Trouble with Troubleshooting

InfoShare – Maintenance Seattle, WA

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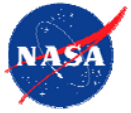
AVIATION SAFETY REPORTING SYSTEM

Topics for Discussion

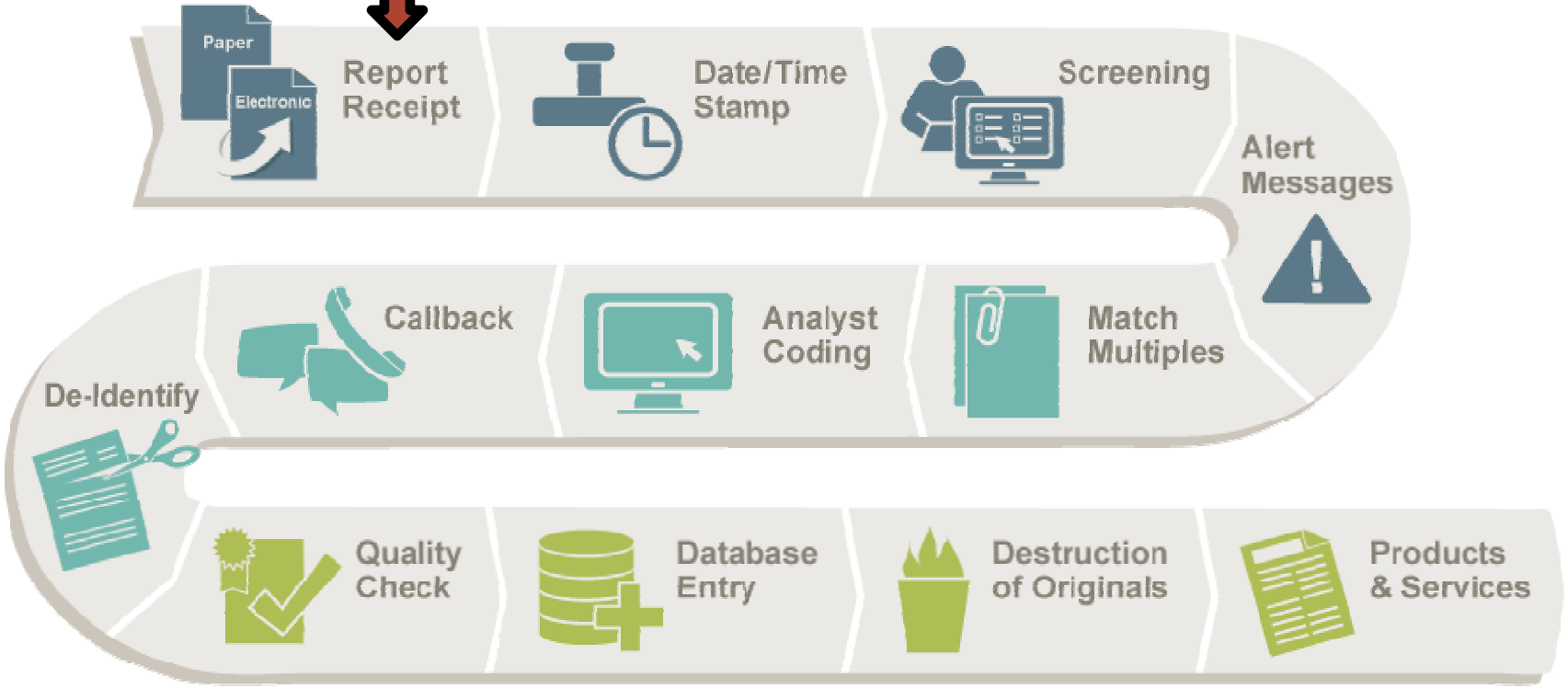
- ASRS Maintenance Reporting
  - General and Maintenance Intake
  - Maintenance Related Events - Overview
- Trouble with Troubleshooting: A NASA ASRS Analysis of Factors

ASRS Maintenance Reporting



Report Processing Flow

Airline Safety Action Program (ASAP) and Air Traffic Safety Action Program (ATSAP) reports

