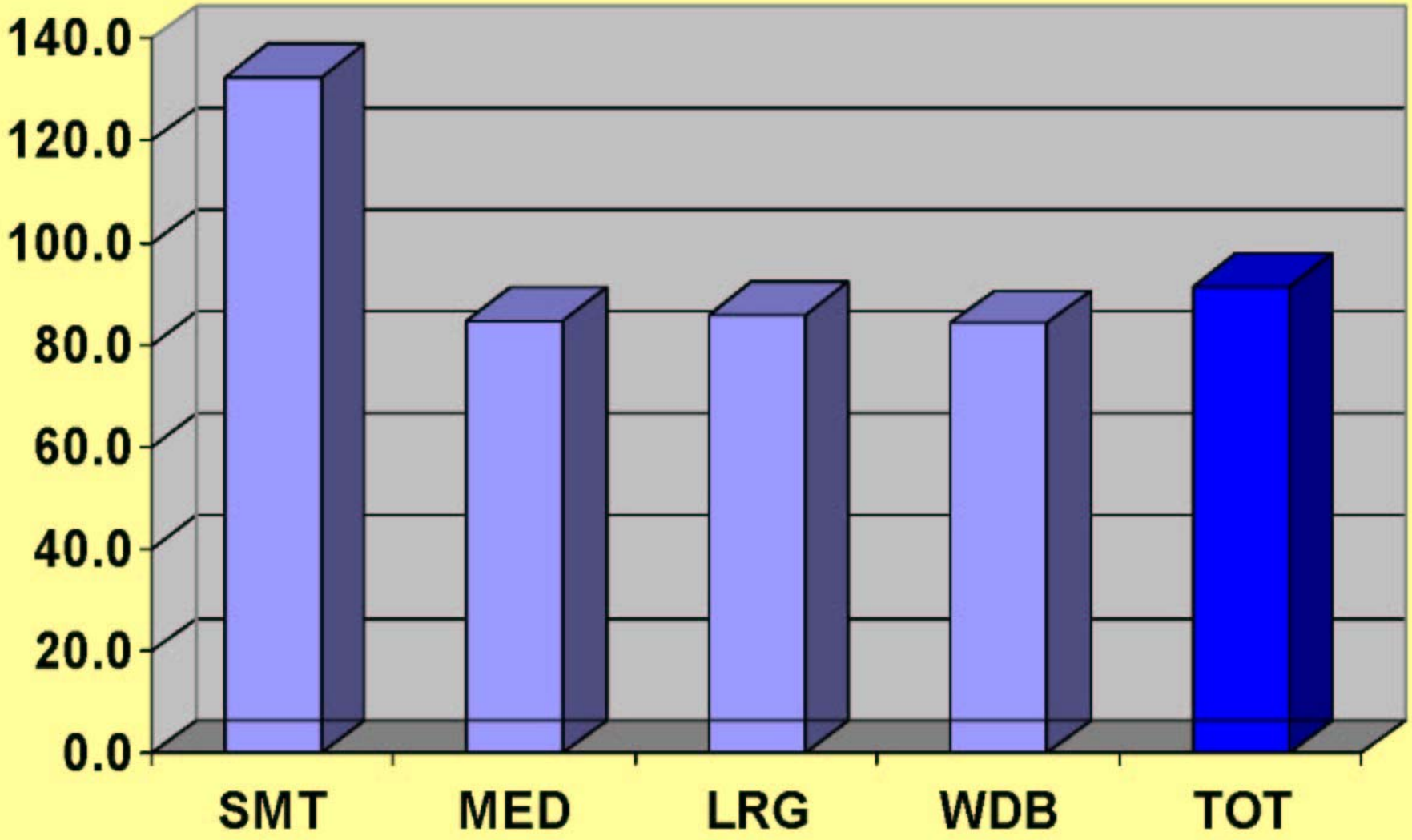
Estimated Air Carrier Event Rates

ATC Denied Request to Circumvent Wx

Question: **Weather-Related Events (WE2)**

Exposure Factor: **Events per 100k Hours**

Rate estimates based on all data collected through October, 2002.



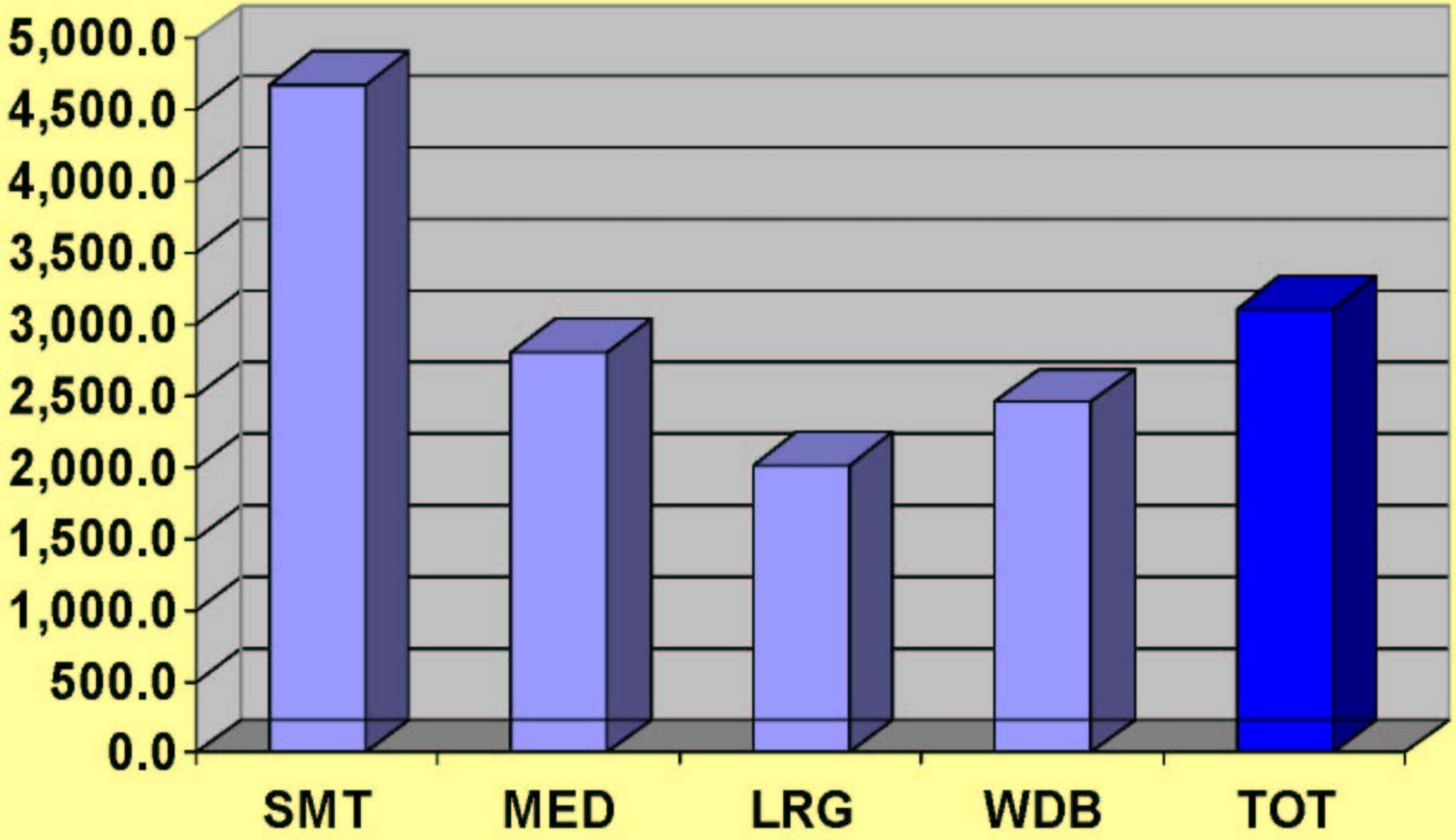
Estimated Air Carrier Event Rates

Diverted to Alternate Airfield because of Wx

Question: Weather-Related Events (WE3)

Exposure Factor: Events per 1 million Legs

Rate estimates based on all data collected through October, 2002.



