International Investigations

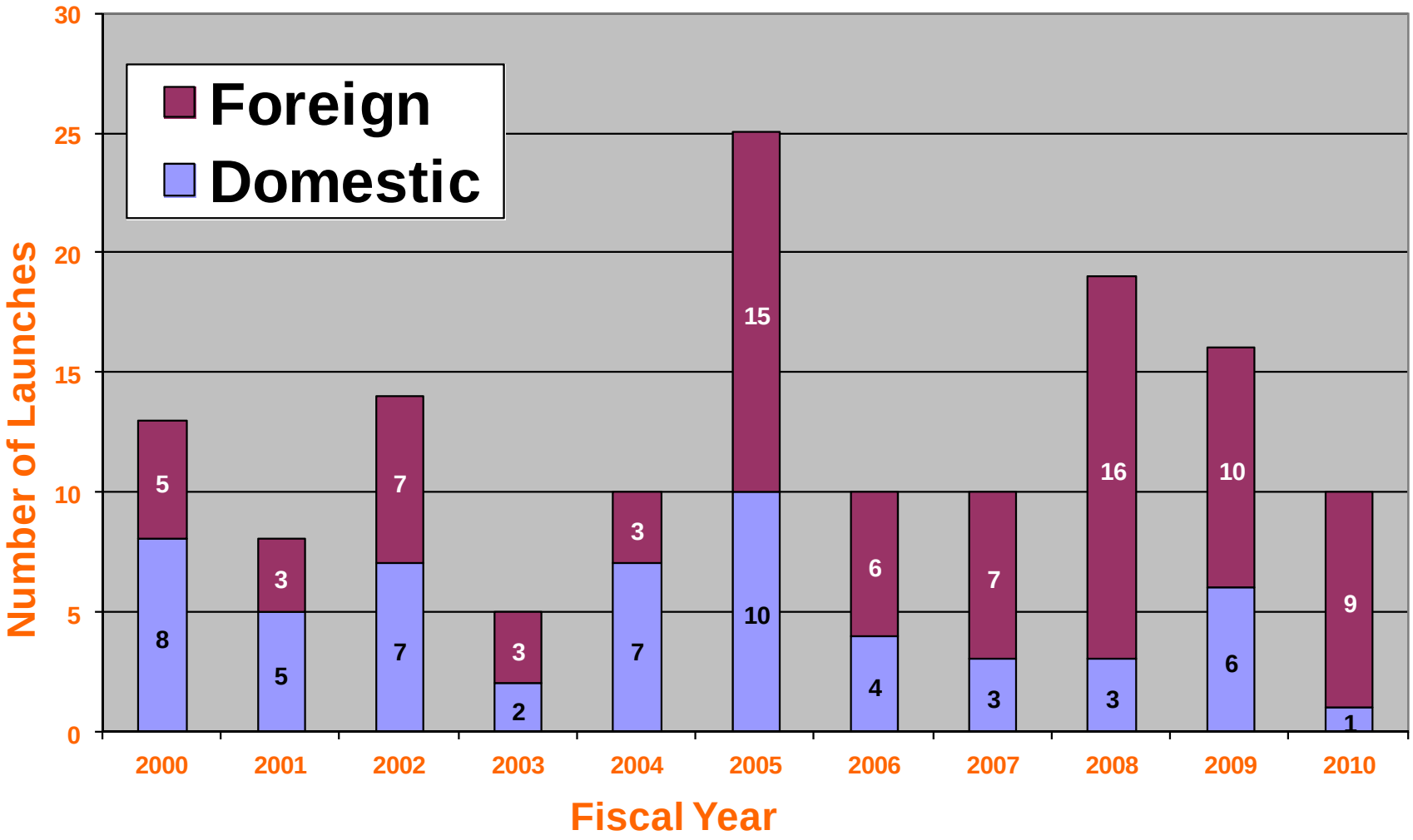
Global Collaboration with Domestic Impact

Opening Statement
Joseph M. Sedor

Aviation International Investigations

- Significant international workload
- Significant safety impact for U.S. aviation
- International safety effort
  - Investigative protocols
  - Outreach
  - Laboratory and data support
  - Family assistance
  - Case studies

Major Domestic & Foreign Launches



International Civil Aviation Organization

- Chicago Convention on International Civil Aviation
  - Administered by ICAO
  - United States is a signatory
- NTSB responsible for fulfilling obligations
  - In coordination with State Department
- Annex 13: Aircraft Accident and Incident Investigation
- Annex 8: Airworthiness of Aircraft

Annex 13 – General

- Objective of Annex 13 investigations
  - Prevention of accidents, not for liability
- Standards and Recommended Practices
- Countries that take part in the investigations
  - State of Occurrence
  - State of Manufacture/Design
  - State of Operator
  - State of Registry

Annex 13 – Investigative Process

- State of Occurrence
  - Conducts the Investigation
  - Notifies ICAO and appropriate States
  - Investigator in Charge (IIC)
  - Organize, conduct, and control investigation
- State of Registry
  - Conducts investigation in international waters

Annex 13 – Investigative Process

- Accredited Representatives Rights
  - Appoint technical advisors
  - Visit the site and examine the wreckage
  - Participate fully in the investigation
    - recorder readouts, progress meetings, etc.
  - Have full access to all relevant data
- Accredited Representatives Obligations
  - Provide IIC all relevant information
  - Not release accident information

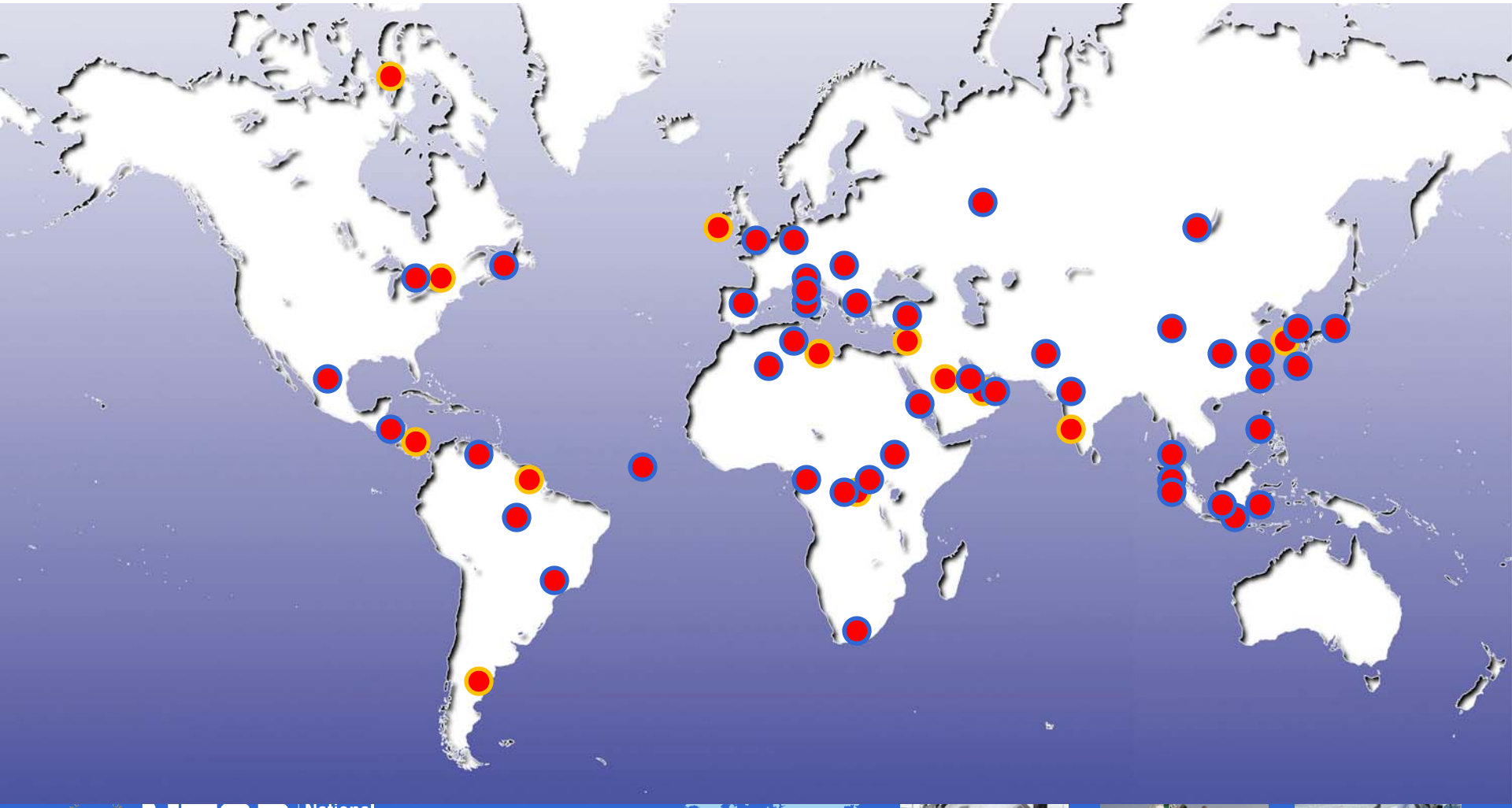


Annex 13 – Final Report

- Draft Final Report
  - Completed by State of Occurrence
  - Draft report sent to all States that participated
  - 60 day review period
- State comments on draft report
  - Must modify report OR
  - Append comments to the final report if requested