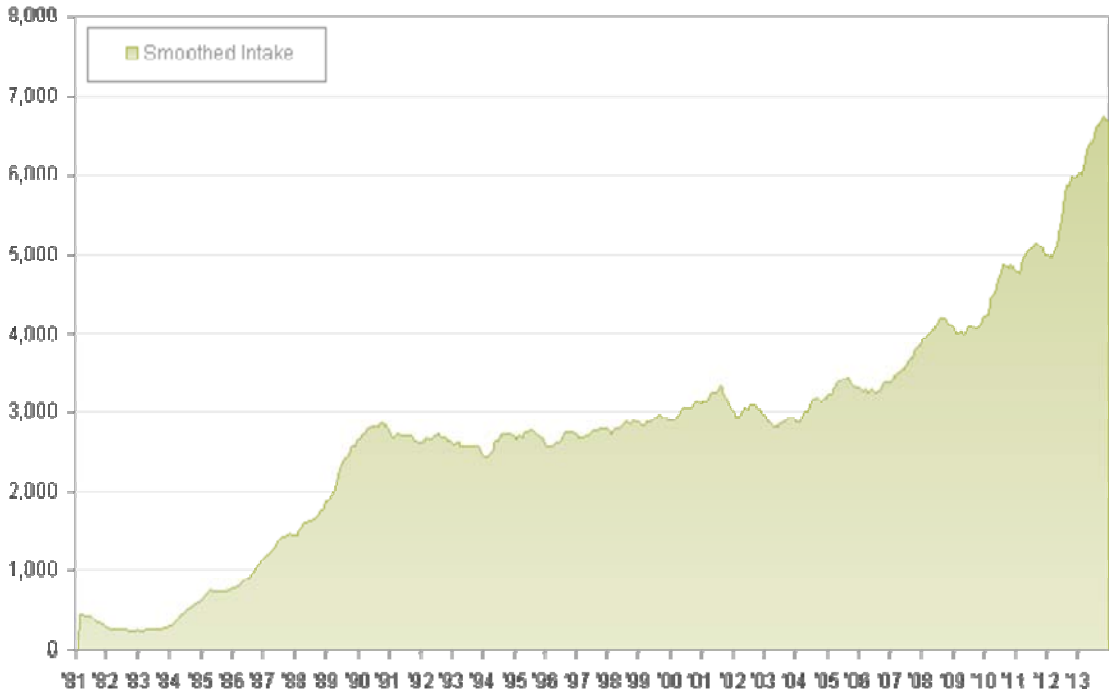


All reports are routed through a differential processing analysis flow

ASRS Report Volume Profile

- **37 years of confidential safety reporting**
- **Over 1,150,000 reports received**
- **Over 5,800 alert messages issued**
- **Over 6,700 reports per month, or 323 per working day**
- **Total report intake for 2013 was 80,840**
- **Current rate estimate for 2014 is over 90,000**

Monthly Intake
January 1981 – December 2013



ASAP Reporting to ASRS

- **Overall ASAP Intake**
  - 181 Total Programs
  - 76 Air Carriers
- **Reporting Groups**
  - 74 Pilot
  - 44 Mechanic
  - 39 Dispatch
  - 19 Flight Attendant
  - 5 Ground Crew
- **Secure Electronic Data connection protocols between airline and ASRS**
  - 179 Programs
  - 75 Airlines

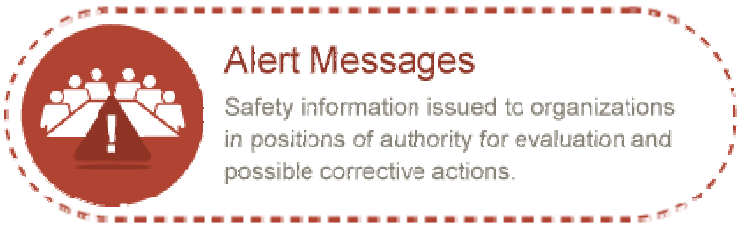
ASRS Electronic Transmission Methodology compatible with numerous software platforms

More airline programs being added continuously

26% of all reports are matched to unique events in 2013

ASRS Products

- **These products and services fulfill the program's mission to disseminate safety data**



Alert Messages

Safety information issued to organizations *in positions of authority for evaluation and* possible corrective actions.

CALLBACK

Monthly newsletter with a lessons learned format, available via website and email.

Quick Responses

Rapid data analysis by ASRS staff on safety *issues with immediate operational importance* generally limited to government agencies.

ASRS Directline

Safety topic summaries based on ASRS reports published to meet the needs of operators and flight crews.