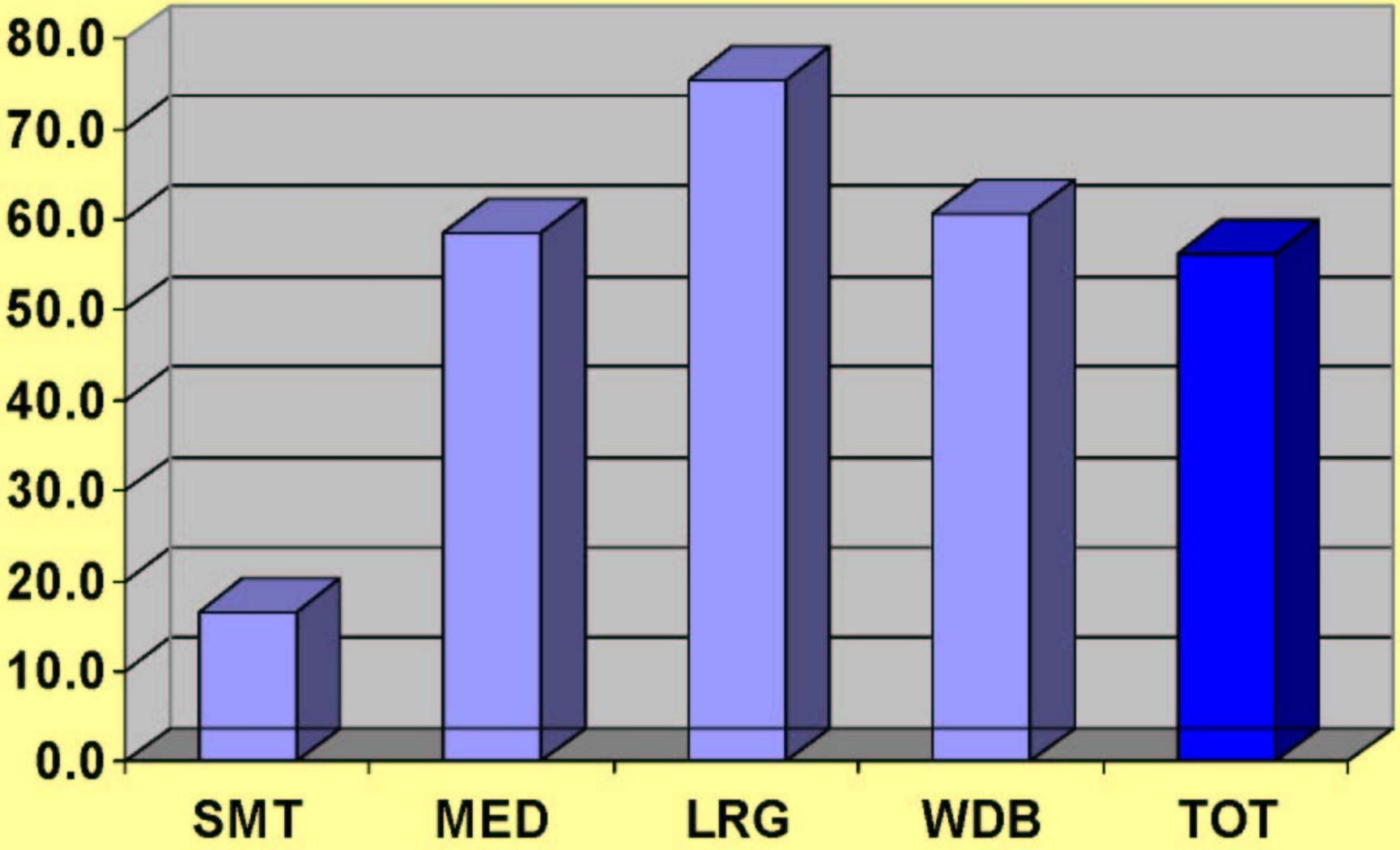
Estimated Air Carrier Event Rates

Expedited Lndg or Diversion due to Pax Medical Emergency

Question: Passenger-Related Events (CP1)

Exposure Factor: Events per 100k Hours

Rate estimates based on all data collected through October, 2002.



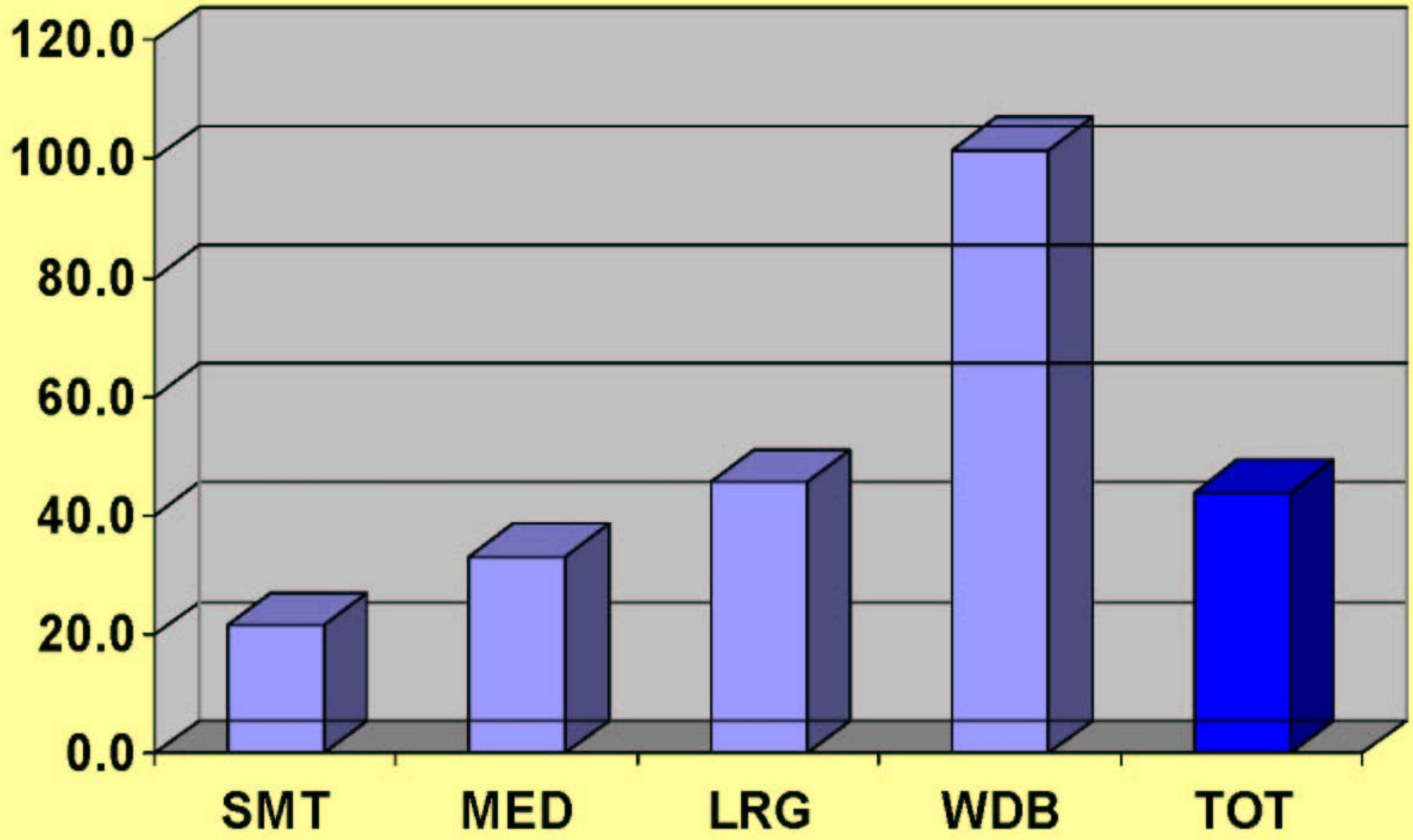
Estimated Air Carrier Event Rates

Pilot Left Cockpit to Deal with Pax Disturbance

Question: Passenger-Related Events (CP3)

Exposure Factor: Events per 100k Hours

Rate estimates based on all data collected through October, 2002.



Turbulence Events

Questions address severe turbulence as well as wake turbulence events.

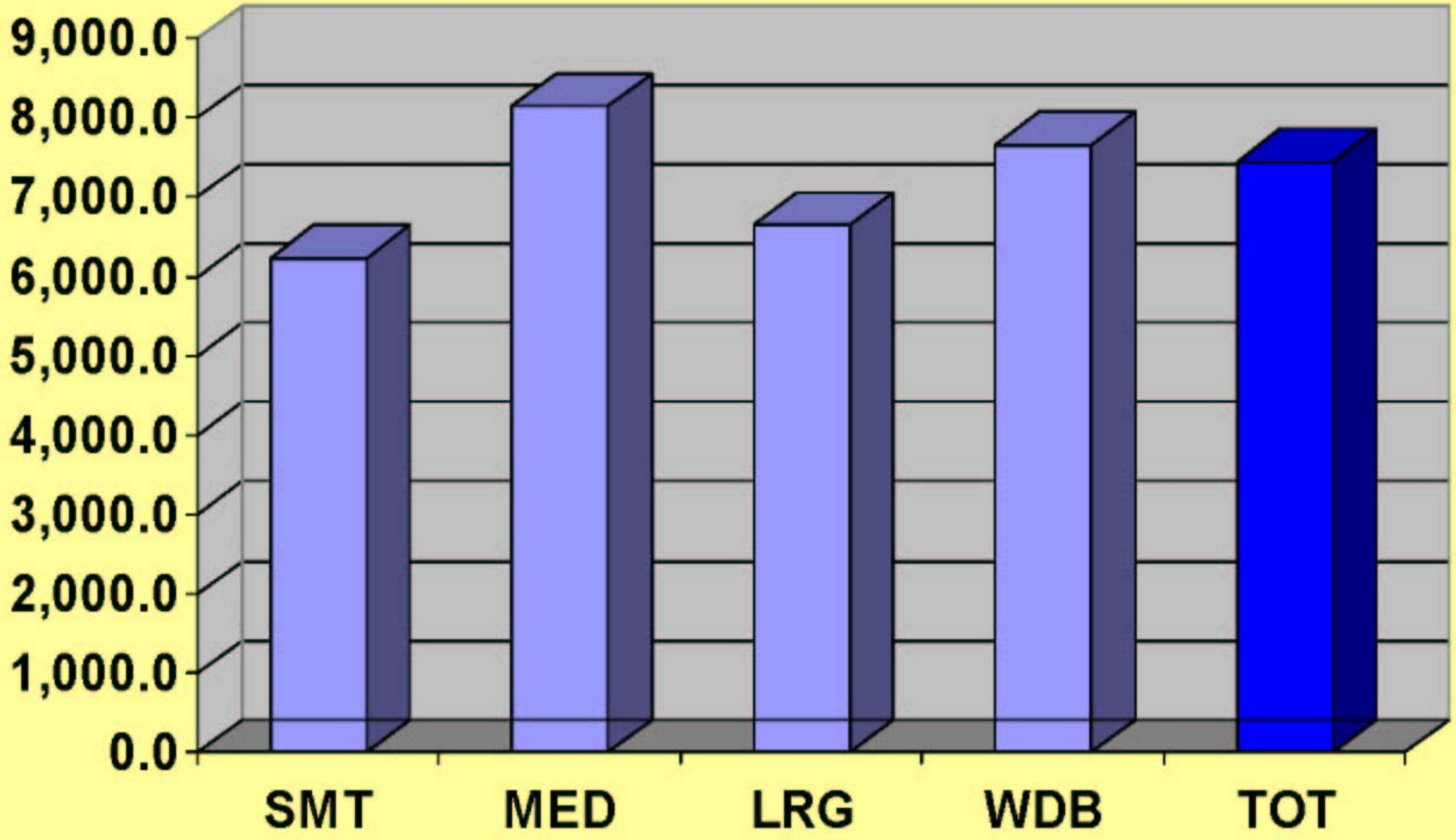
Estimated Air Carrier Event Rates

Wake Turbulence Encounter

Question: **Turbulence Encounters (TU2)**

Exposure Factor: **Events per 1 million Legs**

Rate estimates based on all data collected through October, 2002.