NTSB Annex 13 International Investigations

Significant Launches: 2000 to Oct. 2011



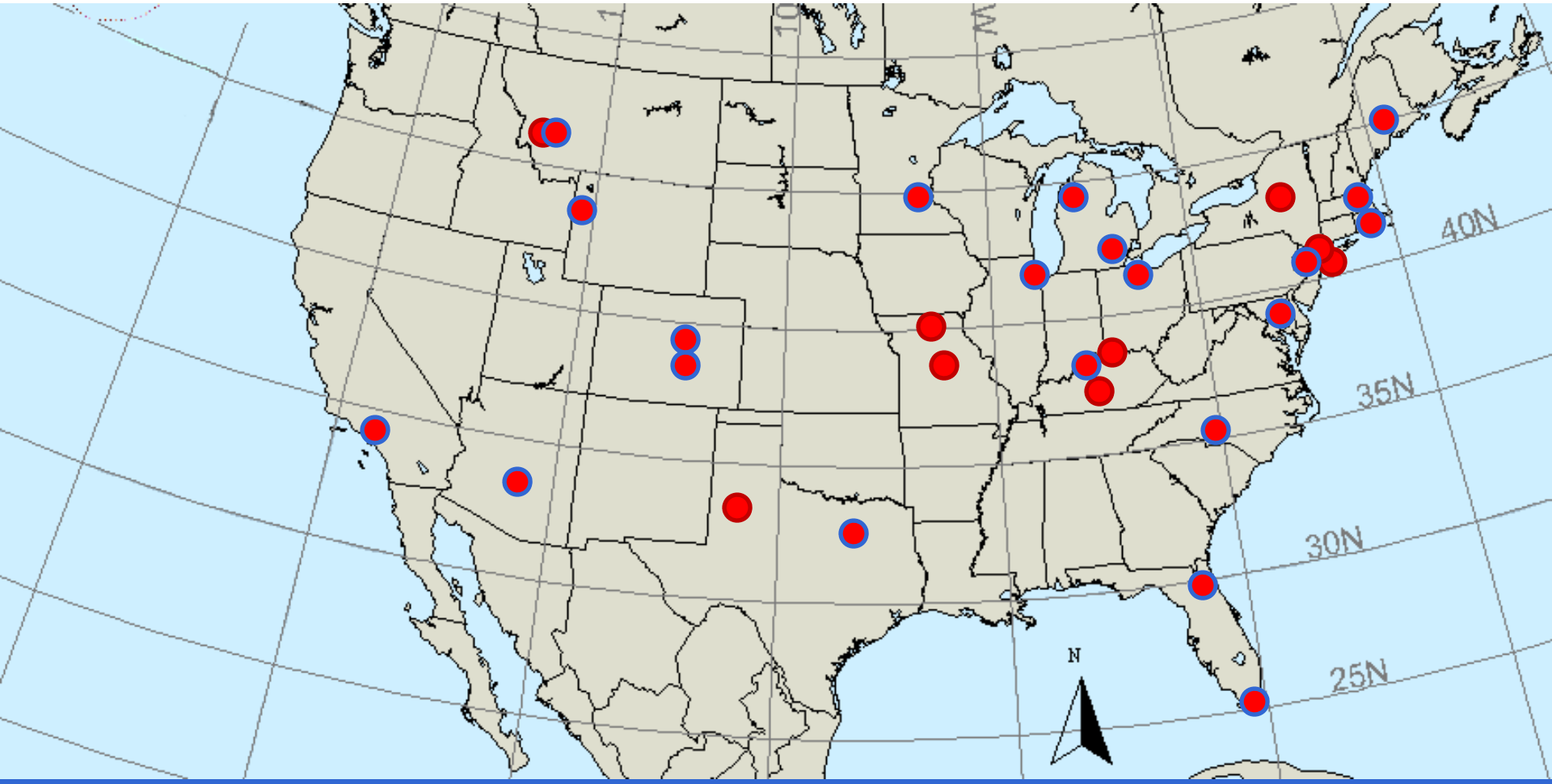
NTSB Annex 13 International Safety Results

- Recommendations
  - Hundreds issued by State of Occurrence
- NTSB Recommendations issued
  - Since 2008 – 33 NTSB recommendations
  - Last 10 years – 78 NTSB recommendations
- Total NTSB recommendations issued
  - **Over 320 recommendations**



NTSB Annex 13 Domestic Investigations

…not a “one-way street”…



Annex 13 Investigations

- Critical factor in global aviation safety
- Critical component of U.S. aviation safety
- Identify safety issues from all accidents
- Required for many domestic accidents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International Investigations

Global Collaboration with Domestic Impact

International Outreach

Frank Hilldrup

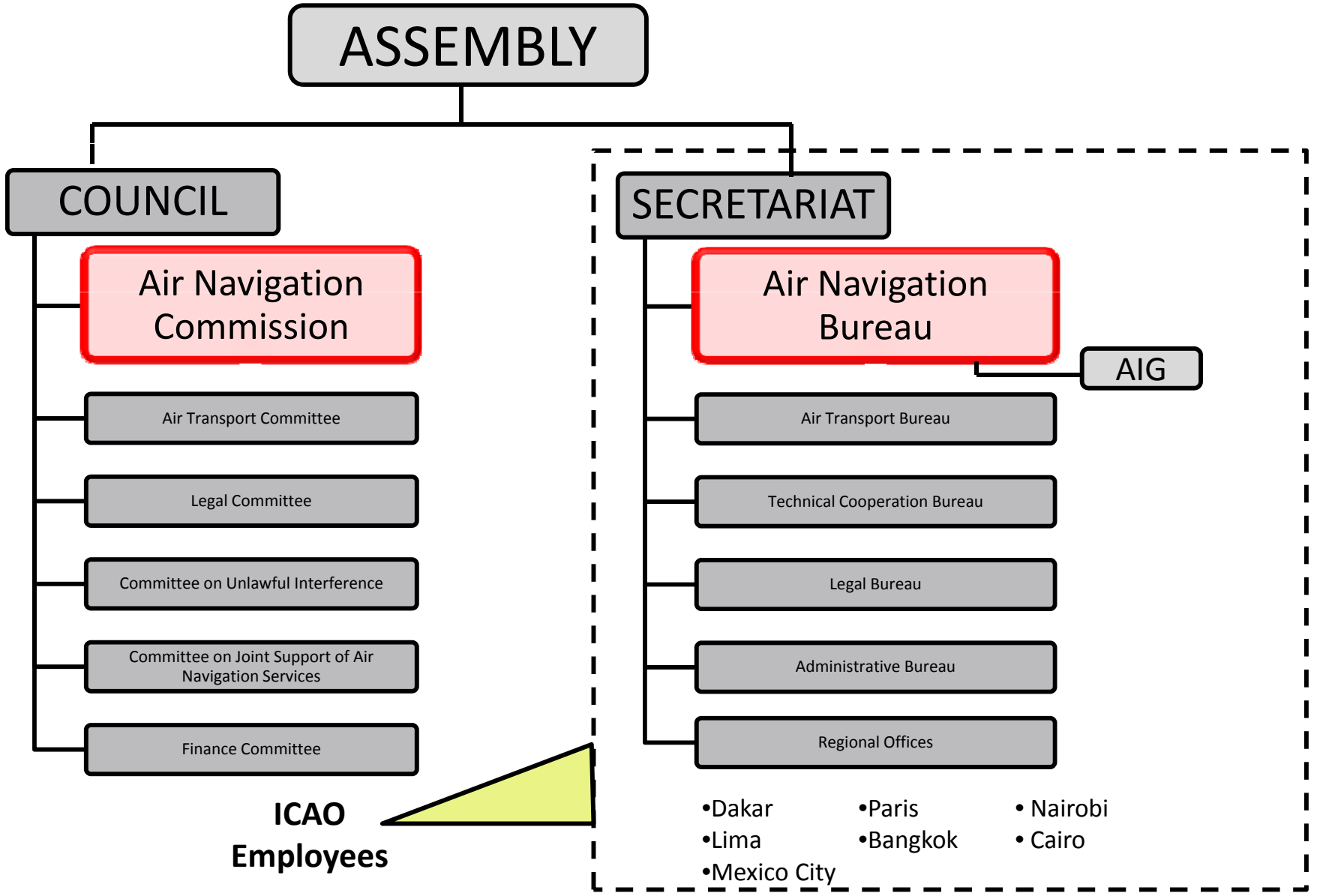
Why We Engage in International Outreach

- Improve bilateral cooperation
- Harmonize accident investigative procedures
- Enhance investigative knowledge
- Foster development of international safety protocols

Where We Engage in International Outreach

- International Civil Aviation Organization (ICAO)
- Flight Safety Foundation (FSF)
- International Society of Air Safety Investigators (ISASI)
- European Civil Aviation Conference (ECAC)
- European Organization for Civil Aviation Equipment (EUROCAE)
- Meetings with foreign counterparts

ICAO Organization



ICAO Activities/Interactions

Major Meetings and Symposia

- 2011 Fatigue Risk Management
- 2011 Runway Safety
- 2010 Triennial Assembly Meeting
- 2008 AIG meeting

ICAO Activities/Interactions (Cont'd)

ICAO Panels/Study Groups/Task Forces –

- Panels—
  - Flight Recorder Panel
  - Safety Management Panel
- Study Groups—
  - Accident Investigation Methods SG
  - Safety Indicators SG
- Task Forces—
  - Safety Information Protection TF
  - Circular 285 Update TF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Global Collaboration with Domestic Impact