ASRS Database

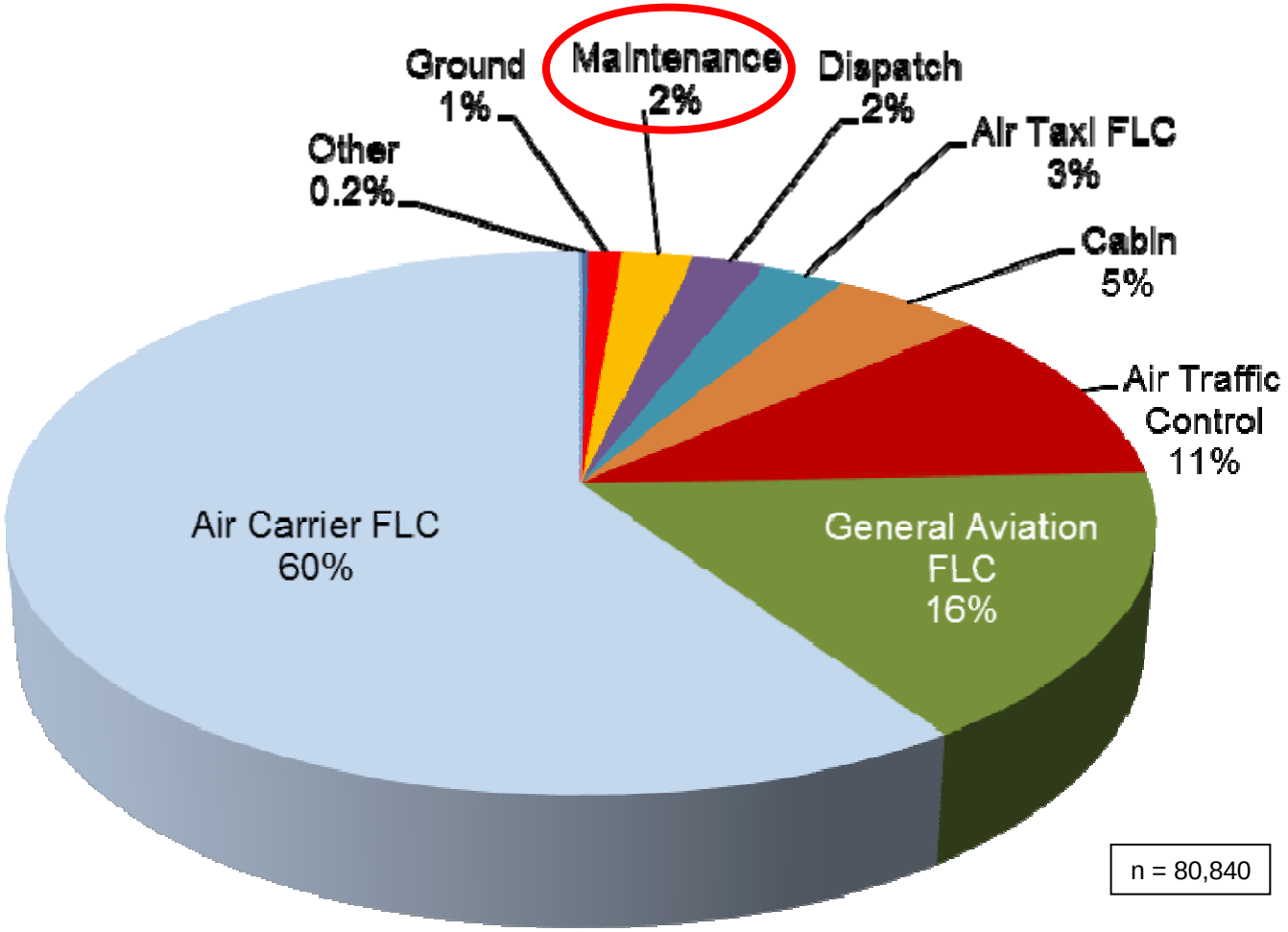
The public ASRS Database Online and *data available in Database Report Sets or* Search Requests fullfilled by ASRS staff.

Focused Studies/Research

Studies/Research conducted on safety topics of interest in cooperation with aviation organizations.