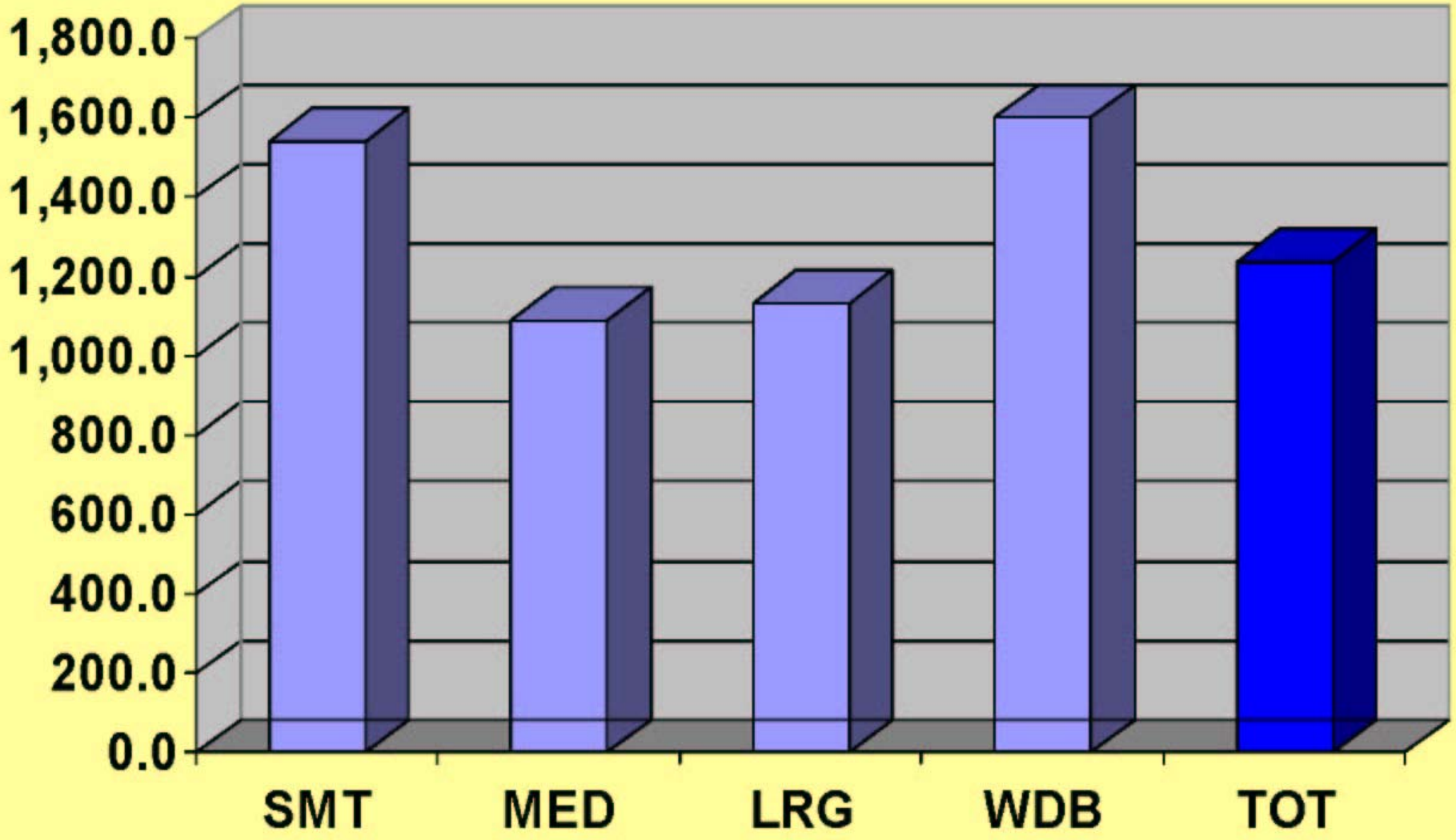
Estimated Air Carrier Event Rates

Windshear or Microburst Encounter; Windshear Maneuver

Question: Weather-Related Events (WE6)

Exposure Factor: Events per 1 million Legs

Rate estimates based on all data collected through October, 2002.



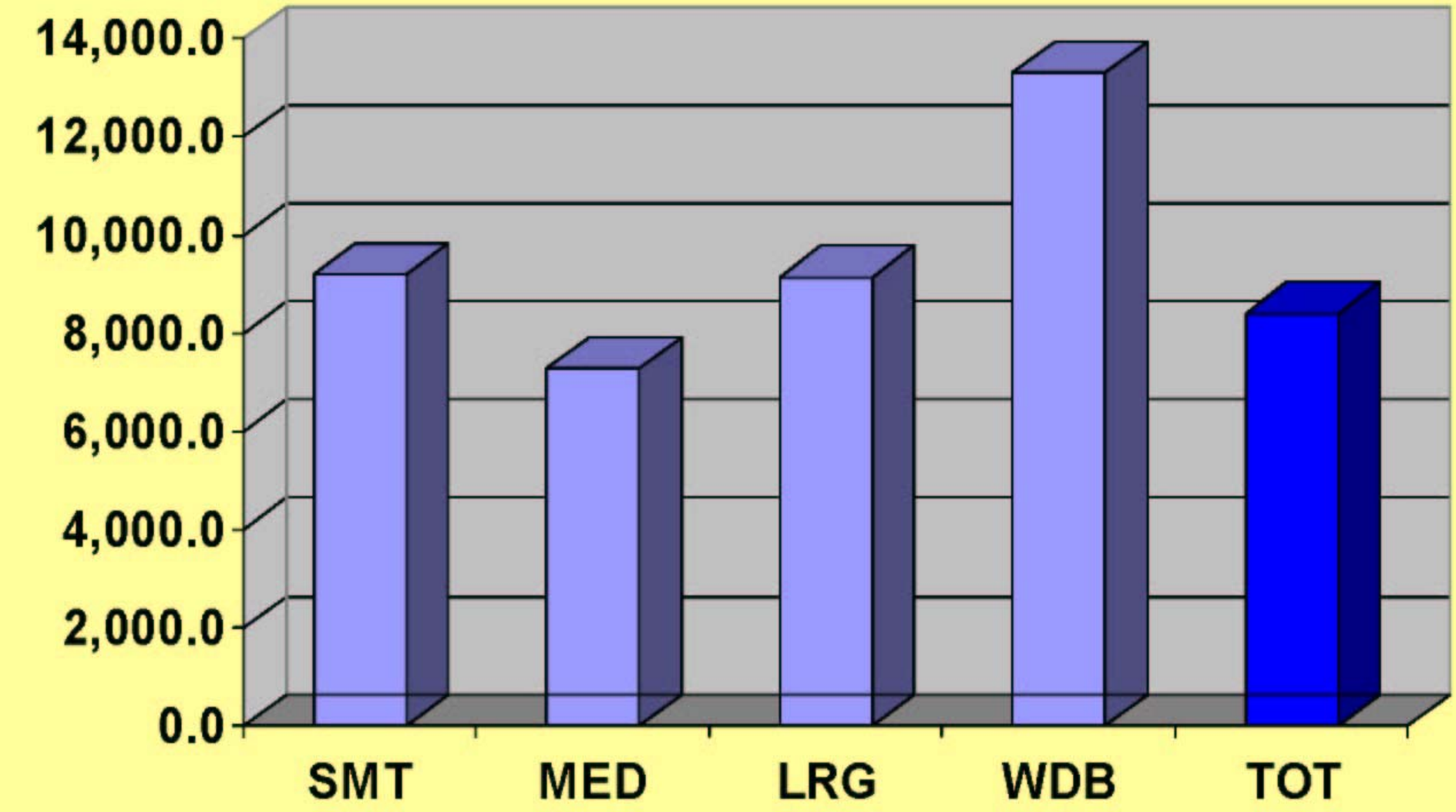
Estimated Air Carrier Event Rates

Windshear or Microburst Encounter; >15 Knot Airspeed Chg

Question: Weather-Related Events (WE5)

Exposure Factor: Events per 1 million Legs

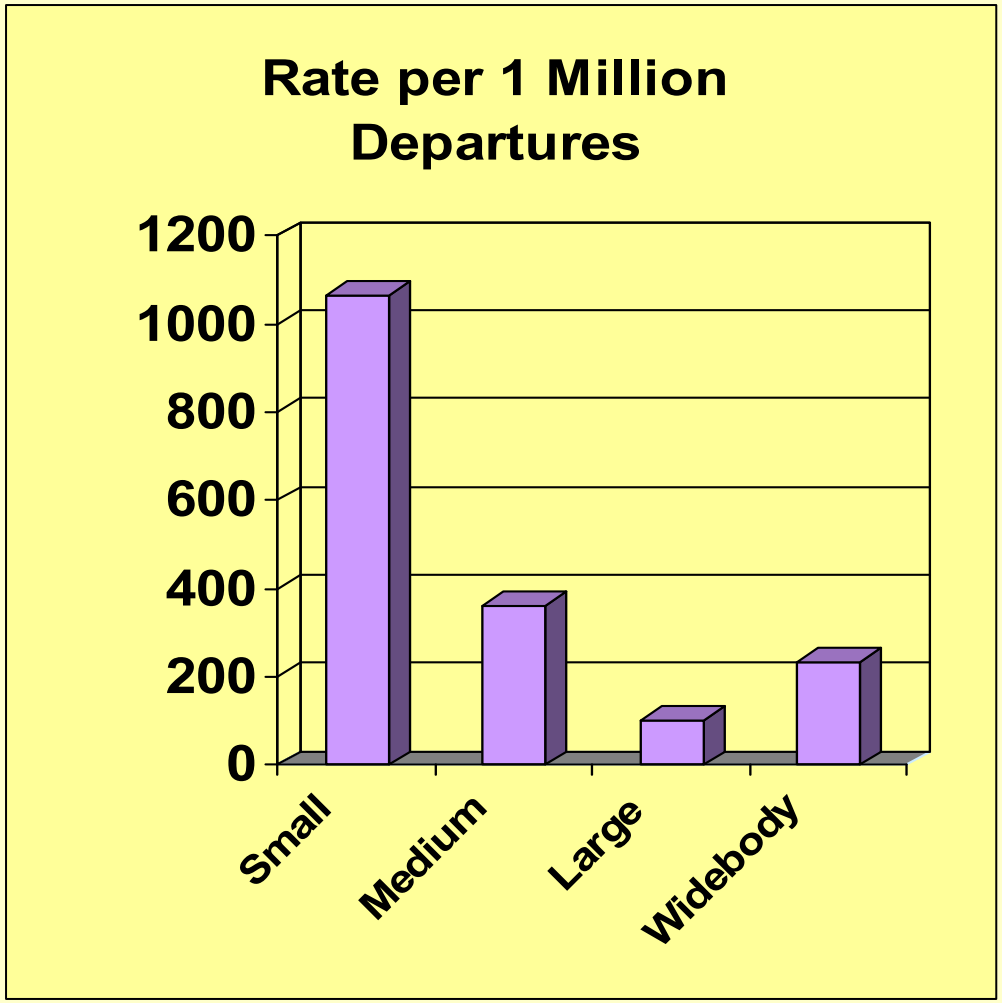
Rate estimates based on all data collected through October, 2002.