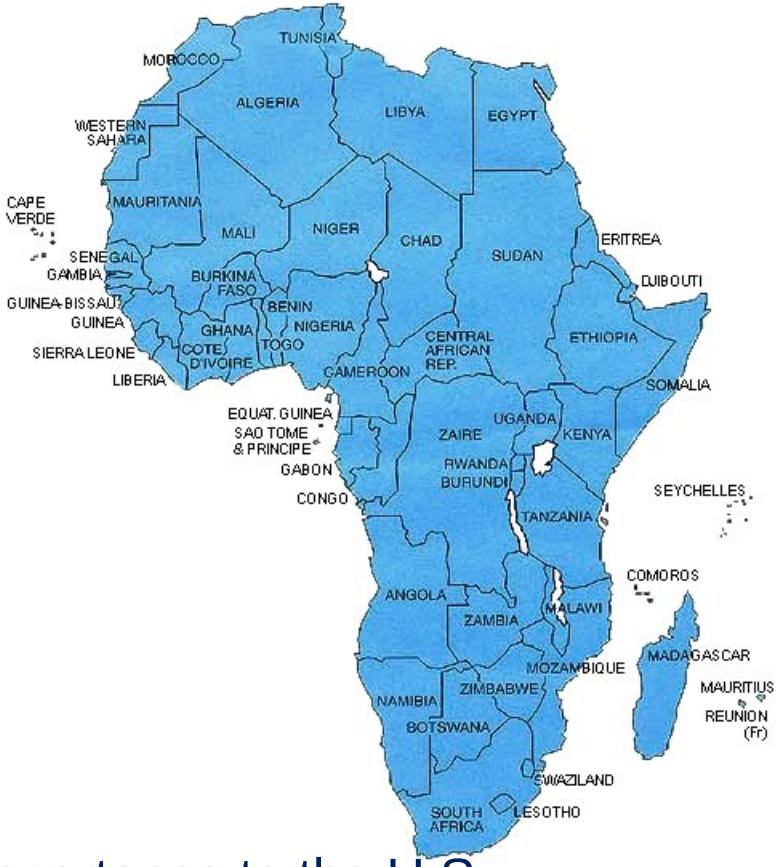
Aviation Safety in Africa - Safe Skies For Africa

Dennis Jones

Background

Second largest continent
55 countries
Three times the size of U.S.

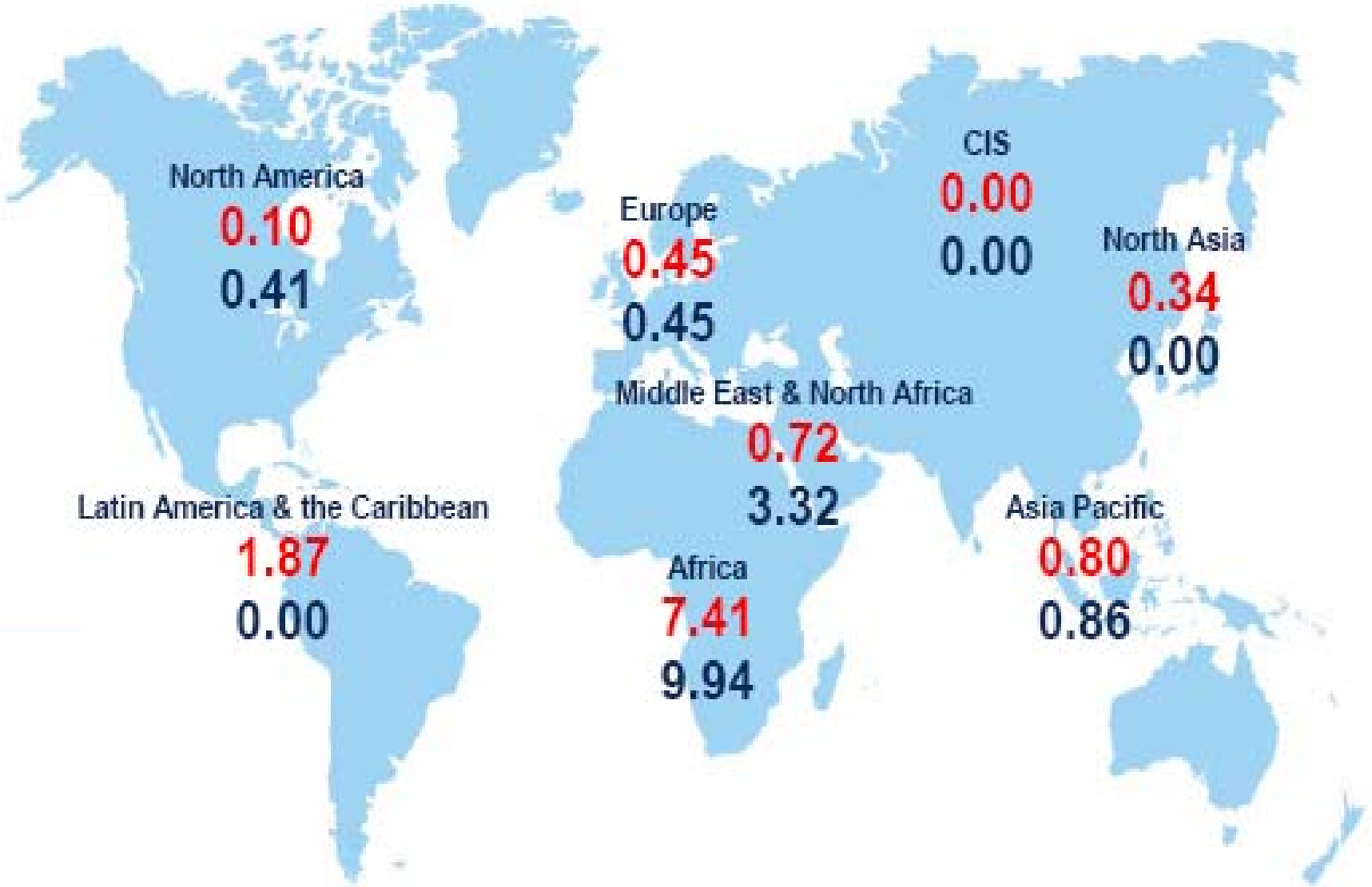
Country/ region	Area (in millions of square miles)
Africa	11.7
Argentina	1.1
China	3.7
India	1.3
Kazakhstan	1.0
Mexico	0.8
United States	3.8



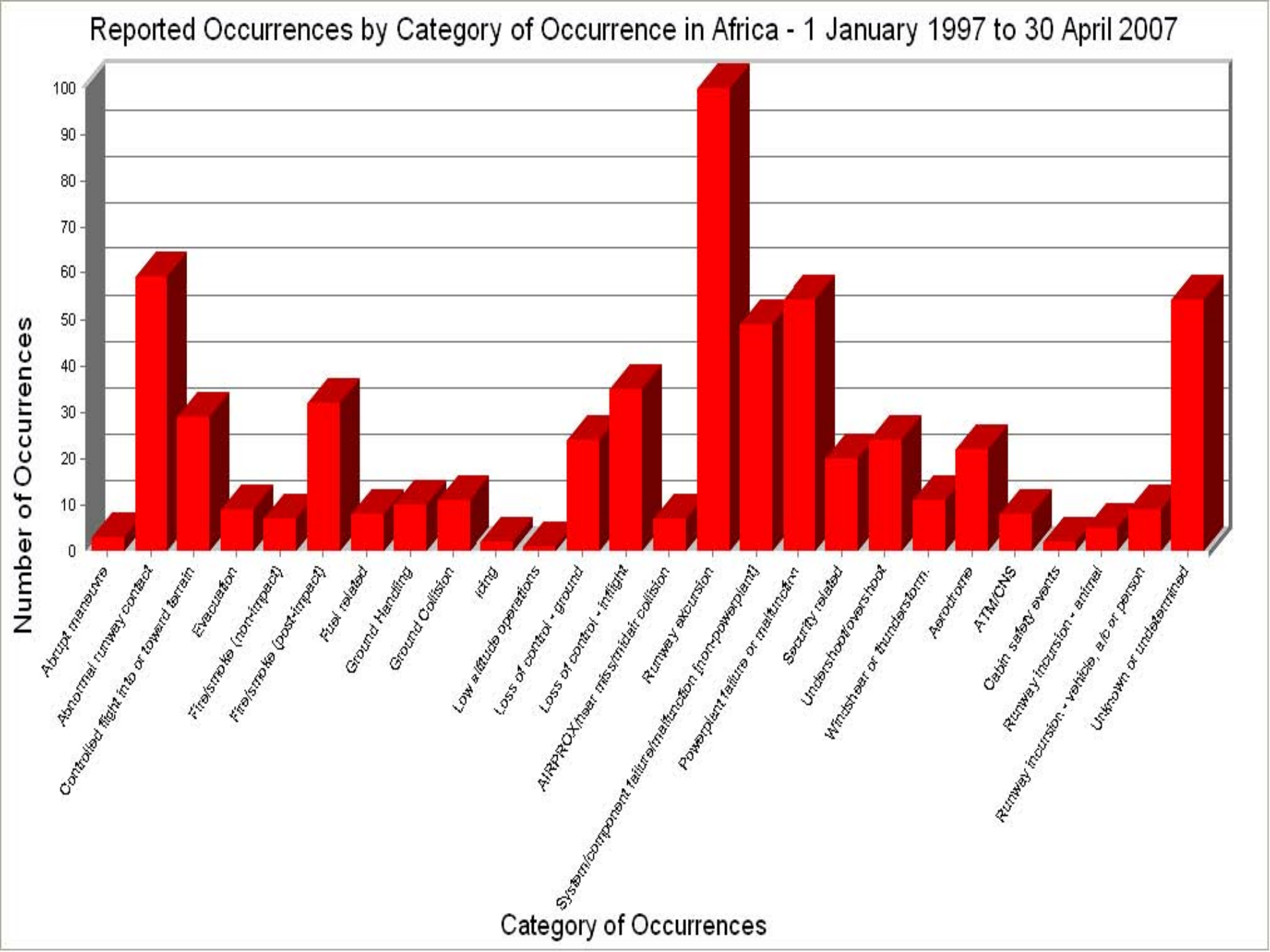
Importance to the U.S.:

- Economic
- Strategic
- Foreign Policy


Africa
ATLANTIC OCEAN
Canary Is.
Tropic of Cancer
20° N
Western Sahara (Morocco)
Morocco
Tunisia
Mediterrancan Sea
ASIA
Algeria
Libya
Egypt
Red Sea
SINAI
Arabian Sea
Cape Verde
Mauritania
Senegal
Gambia
Guinea-Bissau
Guinea
Mali
Burkina Faso
Niger
Chad
Sudan
Eritrea
Djibouti
Sierra Leone
Liberia
Ghana
Nigeria
C.A.R.
Cameroon
Ethiopia
Togo
Côte d'Ivoire
Eq. Guinea
Somalia
0° Equator
São Tomé & Príncipe
Gabon
Democratic Rep. of the Congo
Uganda
Kenya
Rwanda
Burundi
Rep. of the Congo
Cabinda (Angola)
Tanzania
INDIAN OCEAN
Seychelles
SOUTH AMERICA
ATLANTIC OCEAN
Malawi
Comoros
Angola
Zambia
Mozambique
Mauritius
Zimbabwe
Namibia
Madagascar
Botswana
20° S
Tropic of Capricorn
Swaziland
South Africa
Lesotho
60° W
40° W
20° W
0°
20° E
40° E
60° E
African Nations with Direct Air Carrier Service to USA



Red = 2010 / Blue = 2009


Reported Occurrences by Category of Occurrence in Africa - 1 January 1997 to 30 April 2007
Number of Occurrences
0
10
20
30
40
50
60
70
80
90
100
Abrupt maneuvre
Abnormal runway contact
Controlled flight into or toward terrain
Evacuation
Fire/smoke (non-impact)
Fire/smoke (post-impact)
Fuel related
Ground Handling
Ground Collision
Icing
Low altitude operations
Loss of control - ground
Loss of control - inflight
AIRPROX/near miss/midair collision
Runway excursion
System/component failure/malfunction (non-powerplant)
Powerplant failure or malfunction
Security related
Undershoot/overshoot
Windshear or thunderstorm
Aerodrome
ATM/CNS
Cabin safety events
Runway incursion - animal
Runway incursion - vehicle, a/c or person
Unknown or undetermined
Category of Occurrences

Safe Skies for Africa Program

- White House initiative created in 1998
- Assists civil aviation in African States:
  - Safety
  - Security
  - Air Navigation
- DOT-managed
- DOS-funded

Safe Skies for Africa - Goals

- ICAO Aviation Safety Standards
- Improve aviation security at a number of African airports
- Improve regional air navigation services in Africa

Safe Skies for Africa Participants

Eight states selected in 1998

Angola, Cameroon, Cape Verde, Coite d'Ivore (Ivory Coast), Kenya, Mali, Tanzania, Zimbabwe

Three states added June 2003

Djibouti, Namibia, Uganda

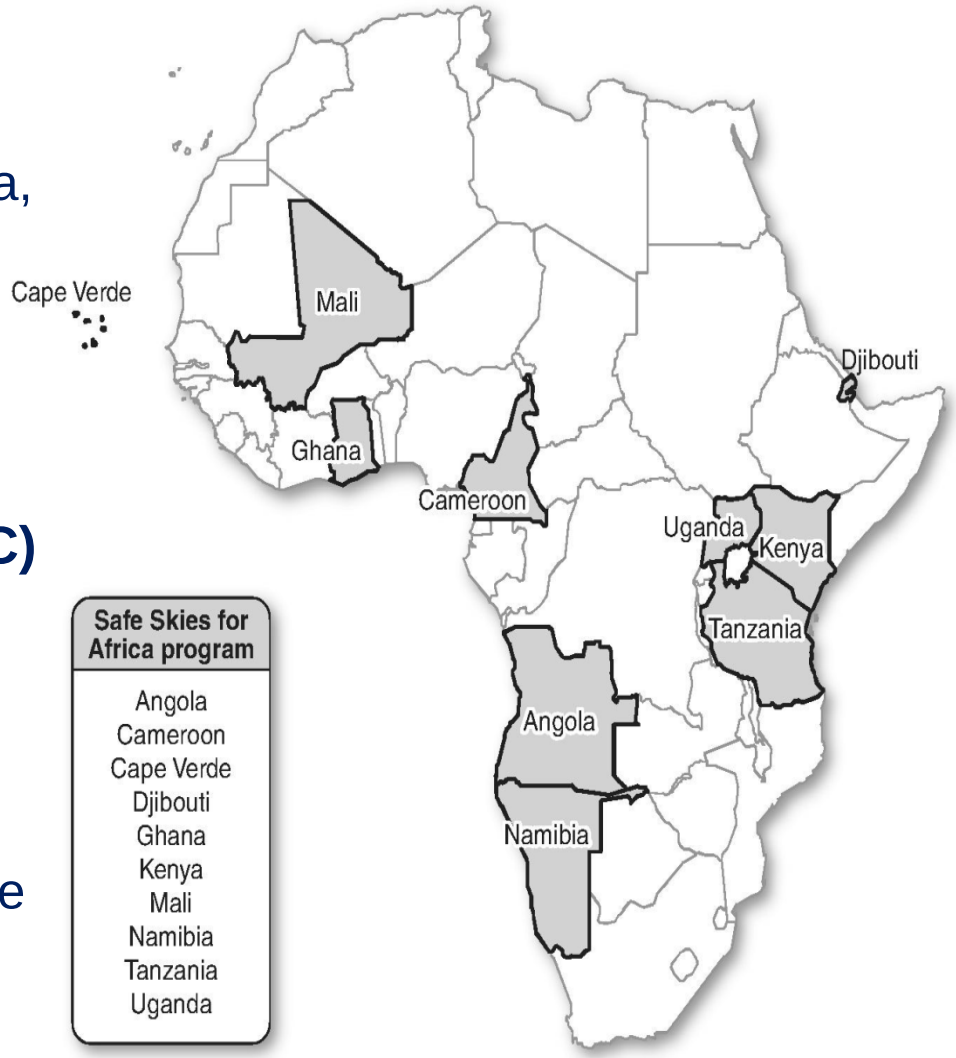
Regional focus:

East African Community (EAC)

Kenya, Tanzania, Uganda, Rwanda, Burundi

Banjul Accord Group (BAG)

The Gambia, Ghana, Nigeria, Liberia, Sierra Leone, Cape Verde



NTSB and Safe Skies for Africa

Training and Technical Assistance

Accident Investigation Workshops

Nigeria – An African Success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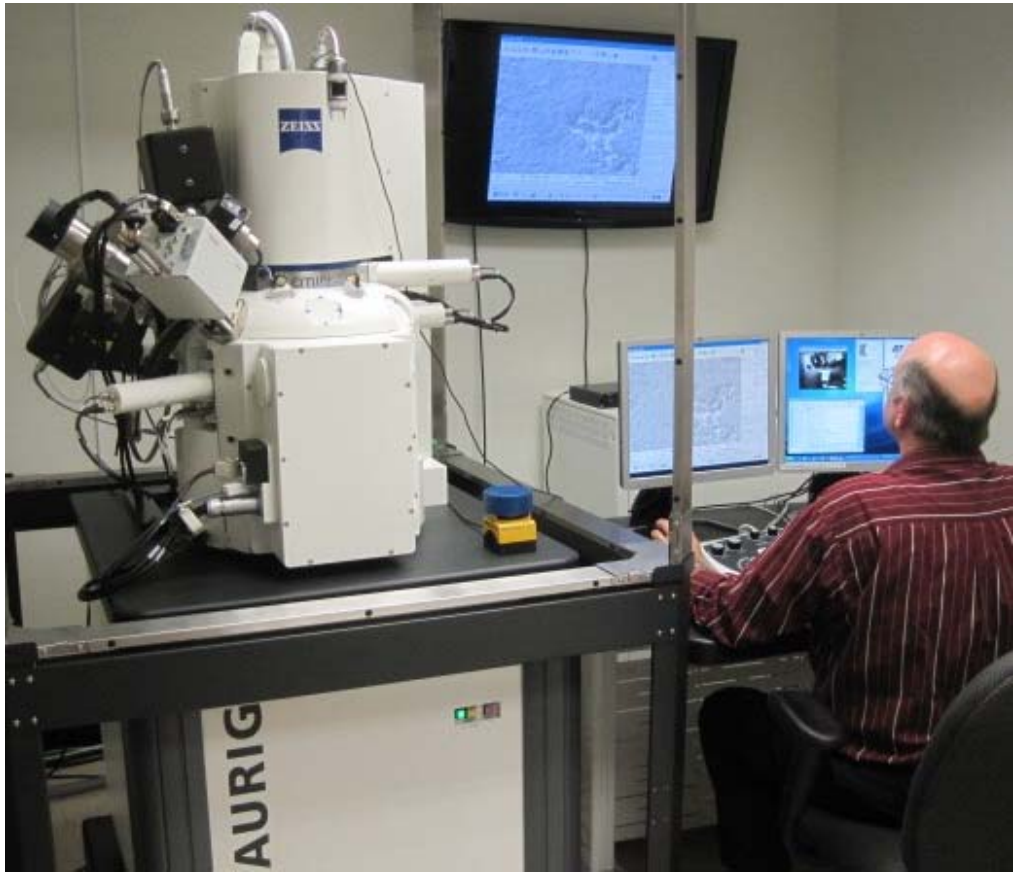
Global Collaboration with Domestic Impact