Incident Reporter Distribution

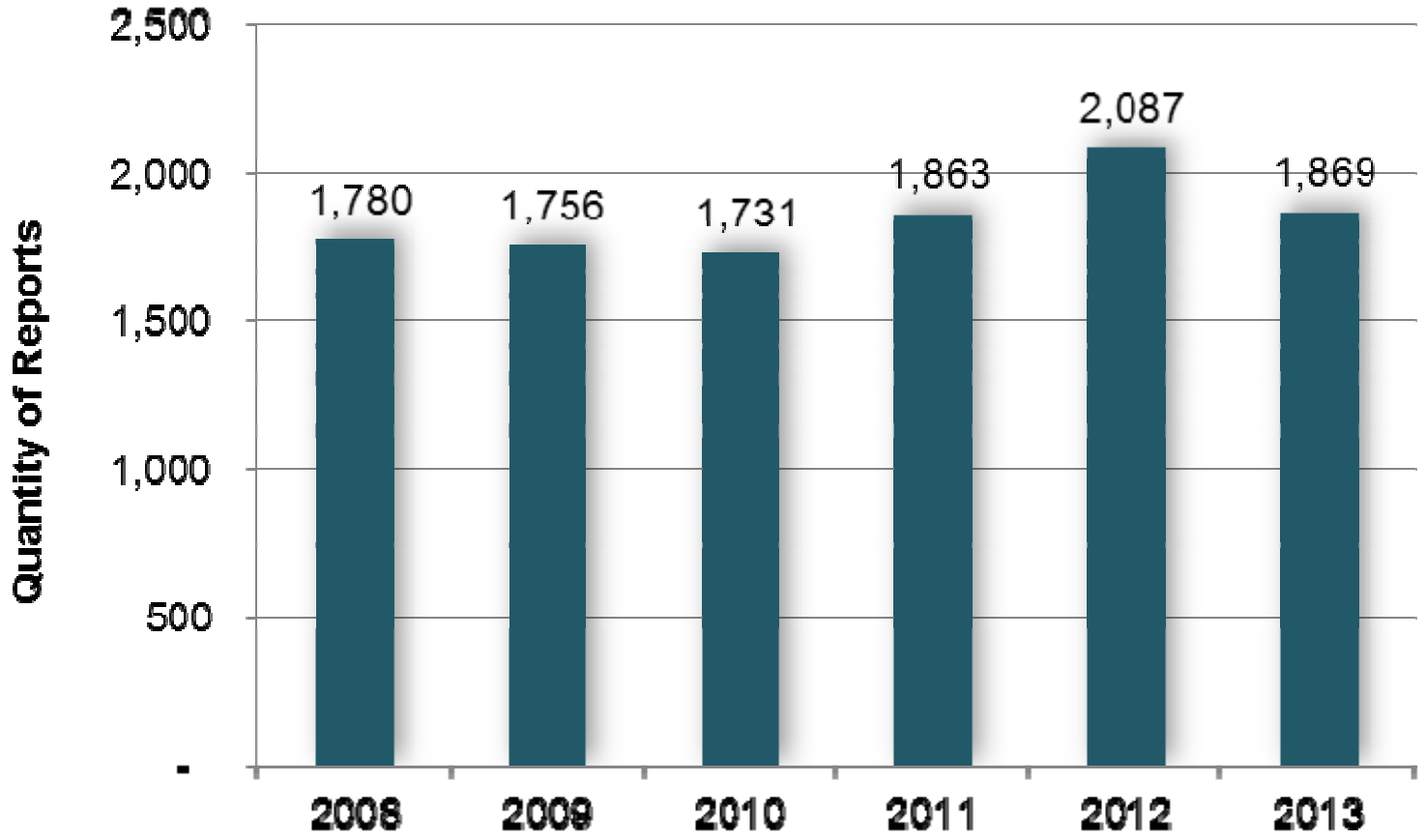
January – December 2013



Source: 100% ASRS report data

Maintenance Report Intake

2008 – 2013

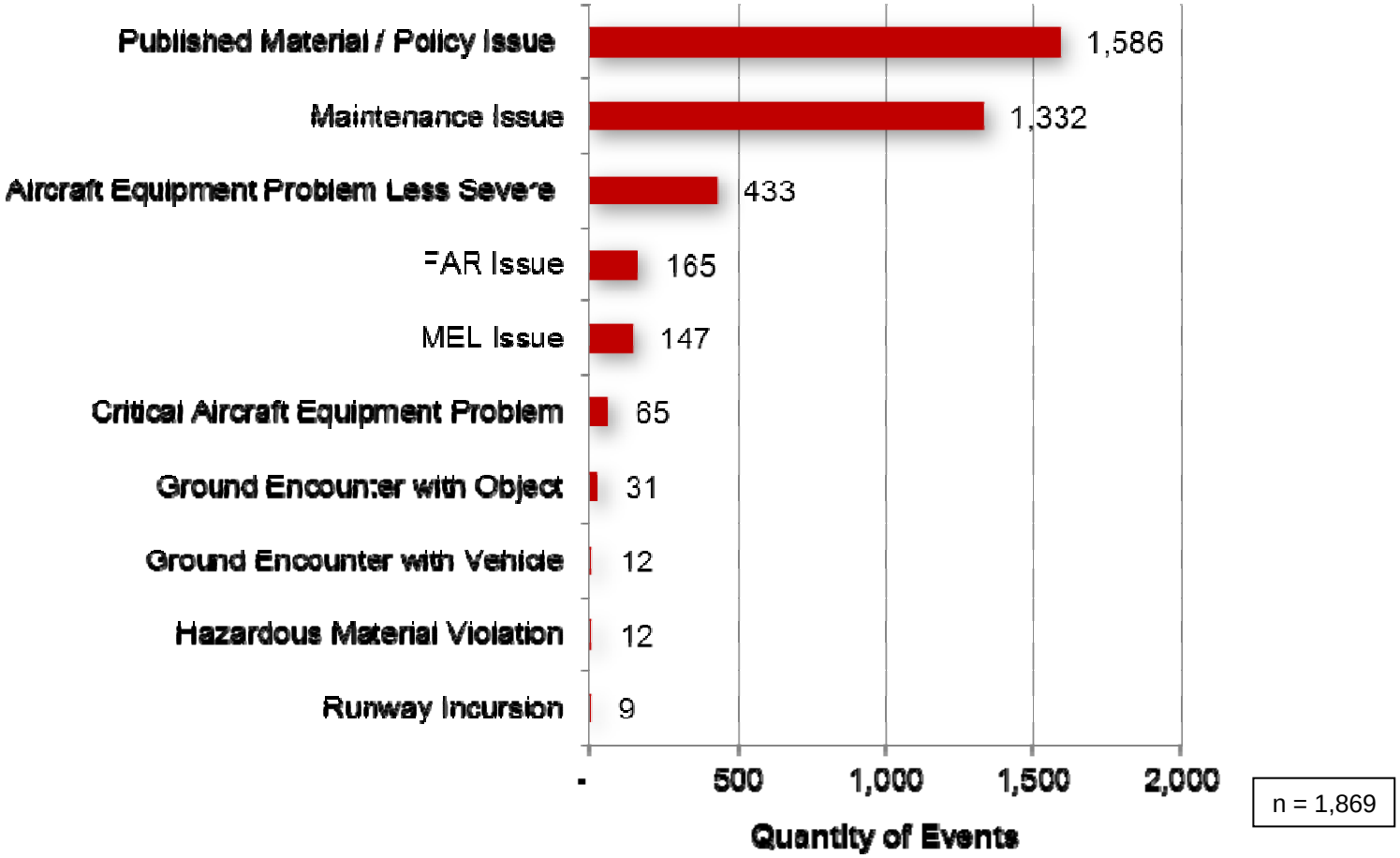


n = 11,086

Source: 100% ASRS report data

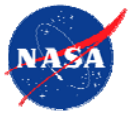
Maintenance Report Intake – Top Ten Anomalies

January – December 2013



Categories are not mutually exclusive. Therefore, a single incident may be coded by ASRS analysts as involving more than one anomaly.
Source: 100% ASRS report data