Weather-Related Events

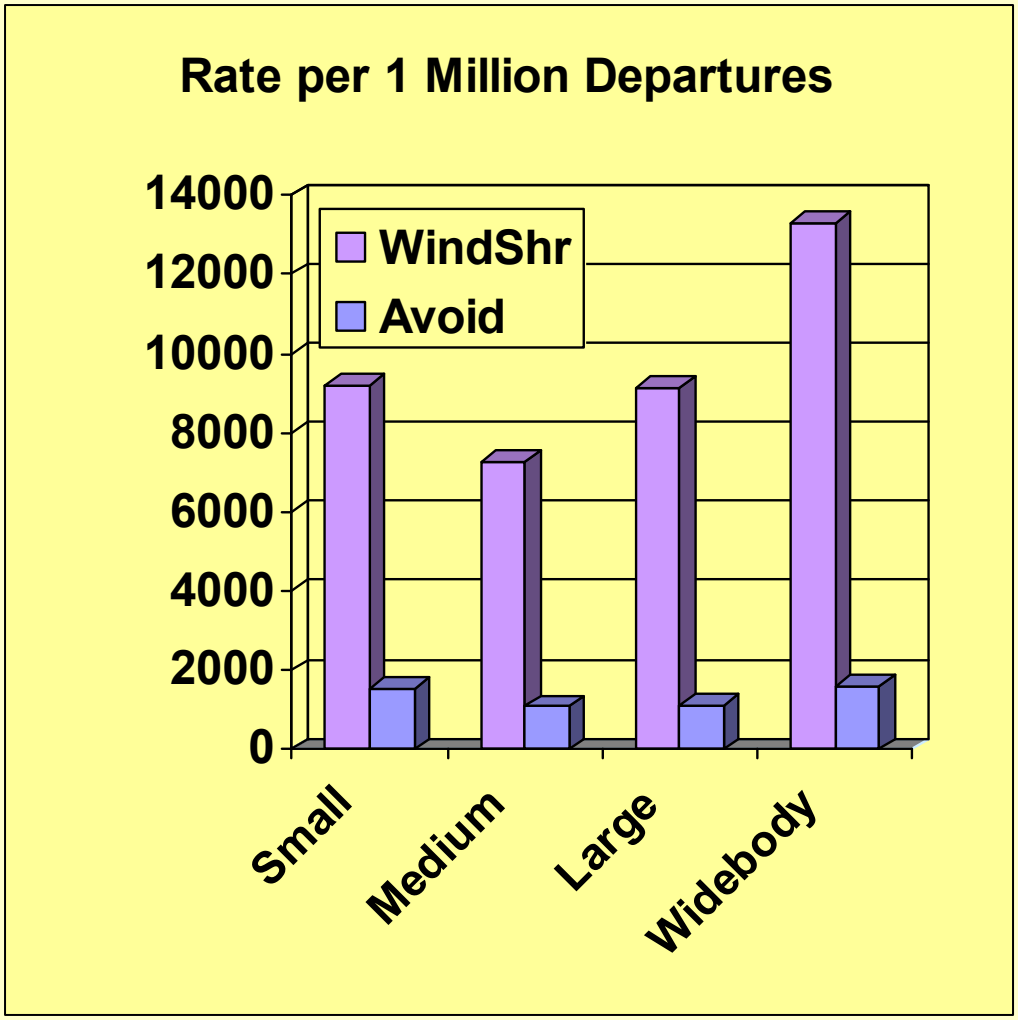
Questions focus on weather related events and issues. Topics include, but are not limited to, airframe icing, wind shear, weather diversions and other factors.

Performance Compromising Airframe Icing Events



NAOMS data suggest that approximately 3,000 icing events occur per year system-wide.

Windshear Encounters

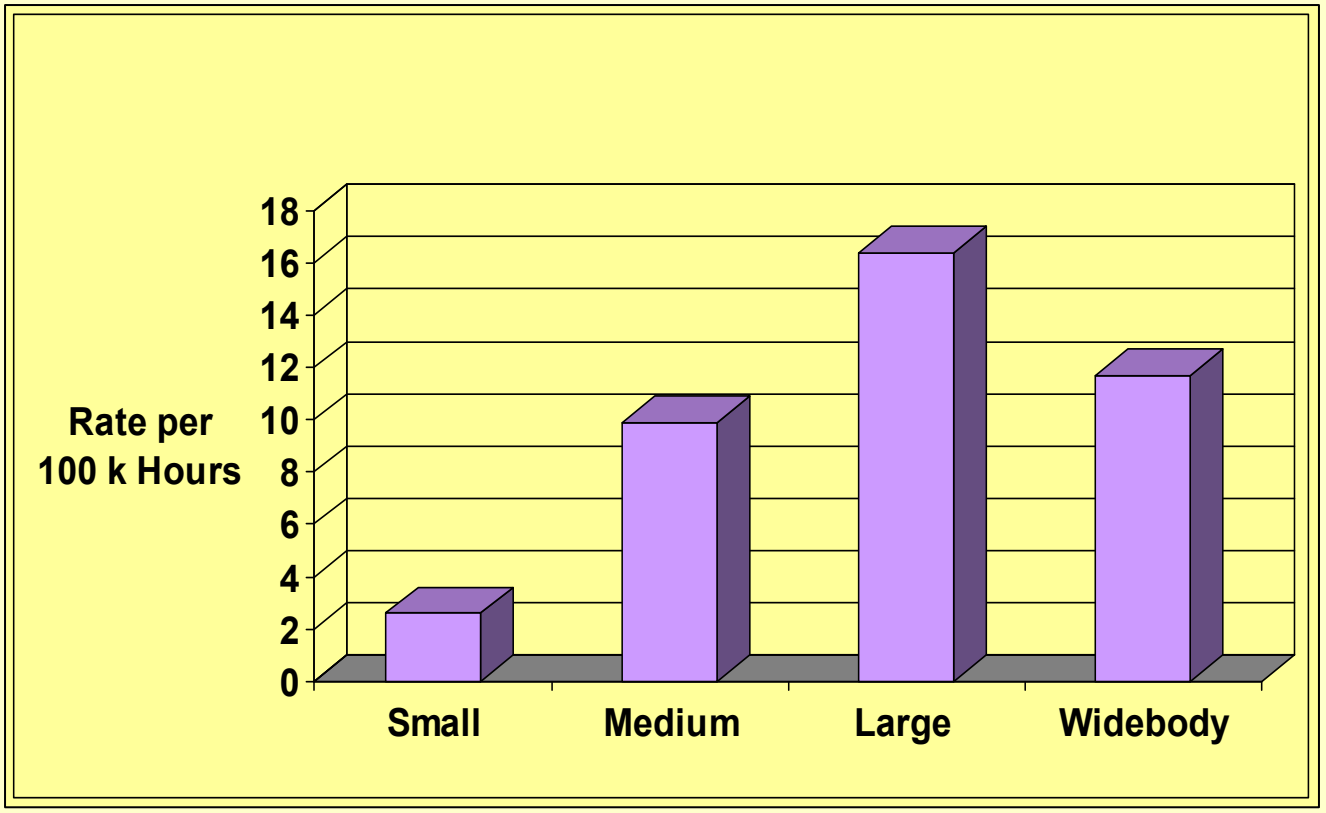


NAOMS data suggest that approximately 7,600 wind shear avoidance maneuvers per year system-wide.

Passenger-Related Events

These questions focus on passenger emergencies and disruptions.

Passenger Disturbance Rates

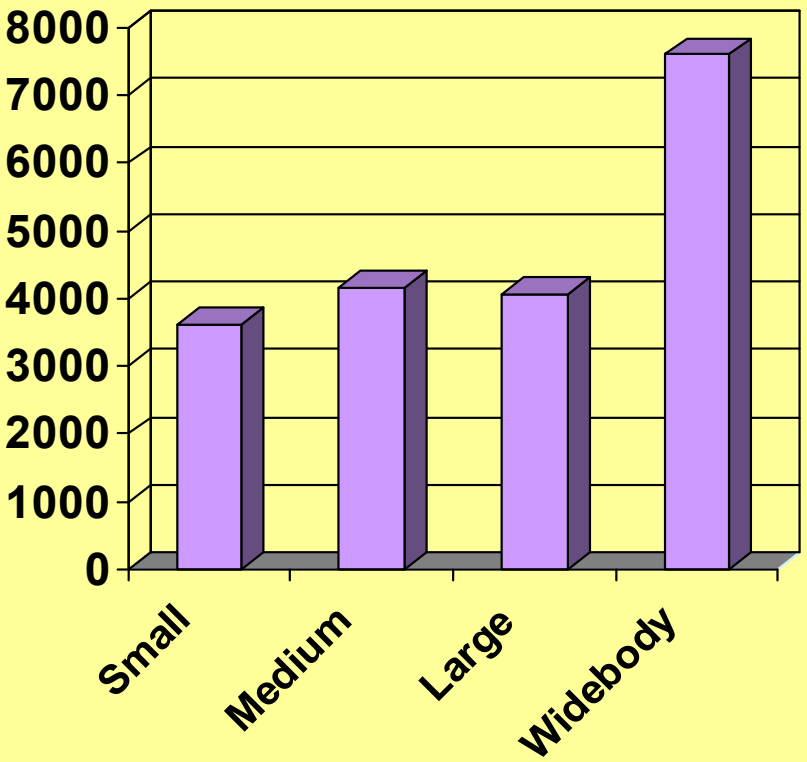


NAOMS data indicate approximately 1,400 landings occur system-wide each year due to passenger disturbance.