Materials Laboratory
Michael Budinski

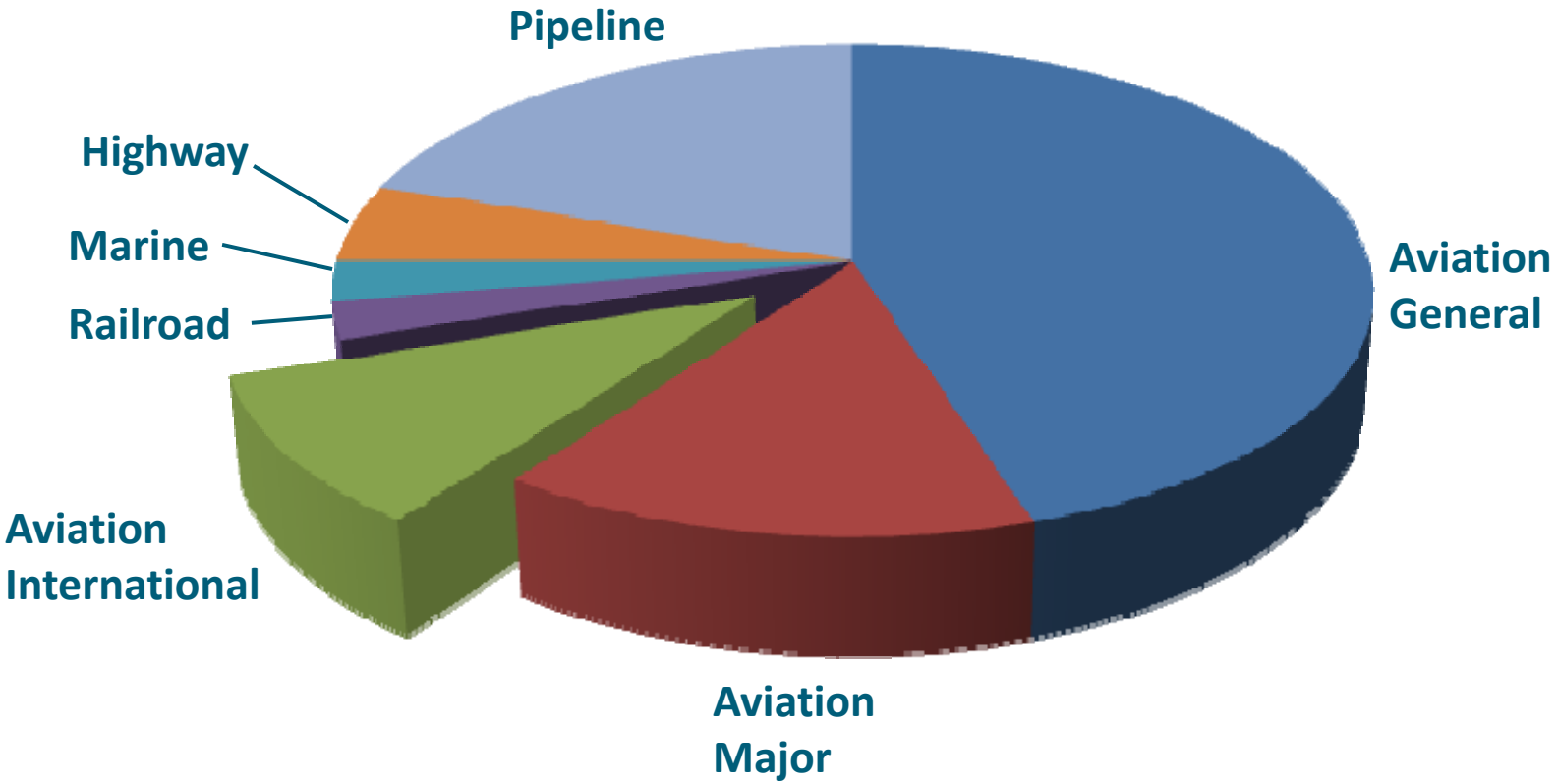
Materials Laboratory: International Overview

- Technical specialists:
  - Materials science
  - Metallurgy
  - Fire science
- Laboratory
  - Material failure analysis
  - Structural analysis
  - Group examinations
  - Experimental testing
  - On-scene examinations
  - Consultation



Materials Laboratory: International Overview

12-month "snap shot" of Materials Laboratory work based on labor hours



El Al Flight 027, Boeing 777-200, Tel Aviv, Israel

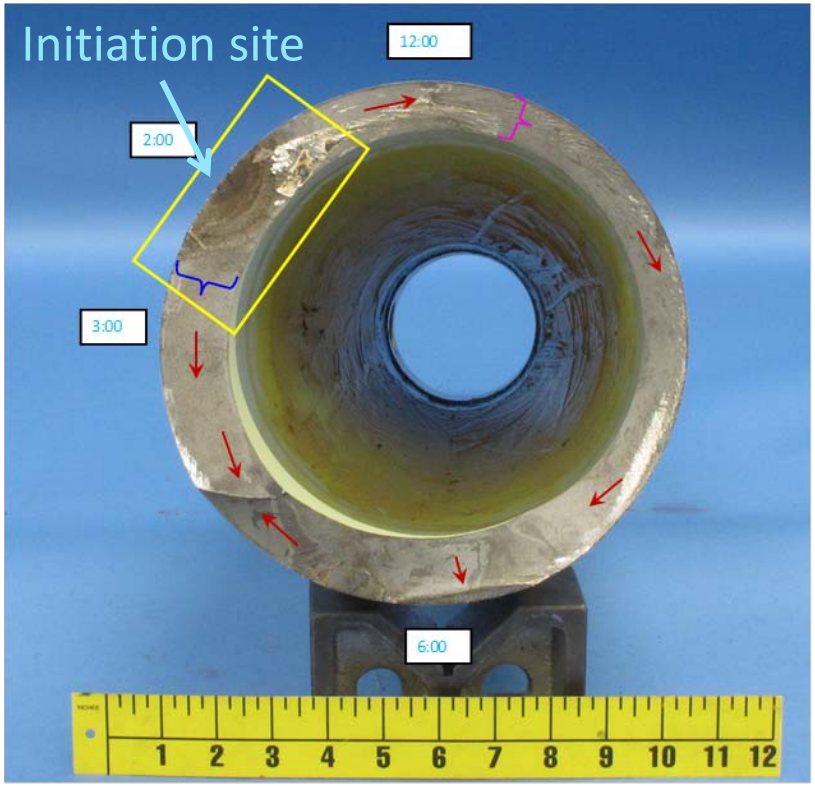
- **Normal takeoff from Ben Gurion International Airport—the left main landing gear (MLG) did not retract**
- **Aircraft returned to airport and landed without incident**

El Al Flight 027, Boeing 777-200, Tel Aviv, Israel

- **Post-flight inspection revealed fractured left MLG forward trunnion**

El Al Flight 027, Boeing 777-200, Tel Aviv, Israel

- Metallurgical analysis of the fractures, materials and specialized crack inspection
- Failure from fatigue at grinding burn cracks
- Examination of MLG steps at the overhaul shop in Singapore
- Opportunities identified to lower the probability of recurrence

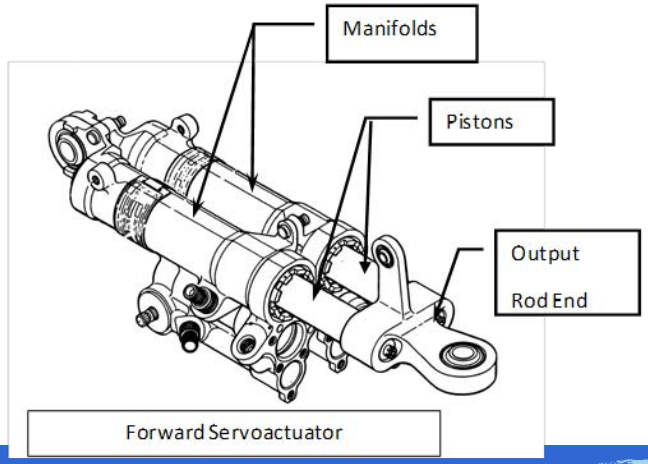


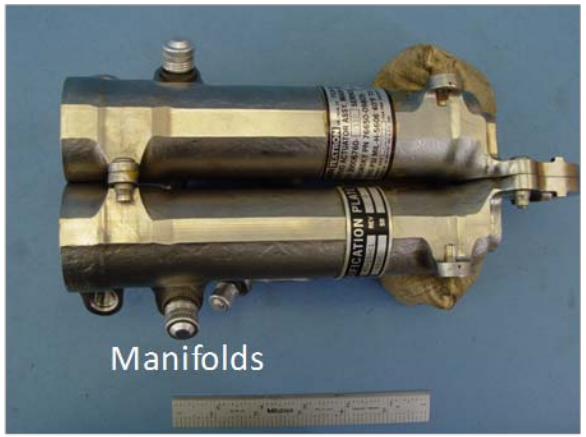
Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