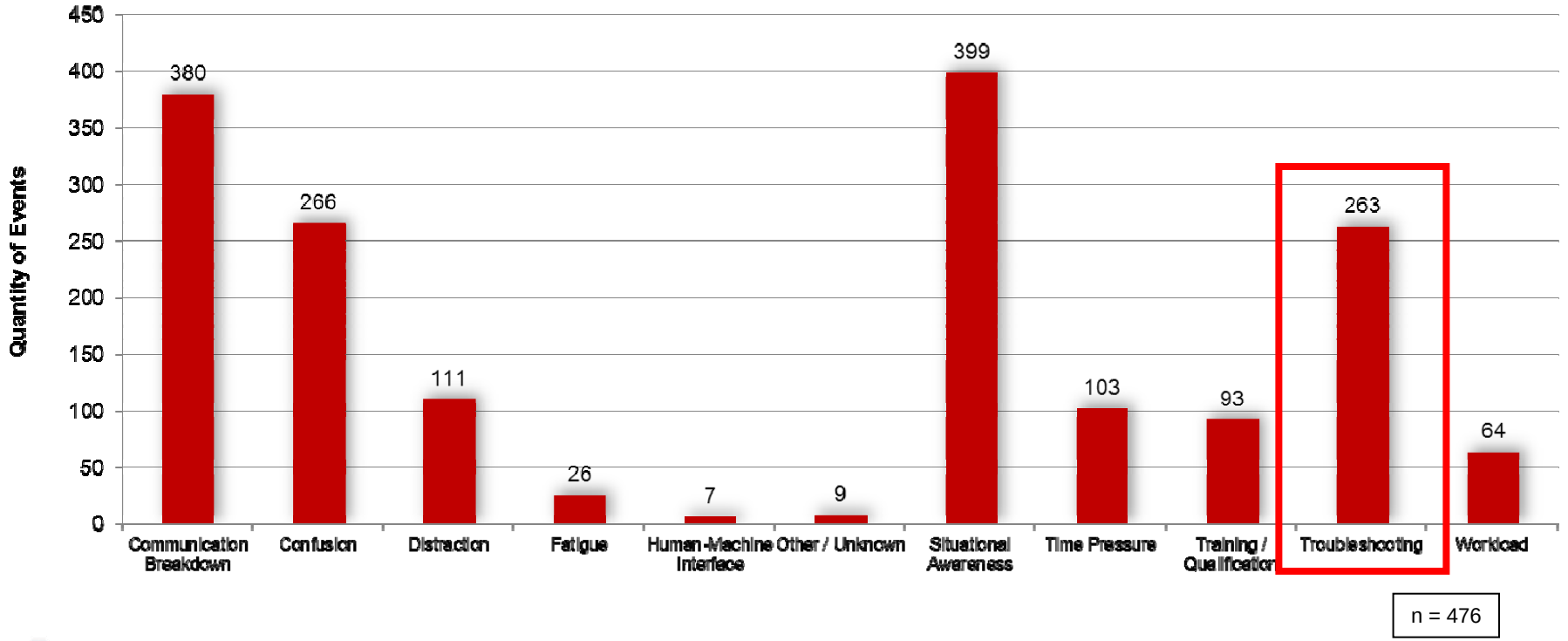
Trouble with Troubleshooting



Troubleshooting – Human Factors

May 2009 – Present

- ASRS receives many reports about Troubleshooting



n = 476

Categories are not mutually exclusive. Therefore, a single incident may be coded by ASRS analysts as involving more than one factor.
Source: NASA ASRS Database