Airborne Conflicts

Airborne conflicts involve issues such as near mid-air collisions, evasive actions to avoid collisions and bird strikes.

Bird Strikes

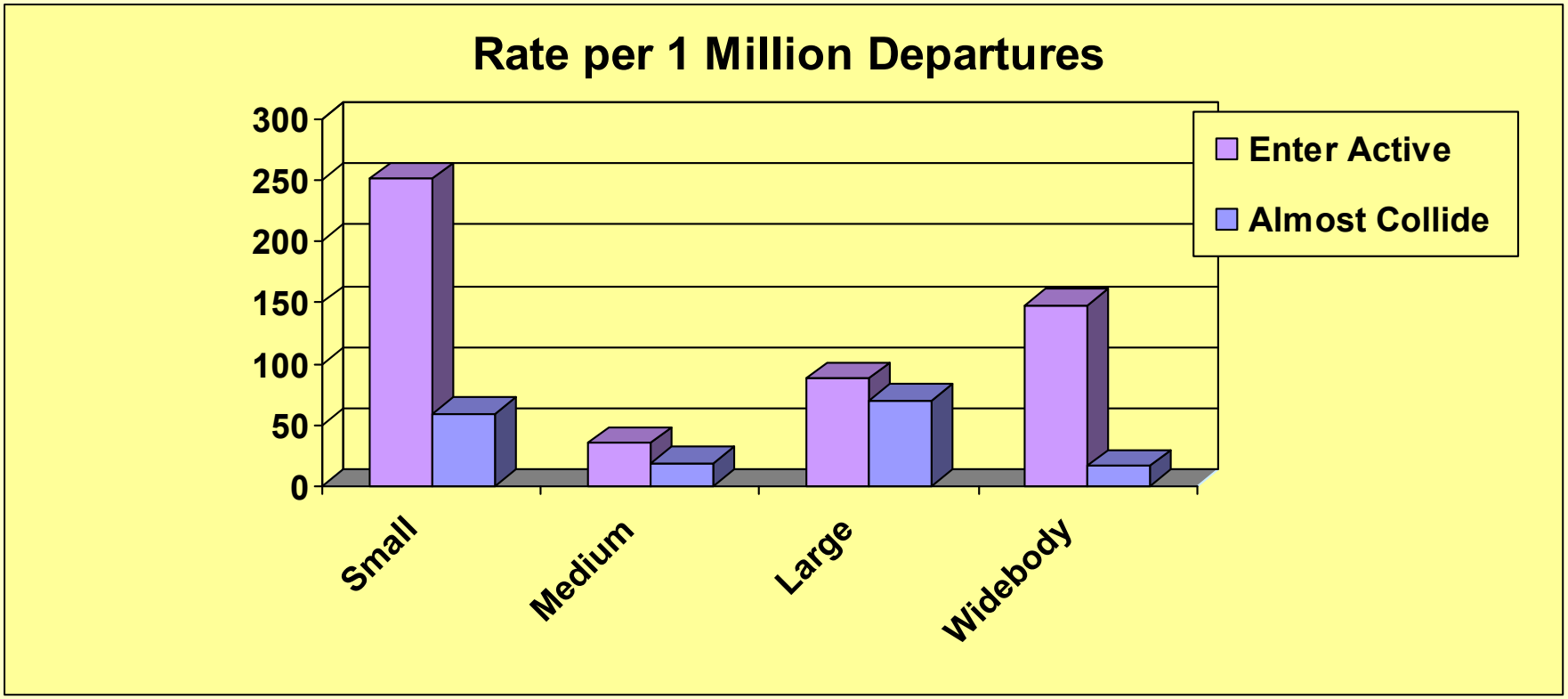


The FAA reports 5,450 bird strikes for the time period of August 2001 through July 2002. NAOMS data suggest approximately 26,000 bird strikes occur each year system-wide.

Ground Operations

This section asks questions relating to aircraft departures from paved surfaces, near collisions with other vehicles on the ground, intrusion into occupied runways and more.

Enter Active Runway Inadvertently or Nearly Collide with Other Aircraft on Runway

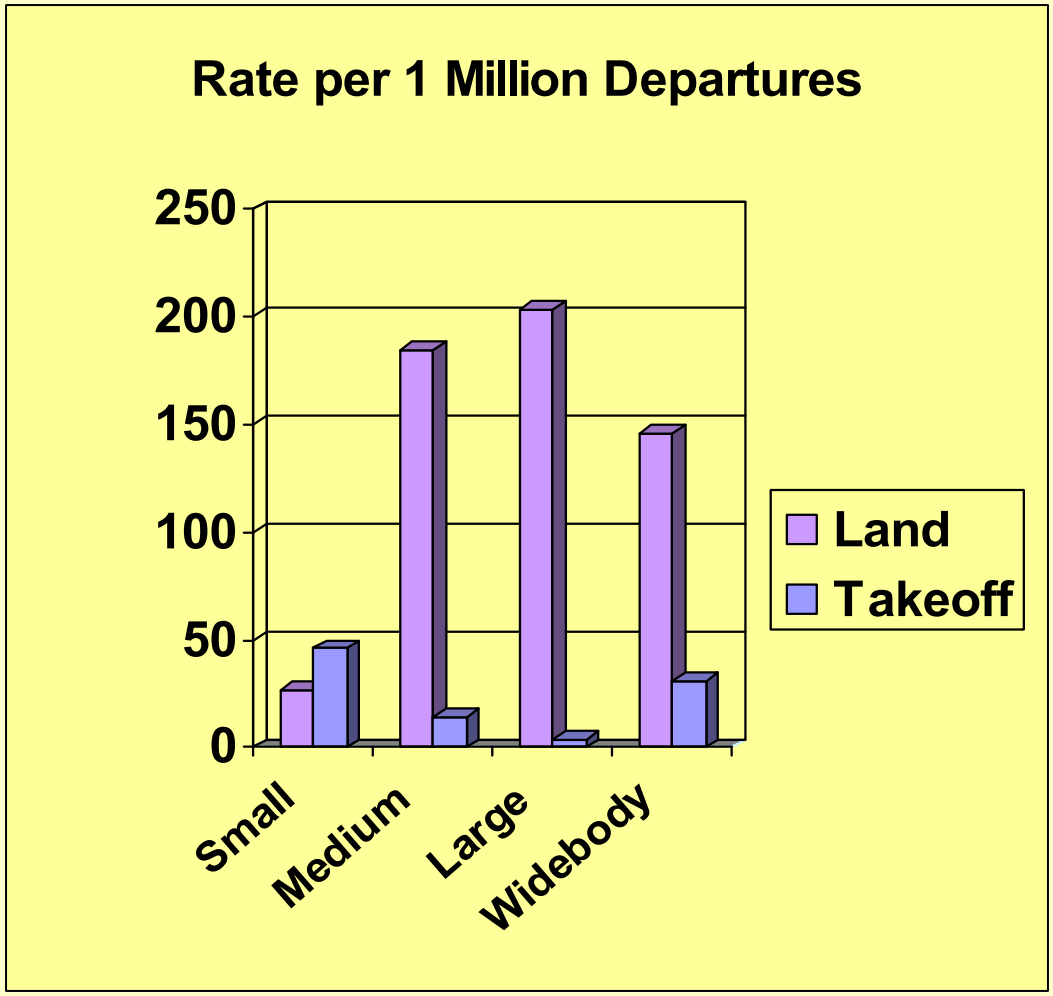


NAOMS data suggest that approximately 830 runway incursions occur system-wide per year.

Aircraft Handling

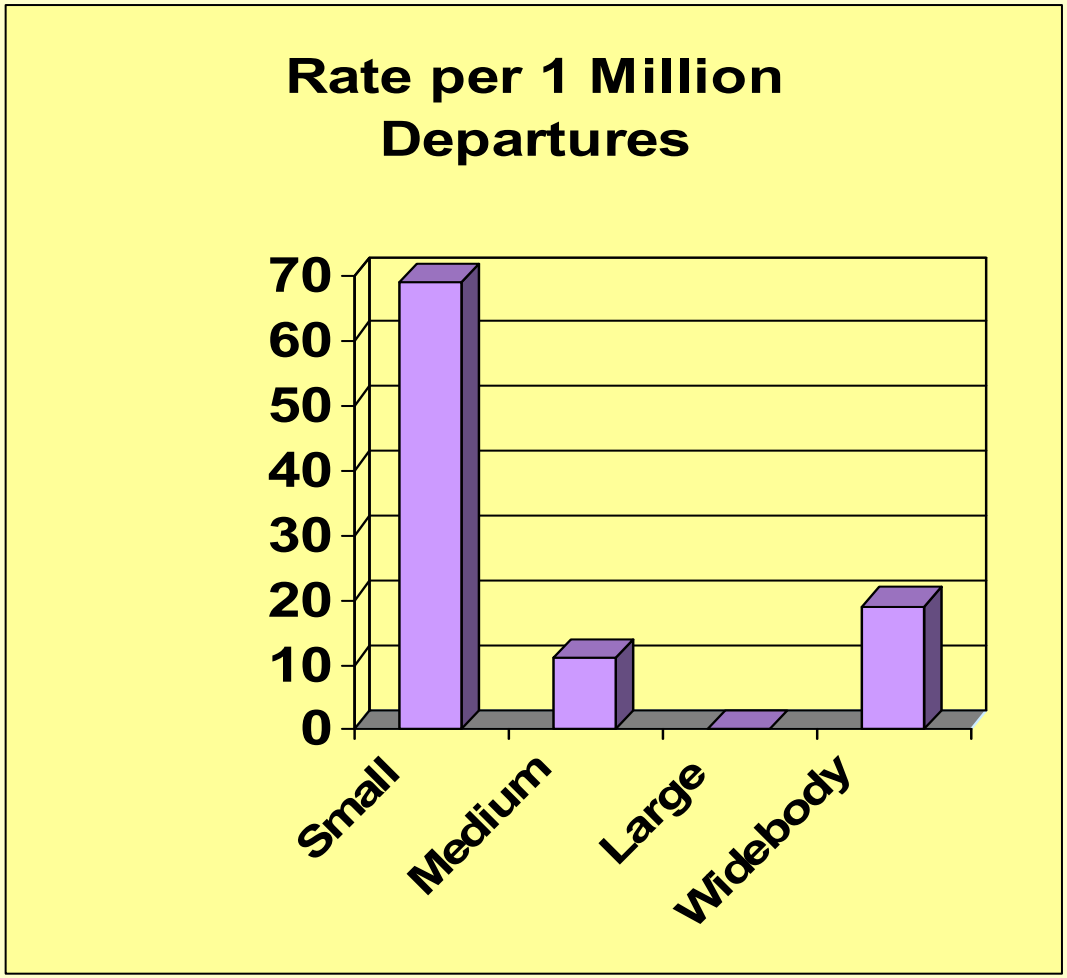
Questions related to landing or takeoff without clearance, configuration issues, hard landings, near CFITs, and more.