- Copterline Sikorsky S-76C+ helicopter (OH-HCI Finland), crashed into the Baltic Sea shortly after takeoff from Tallinn, Estonia
- The investigation revealed the failure of the forward main rotor actuator

Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

The NTSB conducted a metallurgical evaluation of the main rotor forward actuator components, exemplar actuator pistons, and other system components

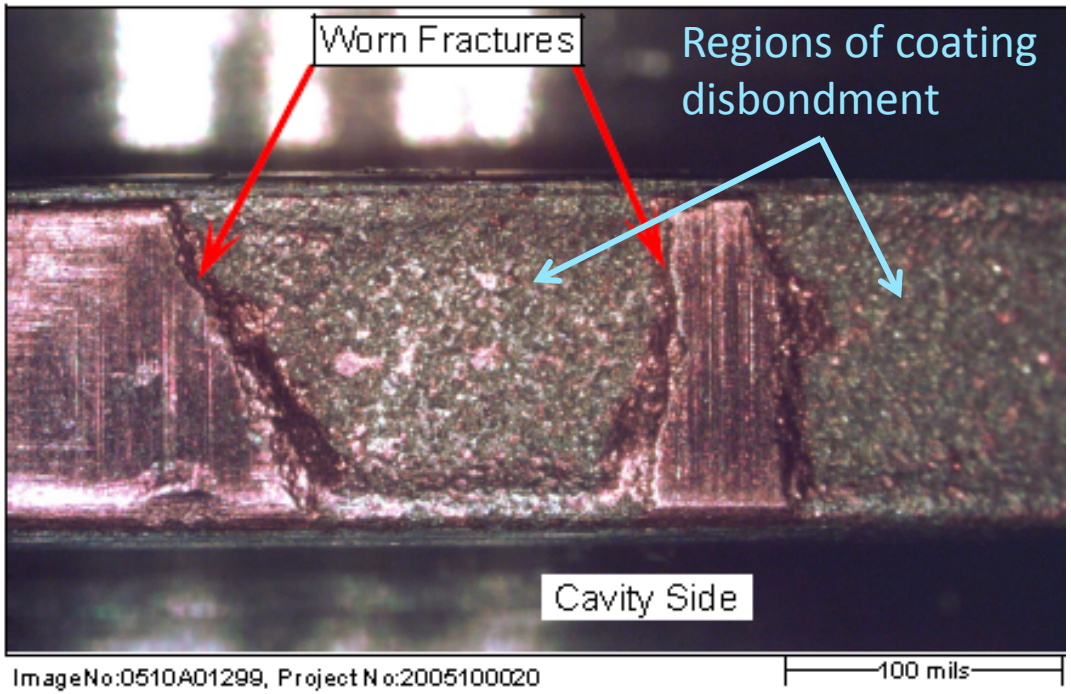




Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

Metallurgical evaluation revealed failure of the coating system on the actuator pistons

- Excessive wear of components
- Hydraulic fluid leakage
- Blockage of a fluid return port



Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

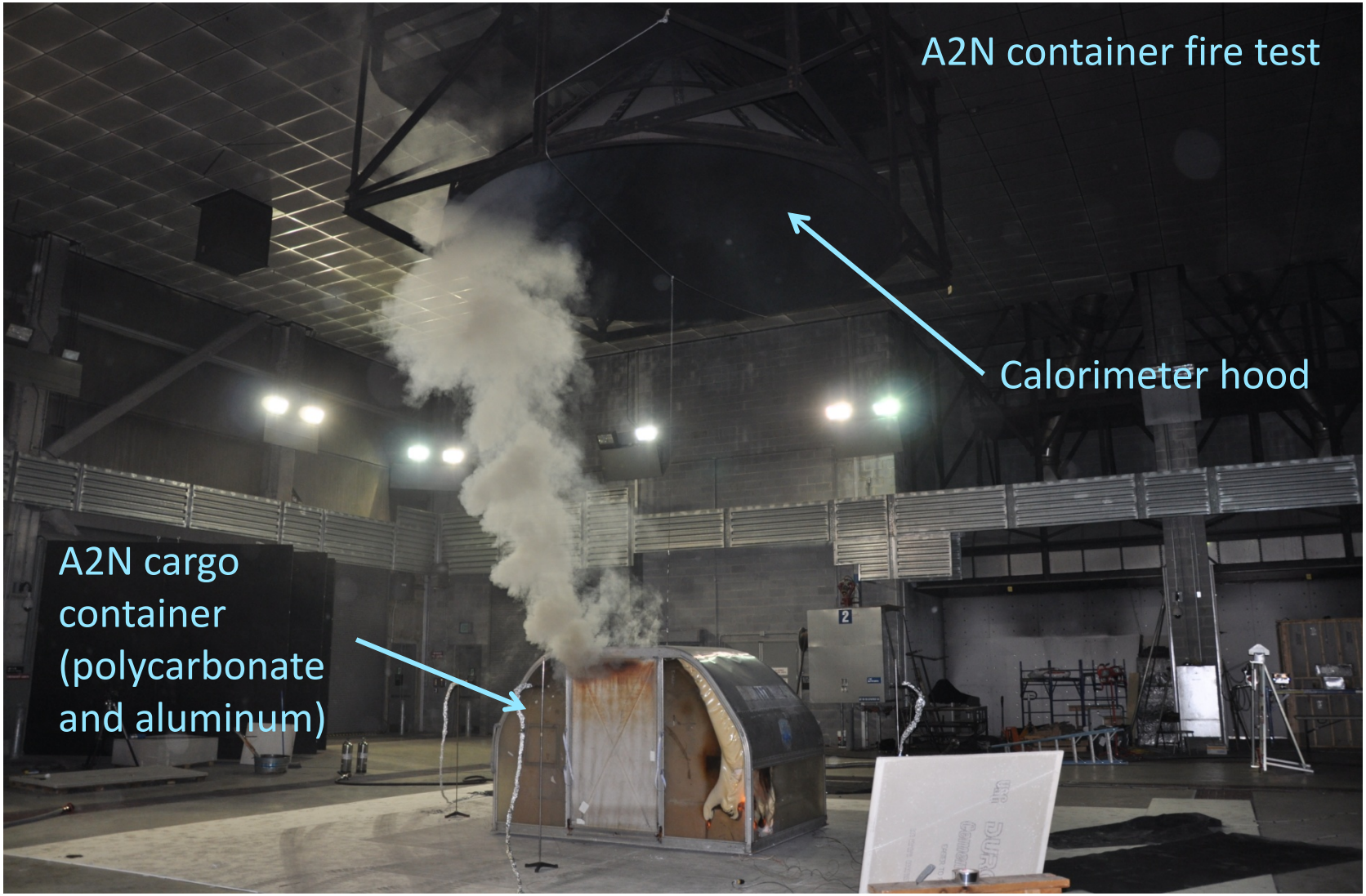
NTSB Safety Recommendations A-05-33 through -35 issued, which ask for:

- Immediate leakage testing of in-service actuators
- Visual and laboratory examination of hydraulic fluid filters
- Preflight check of flight control “stick jump” and control movement smoothness