Taking a Closer Look

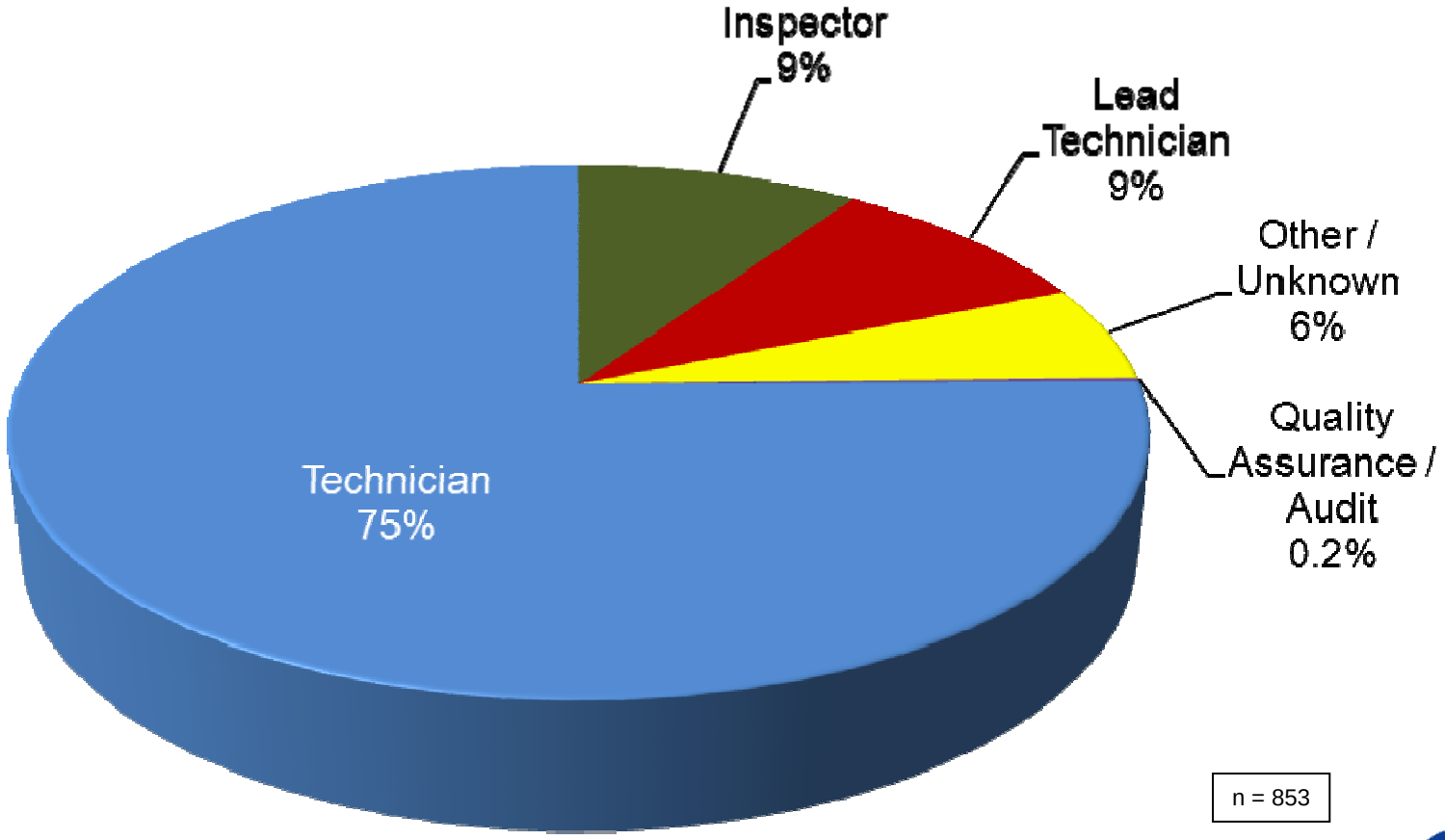
- Database Search Parameters

  1. Maintenance Personnel, and
  2. Time Frame 2008 – Present, and
  3. Narratives containing the terms ‘Troubleshooting’ or ‘Testing’, OR
  4. Human Factor Troubleshooting code