Begin Takeoff or Land without Clearance From Tower



NAOMS data suggest approximately 909 flights per year system-wide land without clearance from the tower. ASRS recorded 530 landings without clearance over the last year.

Nearly Collide With Terrain

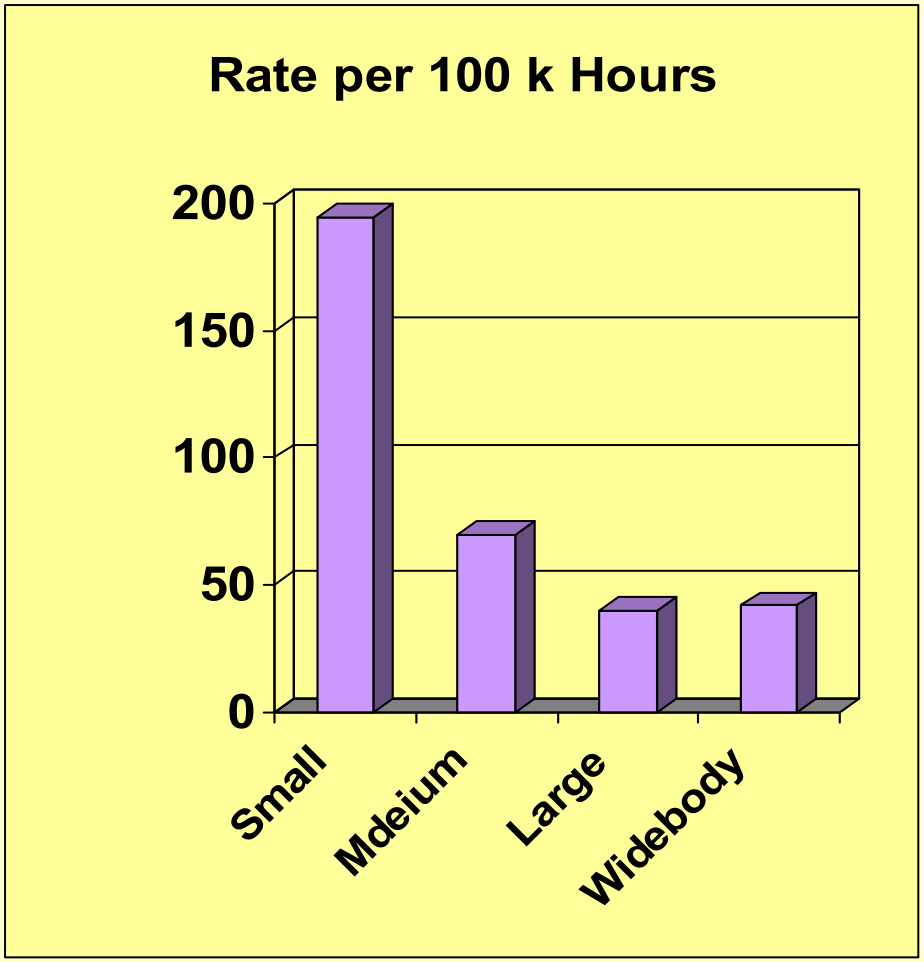


NAOMS data suggest that approximately 150 near-ground collisions occur system-wide per year.

Altitude Deviations

Questions relate to altitude overshoots, inadvertent altitude deviations, and descents below minimum safe altitude (MSA).

Inadvertent Altitude Deviations > 300 Feet

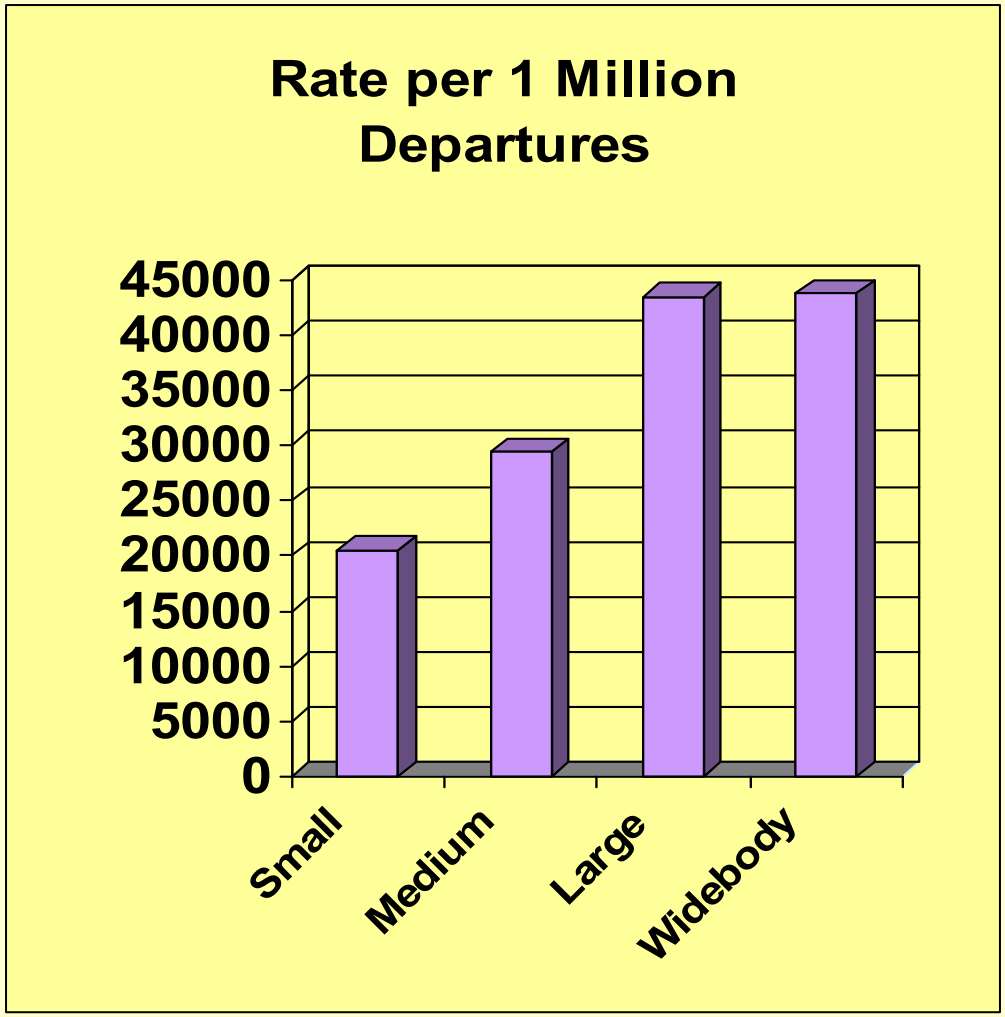


NAOMS data suggest that approximately 10,000 inadvertent altitude deviations occur system-wide per year. ASRS recorded 7,000 altitude deviations over the last year.

Pilot Interactions with ATC

These questions are related to frequency congestion, rushed (high or fast) approaches and other ATC related issues.

Rushed Approaches Due To ATC Request



NAOMS data suggest there are approximately 186,000 rushed approaches system-wide per year.

Section C: Special Topic – In-Close Approach Changes

- **Dynamics of approach clearance changes requested by ATC within ten-miles of a destination airport**
- **Sixteen questions relating to:**
  - Pilot execution of requested changes
  - Consequences
- **Questions focus on number of in-close approach change (ICAC) events**
- **Followed by additional questions concerning the last ICAC experienced by pilot**