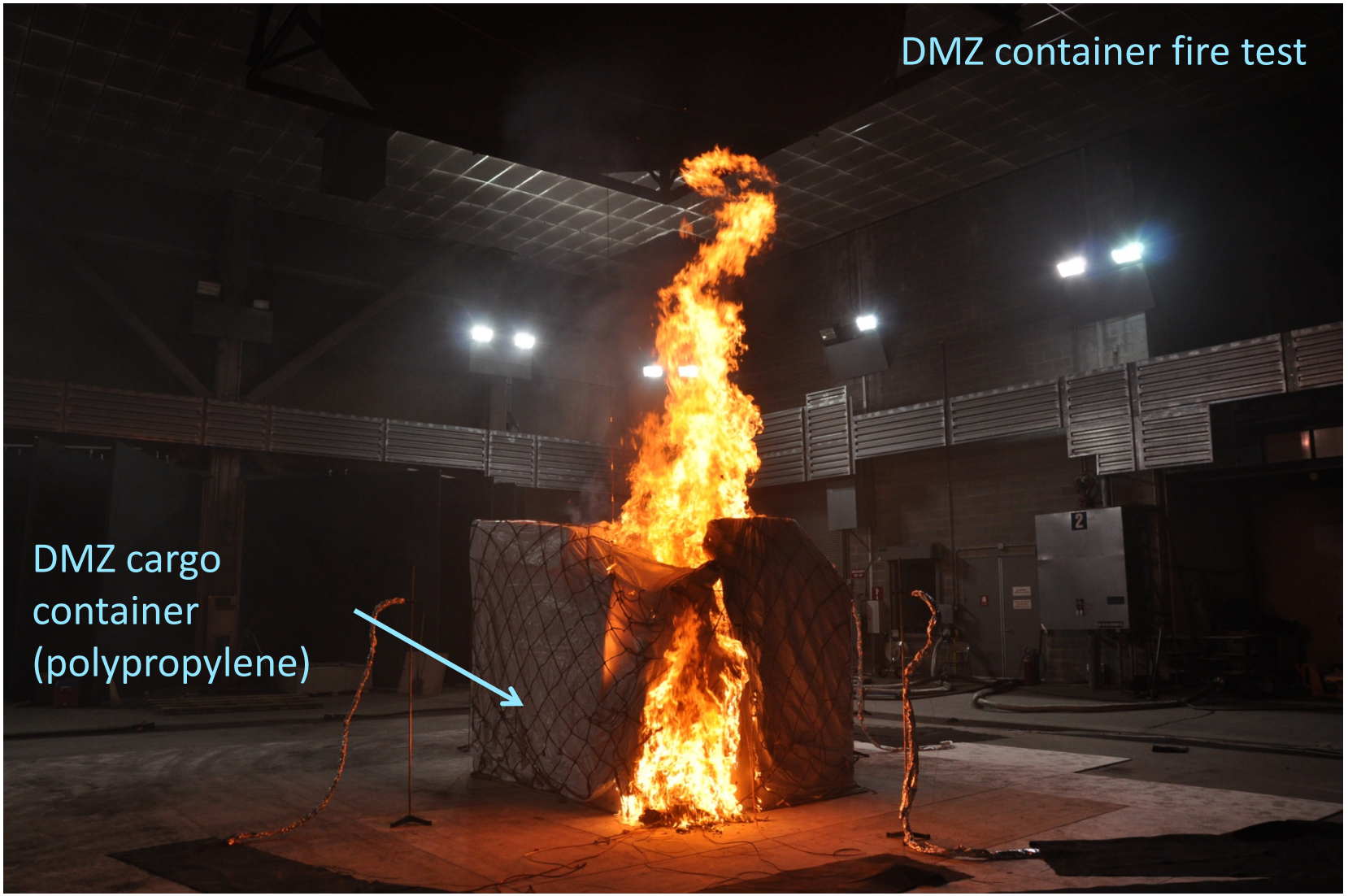
UPS Flight 6, Boeing 747-400F, Dubai, UAE

- NTSB Materials Laboratory fire investigator on scene
- Developed a fire test program to understand cargo fires:
  - Quantify the fire load posed by lithium-ion batteries relative to ordinary combustibles
  - Quantify the size and growth rate of a cargo container fire

UPS Flight 6, Boeing 747, Dubai, UAE



UPS Flight 6, Boeing 747, Dubai, UAE

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Global Collaboration with Domestic Impact

Flight Recorders and Electronic Devices

James Cash

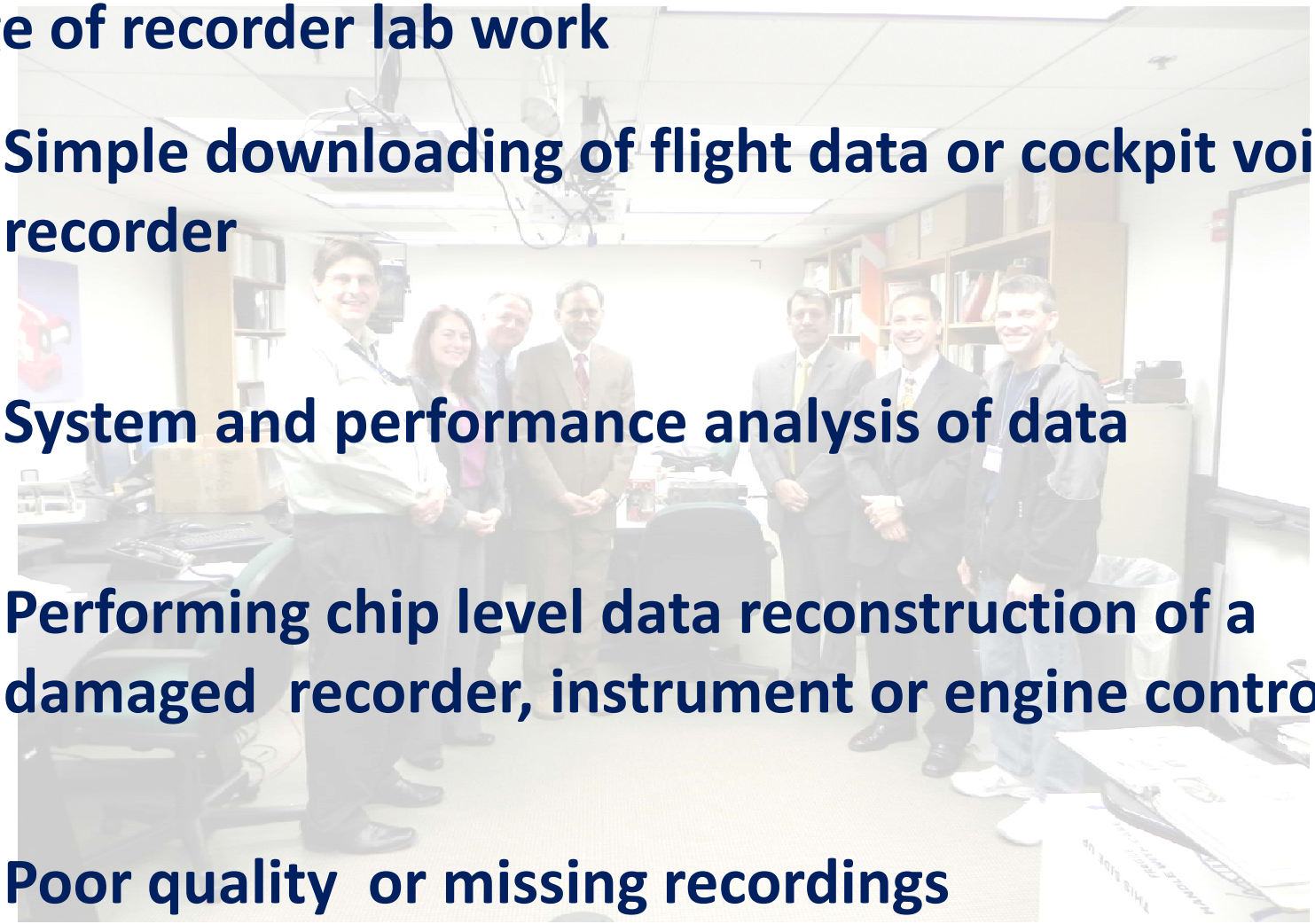
Yearly Workload

- 30% of recorder lab's work is reading out of flight and voice recorders for foreign governments
- In 2010, recorder lab received over 40 recorders from 14 different countries
- Another 30 to 40 cases required support

NTSB Products

Range of recorder lab work

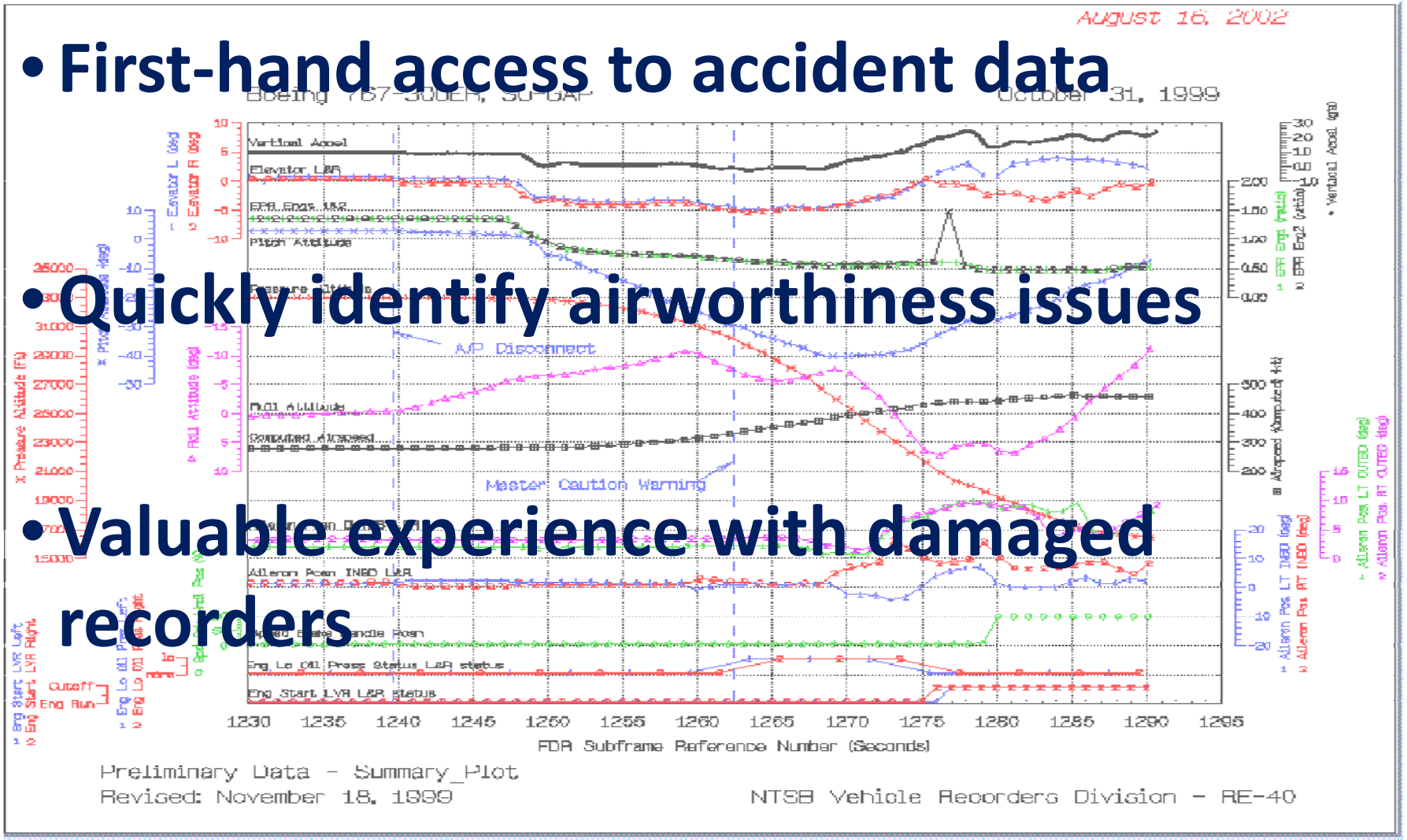
- Simple downloading of flight data or cockpit voice recorder
- System and performance analysis of data
- Performing chip level data reconstruction of a damaged recorder, instrument or engine controller.
- Poor quality or missing recordings