  - The search yielded 853 records

Troubleshooting – Reporter Function

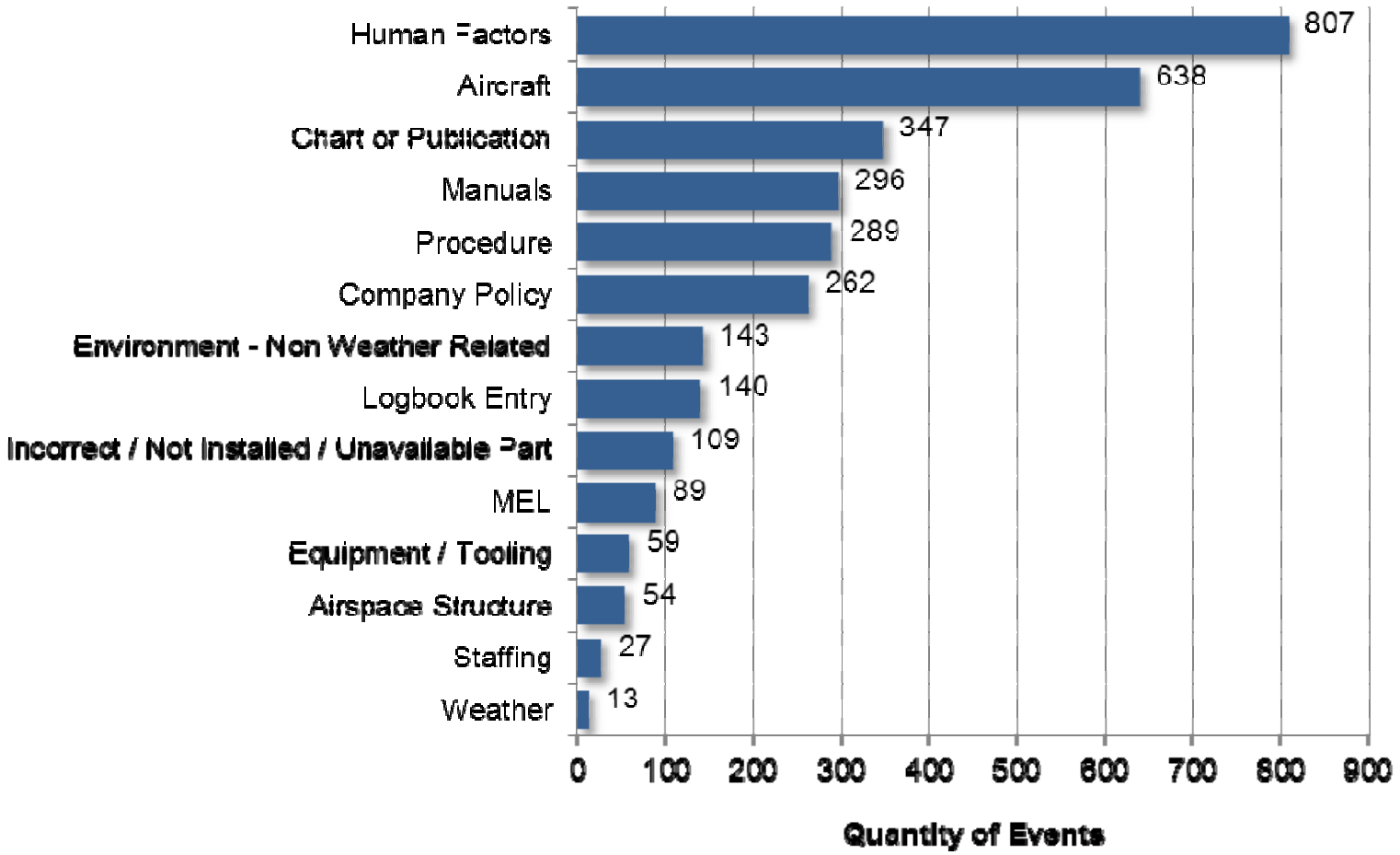
- Database Search Results



n = 853

Source: NASA ASRS Database

Troubleshooting – Contributing Factors



n = 853

Categories are not mutually exclusive. Therefore, a single incident may be coded by ASRS analysts as involving more than one factor.
Source: NASA ASRS Database

# 100 Most Recent Maintenance Personnel Reported Alerts
# Human Factors Overview – Primary Analysis
n = 100

Troubleshooting Human Factor

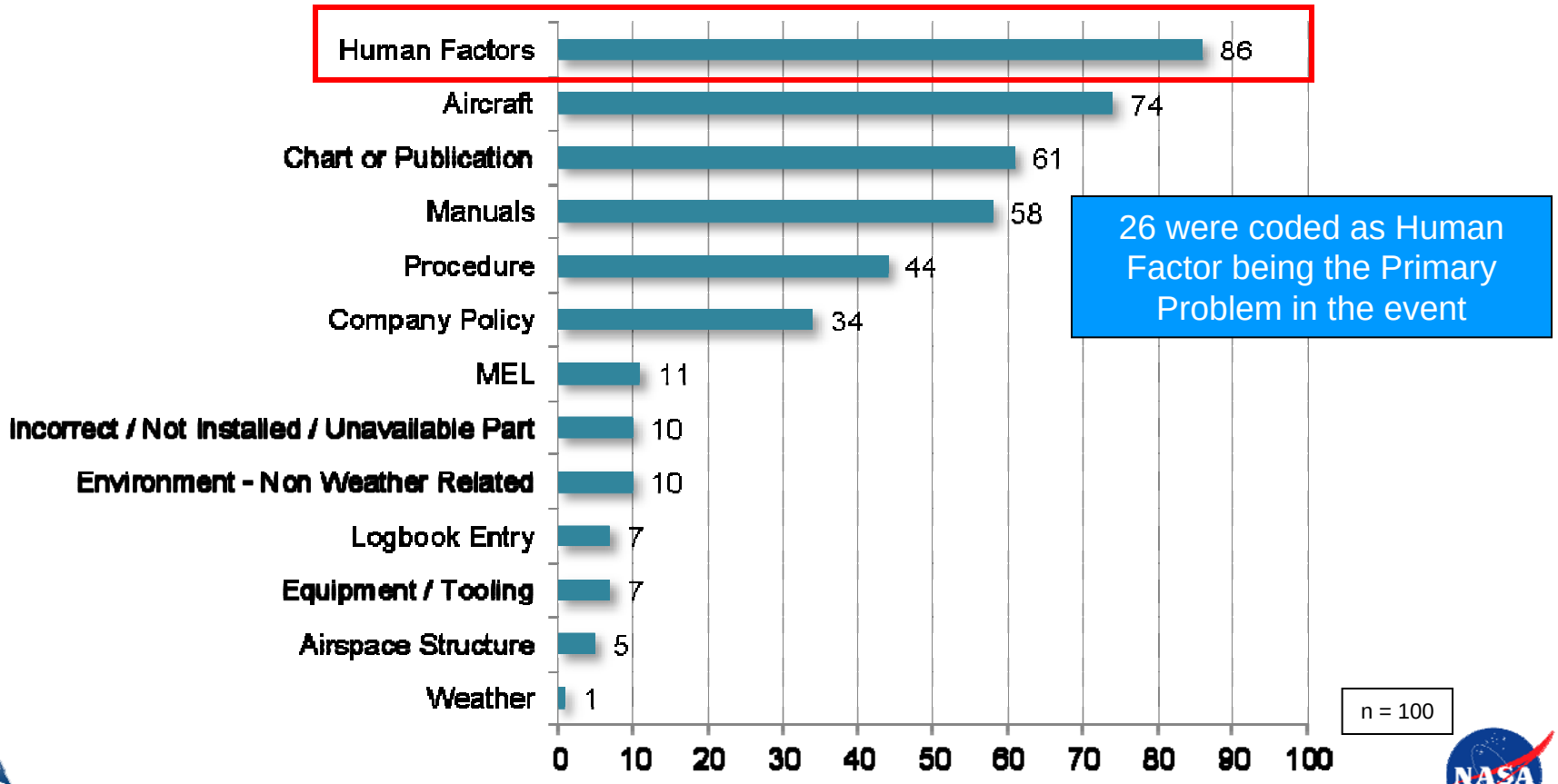
- Comparison of Maintenance reported Alerts and 100 most recent Maintenance Reports

Human Factors	100 Alert Reports	100 Most Recent Reports
Communication Breakdown	63	79
Situational Awareness	55	85
Troubleshooting	41	15
Confusion	33	42
Training / Qualification	13	21
Distraction	6	24
Time Pressure	6	22
Workload	4	15
Other / Unknown	2	4
Fatigue	1	4
Human-Machine Interface	0	1

*Categories not mutually exclusive.