Number of In-close Approach Changes Requested by ATC of NAOMS Response Pilots

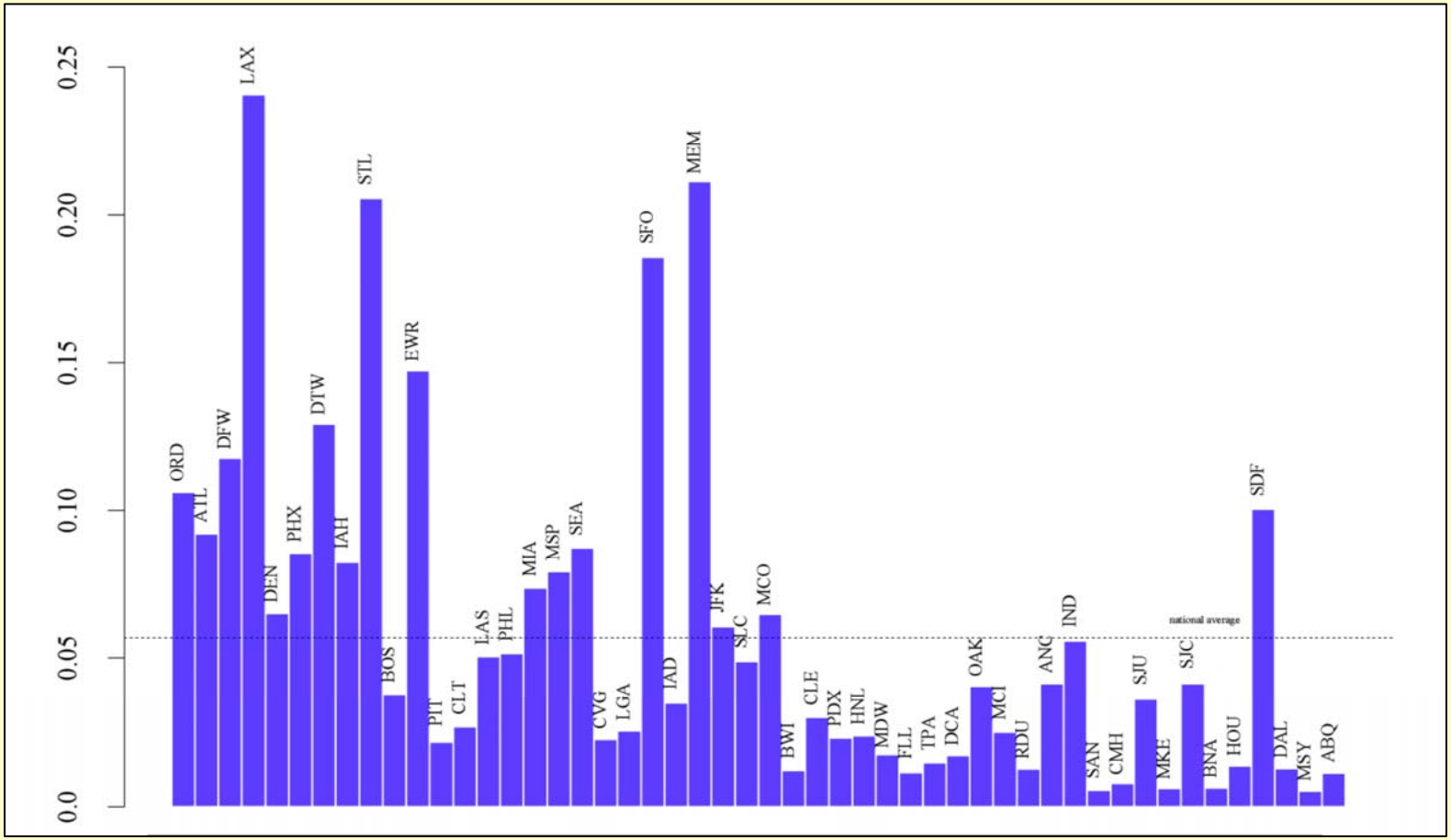
	Approaches Flown	Percentage of Approaches Flown	Extrapolated Annual Events	Comment
Total Approaches Flown	296,165	100.00	8,000,000	Estimated
Total Number of ICAC Requested by ATC	17,943	6.0	484,675	Estimated
Total Number Accepted by Pilots	16,802	5.7	453,855	Estimated
Total Number of ICAC Approaches with Issues	1,083	0.4	29,254	Estimated

Issues Associated with In-Close Approach Changes

Type of ICAC Problem	Number Reported	Percentage of Itemized Problems	Extrapolated Annual Events
Unstablilized Approach	631	3.76	17,045
Long/Fast Landing	561	3.52	15,964
Wake Turbulence	213	1.27	5,754
Missed Approach	211	1.26	5,700
Ground Conflict	52	0.31	1,405
Airborne Conflict	50	0.30	1,350
Out of Limit Winds	33	0.20	891
Landing without Clearance	7	0.04	189
Other	479	2.85	12,939

ok

In-Close Approach Change Probability for the 50 Busiest US Airport



Highest Number of Airport Operations ⟷ **Lowest Number of Airport Operations**

Type of Actions Requested for In-Close Approach Changes

	Total Number	Percentage
Most Recent Accepted ICAC	3,972	100.0
Change of Runway Assignment	2,865	72.1
Change in Airspeed	1,291	32.5
Change in Altitude	582	14.6

Flight Crew Actions in Response to In Close Approach Change

	Total Number	Percent
Most Recent Accepted ICAC	3,972	100.0
Change in Navigational Aid	2,383	60.0
Revised Approach Briefing	2,012	50.6
Disconnect one or more aspects of auto control	1,429	36.0
Change to ATC Frequency	899	22.6
Change to Aircraft Configuration	761	19.2

FMS Reprogramming Problems

Action Taken	Total	%
Had FMS (72%)	**2,864**	**100.0**
Attempted to reprogram	**1,096**	**38.3**
Inputs were not cross-checked among those that attempted reprogramming	350	32.0
Programming was not completed in time among those that attempted reprogramming	99	9.0
Inputs did not load properly among those that attempted reprogramming	67	6.1
Other programming problems among those that attempted reprogramming	98	8.9

Reasons Given by ATC for In Close Approach Change

Reasons Given for ICAC Change	Number	Percentage
Number of Time One or More Reasons Given by ATC	1,679	100
Maintaining Traffic Flow	1,436	85.5
Runway Favorable to Gate	277	16.5
Change in Active Runways	146	8.7
Weather or Wind Factors	90	5.4
Wake Turbulence Avoidance	79	4.7
Noise Abatement	19	1.1
ATC Equipment Problems	6	0.4
Other Reason	163	9.7

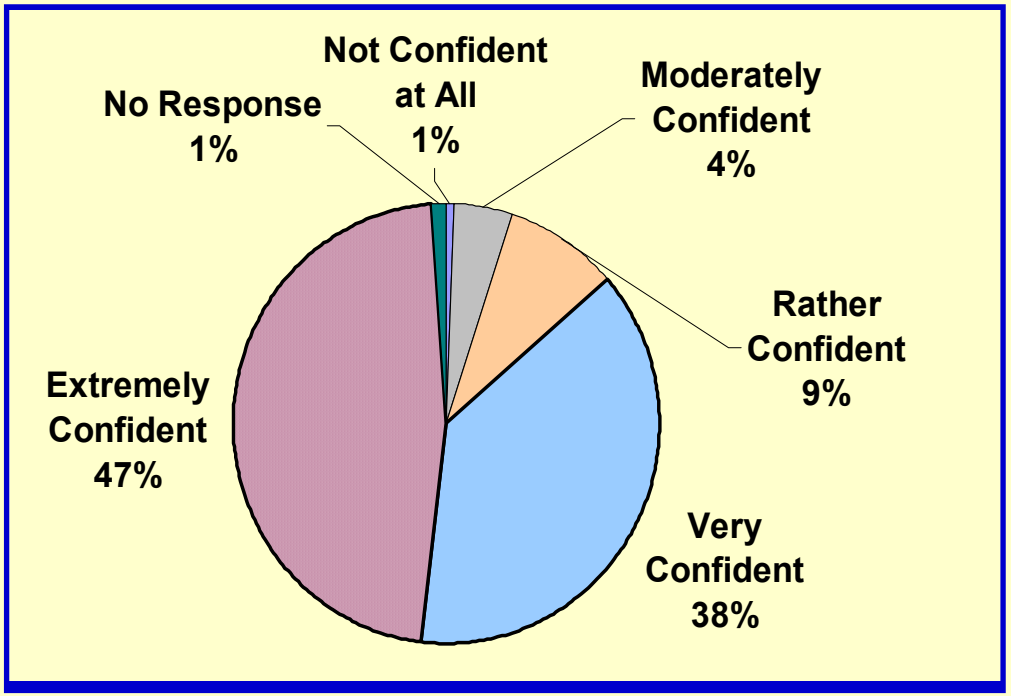
ok

Section D
Questionnaire Feedback

- **This section contains specific follow-up questions to determine the pilots' opinions on process, content and potential new topics.**

Confidence Regarding Accuracy

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?



Suggested Topics
(from survey and field trial)

- **ATC**
  - Communication including phraseology, readback/hearback
  - Delays during reduced weather
  - Frequency Congestion
- **Aircraft Operations**
  - Checklist usage
  - Cockpit Automation
  - LAHSO
  - Portable Electronic Devices, Interference

Suggested Topics (cont'd)

- **Human Factors**
  - Crew Fatigue/rest (cargo, international flights, flight/duty time limitations)
  - Crew Pairing, CRM/Interaction
  - Crew Training
- **Airports**
  - Congestion
  - Security
- **Taxiway Signing and Marking**
- **International Operations including Language**

General Aviation Survey

Mary Connors

General Aviation Interviewing Effort

- **Yearly interviewing effort**
  - Sample size (N = ~23,800)
  - Screening (N = ~15,000)
  - Interview (N = 8,000)
  - Interview length averages 27 minutes
- **Progress to date (13 weeks)**
  - 2,000 completed interviews

General Aviation Interviewing

- Too early to predict final outcomes
- Initial location efforts seem to indicate that when compared with air carrier pilots, GA pilots difficult to locate
- Once located, it takes more effort to get a completed interview
- Although refusal rate is not high yet, it is higher than AC rate after same period of time

General Aviation Questionnaire Structure*

- **Section A: Descriptive Demographic Information**

  Information suitable for exposure determination

- **Section B: Safety Related Events**

  Consistent data set over time

- **Section C: Focus Questions**

  Specific topics driven by government/industry high-priority needs

- **Section D: Questionnaire Feedback**

*** Data collection started August, 2002; over 2,000 completed interviews to date; analysis based on 1,425 interviews**

Flight Time Summary of Respondents

	Lifetime Hours: Mean	Last 60 Days Hours: Mean
Helicopter	7,023	54
Fixed Wing	2,763	29

*** Preliminary analyses involved 40 helicopter and 1,375 fixed-wing GA pilots.**

Distribution of Flight Activity

	Helicopter *	Fixed Wing *
Flight Instructor	6.9 %	13.5 %
Student	1.3 %	5.5 %
Corporate Pilot	1.8 %	15.4 %
Personal Business	2.1 %	12.3 %
Public Use	13.4 %	3.0 %
Revenue Passengers	38.3 %	8.9 %
Cargo Transport	4.9 %	4.1 %
Air Medical	14.0 %	1.5 %
Recreational	1.8 %	32.2%

* **Categories are not mutually exclusive**

Event Indications for General Aviation

- **Preliminary data analysis begun**
- **Data volume still too low for detailed analysis**
- **But, certain events suggest a higher level of occurrence than anticipated**
  - Inadvertently entering airspace without clearance
  - Attitude Indicator Failures, some under IMC

Earmarked Congressional Funds

- **500 helicopter and 500 corporate pilots surveyed with earmarked congressional funds**
  - Interviews just completed
  - Preliminary analyses just begun
- **The broader GA survey confirms**
  - Both helicopter pilots and corporate pilots are infrequently captured in the randomly-selected general aviation survey
  - These groups would require further focused investigation if further information is desired in the near term.

FUTURE PLANS

General Perspectives on Long-Term Survey Research

Jon Krosnick

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

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 -
- 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 -

Features of These Studies

- **Federally-funded via contracts or grants**
- **Long-term tracking studies**
- **Large constituencies use the data**
- **Important policy decisions are based on the data**
- **Conducted by the most prestigious survey research firms in the nation**

Features of These Studies (cont'd)

- Design done by collaborative teams of investigators
- Principal Investigators remain stable over time
- Planning Boards make decisions – rotating membership
- Advisory Oversight Boards oversee the entire project and make suggestions about planning board membership and project direction.
- Methodological experts serve on advisory boards

Features of These Studies (cont'd)

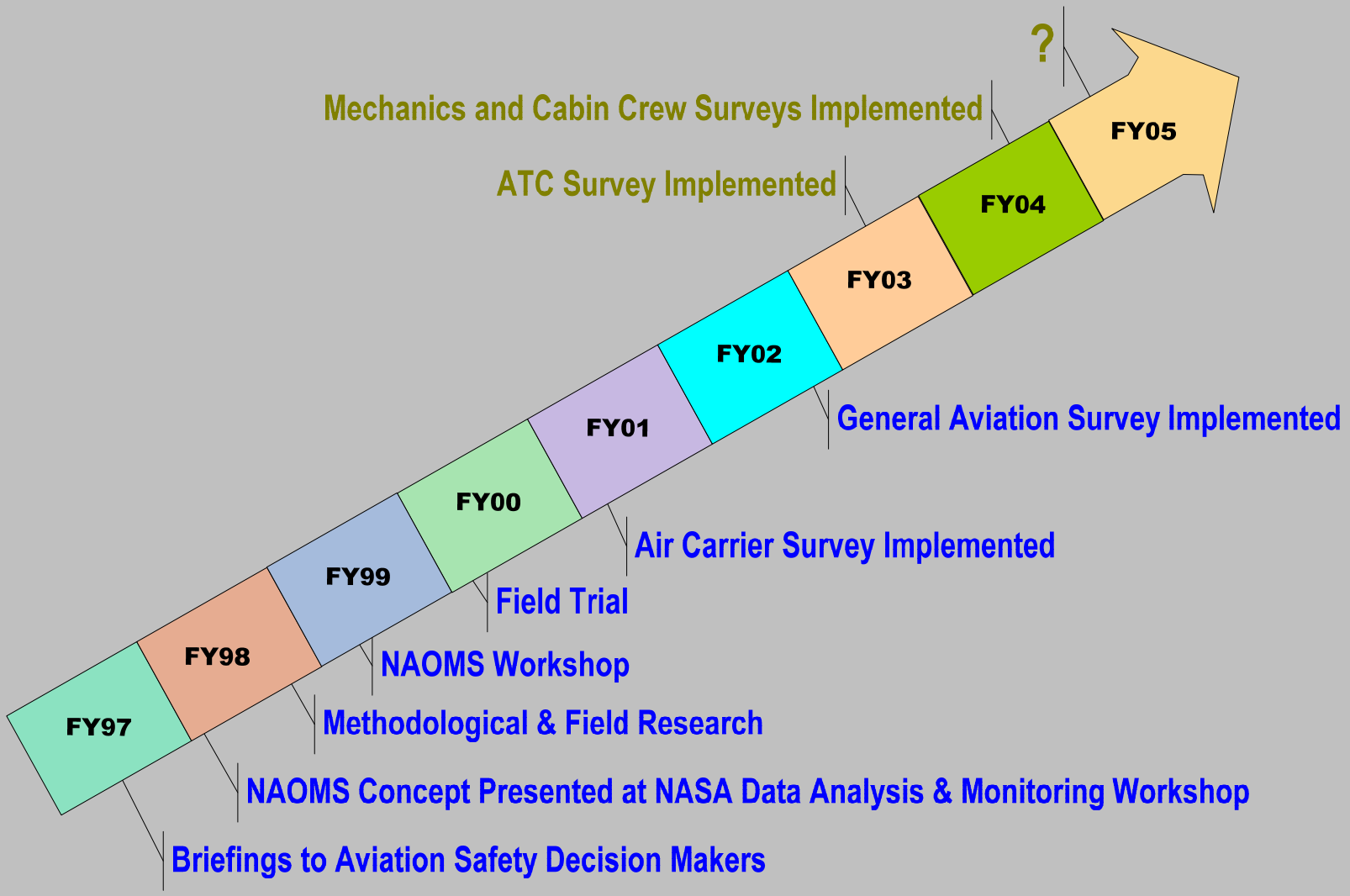
- Questionnaires have core items that remain constant from wave to wave
- Topical questions are rotated into and out of the questionnaire to reflect current interests
- Press releases and press conferences mark the release of new data (e.g., once a year)
- Publications by the project staff summarize a simple set of core trend findings
- Information is released to the public
- Information forms basis for follow-on studies

Perspectives on NAOMS

Linda Connell

The plan for NAOMS called for the full inclusion of air carriers pilots, general aviation pilots, air traffic controllers, mechanics/technicians, and flight attendants by the end of FY 04

NAOMS MILESTONE TIMELINE



Although on schedule through FY02, present planning will not allow the activity to be completed in FY04

Revised Plans for FY03, 04

- **Based on project guidelines, no new user categories will be added in FY'03, FY'04**
- **Emphasis will be placed on:**
  - ATC survey materials and approach (including working with FAA, NATCA, etc.)
  - OMB approval process and field testing of ATC survey in FY '04
  - Efficiency Plan - Assessment of costs/benefits of reducing numbers of interviews; time per interview (number of questions); possible alternative modes; etc.)
  - Developing and distributing products to the community
  - Exploring all options for suitable management organization and funding for continuation of NAOMS beyond FY'04.

FY05 and Beyond

NAOMS must be established as a permanent service

Exploring Outside Options for NAOMS beyond FY'04

Opportunities for hand-off will be explored. However, it should be noted that there are significant barriers to overcome.

Potential Barriers to NAOMS Hand-Off at end of FY 04

- **NAOMS will not be a turn-key system at the end of FY04. Will still need to:**
  - collect and analyze baseline ATC data
  - add mechanics/technicians and flight attendant communities
  - make final adjustments on approaches, methods, modes, questionnaire content
- **Potential new organization would have to take on the added costs in time, money, skill development, etc. associated with managing an uncompleted project.**

Potential Barriers to NAOMS Hand-Off at end of FY 04 (cont'd)

- **Since the system is still being developed, NAOMS value to the community will be only partially demonstrated by the end of FY '04**
  - difficult for an organization to make a long-term commitment when the full benefits cannot be assessed

Outreach and Community Information

Linda Connell

Products

- **OUTPUTS**
  - Summarized aviation operational experience data
  - Statistically reliable estimates of incident rates
  - Identification/tracking of safety trends
  - Near real-time feedback on impacts of new technology and procedures
  - Support for data-driven safety agendas

- **PRODUCT CONSUMERS**
  - Decision makers (government and industry)
  - Safety professionals and research organizations

Industry Groups Briefed

- NBAA
- HAI
- GAMA
- AOPA
- ALPA
- CAST
- NATCA
- NATA
- Boeing
- FAA
- SWAPA
- ASRS Advis. Sub

Briefing Plans

- **December 02 - AvSSP Program Office**
- **February 03 - NAOMS Working Group Kickoff**
- **February 03 – Report to ATAC Subcommittee (?), Code R/HQ (?)**
- **March 03 – Report to AvSSP Bi-Annual (?)**
- **Proposed Follow On:**
  - FAA - Office of System Safety, Flt. Standards, System Capacity, Other - March, 03
  - CAST - March, 03
  - Alphabet Groups, airlines, other - As can be arranged, March through June, 03

Permanent service possibilities will be explored in conjunction with briefing activities.

NAOMS Working Group

- **Industry and government group**

  (Individuals recruited from all major industry groups; independent from employer; selected for their individual/team skills)

- **Non-Disclosure/Confidentiality Agreement**

  (Based on pre-decisional exemption from public information requirements)

- **Ames Associates Program - Industry Participants**

  (No government compensation; no intellectual property rights covered by Workmen's Compensation [by ARC])

- **Purpose**
  - Ensure that results are validly interpreted
  - Gain consensus on content, level, and timing of information release
  - Build community support for NAOMS
  - Meet four times/year

Dear xxxxxx:

Through the Aviation Safety Program (AvSP), NASA has developed an approach to obtaining accurate information on aviation safety events occurring in the National Airspace System. This information is gathered from front line participants such as pilots, air traffic controllers, mechanics, and ohers through a systematic and ongoing scientifically designed survey. The project is called th National Aviation Operations Monitoring System (NAOMS).

I am writing you today to invite you to participate as a representative on a working group that will provide counsel to NASA and the NAOMS project team as we continue the project's development. The counsel we are seeking relates primarily to your experience in aviation operations. We will be looking to the working group for help in correctly interpreting survey results and potentially in suggesting appropriate follow-up activity. We would like to invit you, or your designee, to attend a initial two-day kickoff meeting of prospective working group members scheduled for winter in Washington D.C. During this meeting, we will describe fully the NAOMS project, provide an update on its status and discuss the working group's intended functions and goals.

We are very excited with the attention this project has received and its potentia to provide quality information that will assist the aviation industry in its continuing efforts to improve aviation safety. We hope that you will be able to participate as a active member of the group. It would be very helpful if we cou receive an indication of your willingness to participate by the xx of xx. You can contact either Mary Connors or Linda Connell, the project co-leads by phone o e-mail (contact information listed below.) Please also provide an indication of your availability during the February and March, 2003 timeframe. We would like to select the best time for our kickoff meeting to ensure as many as possible can attend. We have attached some general background information on NAOMS for your review. Please feel free to contact either of us if you would lik to discuss the project or have any questions.

Sincerely,

Mary Connors
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mconnors@mail.arc.nasa.gov

Linda Connell
(650) 604-6654
lconnell@mail.arc.nasa.go