Overall Contributing Factors

- 86 of the 100 Alerts were codified with Human Factor as a contributor to the event



*Categories not mutually exclusive

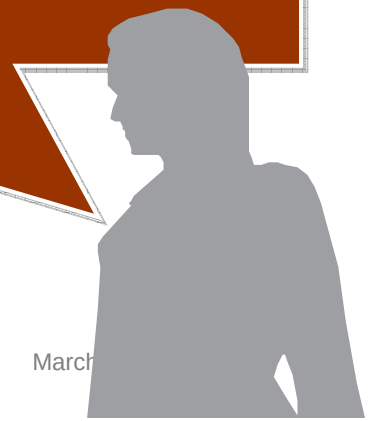
Issues Described in Troubleshooting Incidents

- Reported Troubleshooting Issues
  - Unable to Duplicate
  - Difficulty Monitoring Chronic Issues
  - ‘Flawed’ Approved Parts
  - Complex Allowable Configurations
  - Inadequate Tests and Procedures

Troubleshooting: Unable to Duplicate

"I called my Supervisor and told him everything we had done and that ***we could not duplicate the problem*** *and that everything checked out good… Minutes later…our Supervisor told us…if we could not duplicate the problem, to …return the Aircraft to service….The next day I…saw that* ***the Aircraft had an air return and now required an engine change****…."*

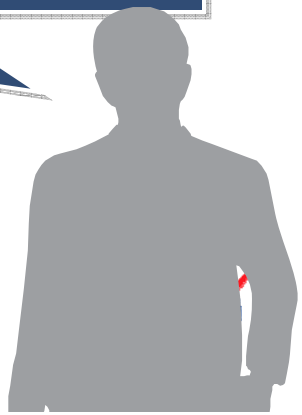
(ACN 1057301 Excerpt)



Troubleshooting: Chronic Monitoring

"In March, a B737-300, had it's 6th and 7th "Stiff Elevator", inflight occurrence with, again, no remedy other than cleaned Feel Control Unit and/or operational checks good. This aircraft should have had both PCU's replaced AND a full cable run Inspection AND a Test Flight with "Touch and Go's" since all write-ups are flare related. My major safety concern is these ***incidents do not fit our chronic reporting****,* ***and there was no action*** *on Maintenance Control to ground this aircraft for a nose-to-tail detailed visual inspection."*

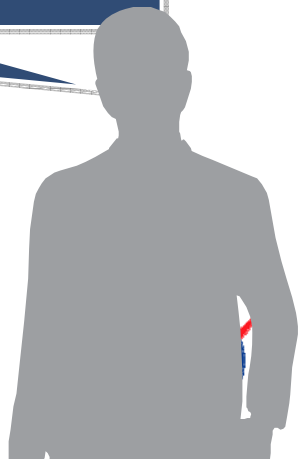
(ACN 881756 Excerpt)



Troubleshooting: “Flawed” Parts

“The Technical Representative told me he had the same problem with another aircraft. He told me to remove the paper filter and install a metal filter and that should take care of the problem. I did so and turned the boost pumps on and the clog indicator was no longer popping. I returned the aircraft to service with no problems.”

(ACN 891981 Excerpt)



Troubleshooting: Complex Configurations

“A -222 GPWS computer was installed, replacing a -224. The electronic maintenance log stated "improper part“, but the IPC effectivity allowed a -222 and I overrode the warning. The Engineering Order that was referenced is 41 pages long. This is one of the most difficult "effectivity" questions I have run into. The information was there, but I did not take the time to research it thoroughly.”

(ACN 951680 Excerpt)

Troubleshooting: Inadequate Tests

"I pulled the M/M and performed DFCS BITE Check…. and ***the DFCS passed all tests with the [Mach Trim] Circuit Breakers pulled****. The B737-700 flight crew returned to the gate after noticing the C/Bs were still pulled, even though a Mach Trim MEL had been signed-off."*

(ACN 1087322 Excerpt)

Troubleshooting: Inadequate Procedures

*"The AMTs were convinced the only way to install the lock was to pressurize the hydraulics and move the elevator surface up [using the Control Column]. This is very dangerous!! If the Control Column is relaxed while attempting to install the locks, severe bodily injury is imminent…. The Engineering Department is reluctant to revise the current Elevator PCA Lock-Out installation procedure, but may be willing to "Add" language using 'Notes' or Warnings. …**the Mechanic was disciplined for not properly installing the Elevator Lock-out tool; even though the company knows the maintenance procedure is confusing and lacks information**."* *(ACN 1084485 Excerpt)*

Summary of Troubleshooting ….

- Time Pressure
- Chronic Troubleshooting
- Correct Parts and Effectivity
- Inadequate Test Equipment and Procedures

Summary of Troubleshooting ….

- Troubleshooting is high on the list of Human Factors issues
- Can these issues be addressed by SMS processes?
- How can current national aviation safety efforts be useful in addressing these issues?

Troubleshooting Challenges Facing Maintenance

QUESTIONS?

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