Animations

Benefits

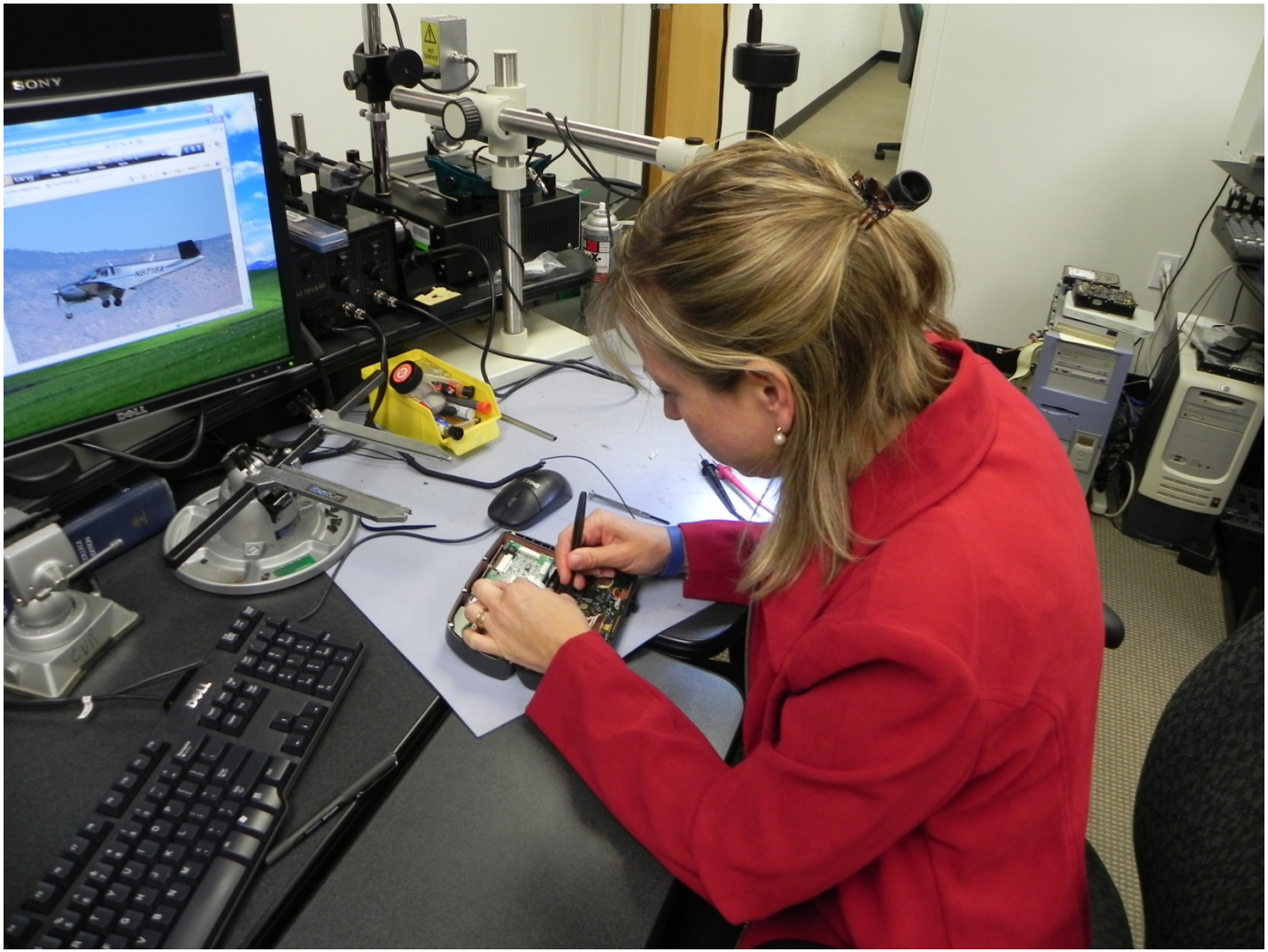
- First-hand access to accident data
- Quickly identify airworthiness issues
- Valuable experience with damaged recorders



New Electronic Technology and Equipment

Recorder lab is adding new equipment

- Technology is changing and growing rapidly
- Hardware tools
  - New recorder readout equipment
  - Board and chip level evaluation
  - Data recovery
- Software tools
  - Reverse engineering of data encoding
  - Reconstruction of accident flight data


SONY
DELL

Annex 13 Involvement

- NTSB will send a recorder specialist to assist in the download and readout of flight recorders

- The lab frequently will interface between foreign data requests and U.S. manufacturers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Data Gathering and Sharing

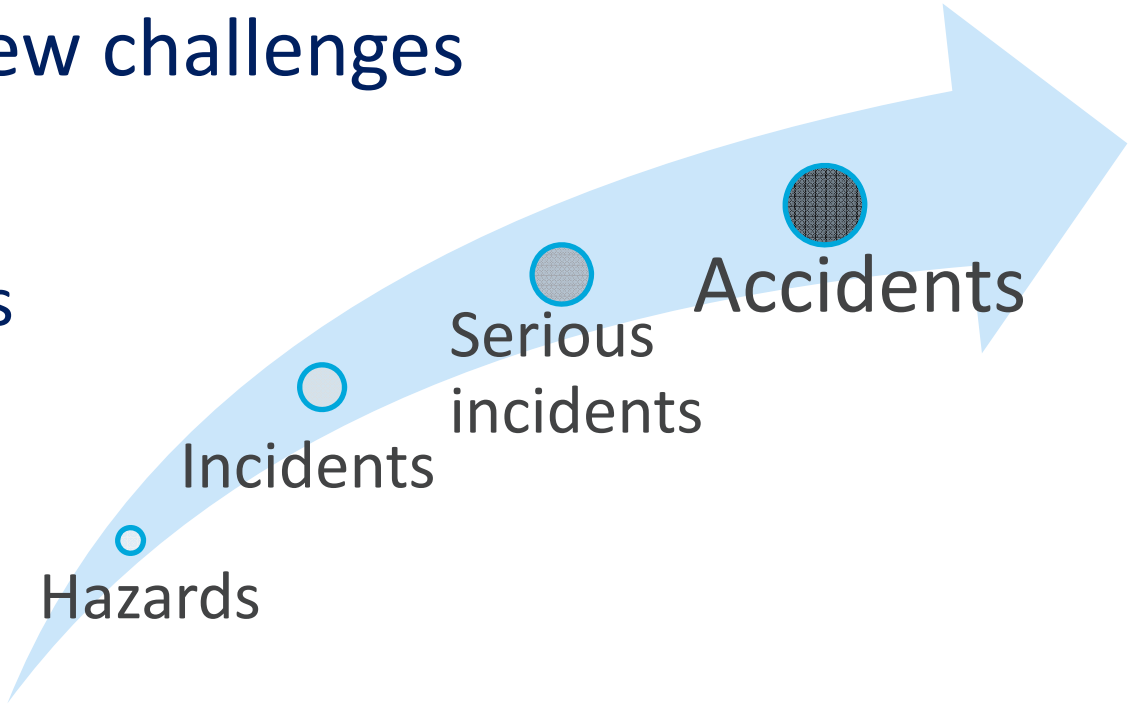
Loren Groff, PhD

ICAO Standards and Recommended Practices

- Notification and reporting
- Mandatory and voluntary reporting systems
- Database systems and analysis
- Exchange of safety information

Expanding Use of Data Systems

- Safety management programs demand more data
- Demand brings new challenges
  - Standardization
  - Legal protections



Adopting Common Standards and Techniques

- CAST/ICAO Common Taxonomy Team (CICTT)

- European Coordination Centre for Accident and Incident Reporting Systems (ECCAIRS)

Developing Common Standards and Techniques

- ICAO Safety Indicator Study Group (SISG)

Addressing Shared Challenges

- Diverse legal frameworks
  - Safety Information Protection Task Force (SIP TF)
- Safety management procedures
  - ICAO Safety Management Advisory Group (SMAG)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Global Collaboration with Domestic Impact

International Family Assistance Efforts

Paul Sledzik

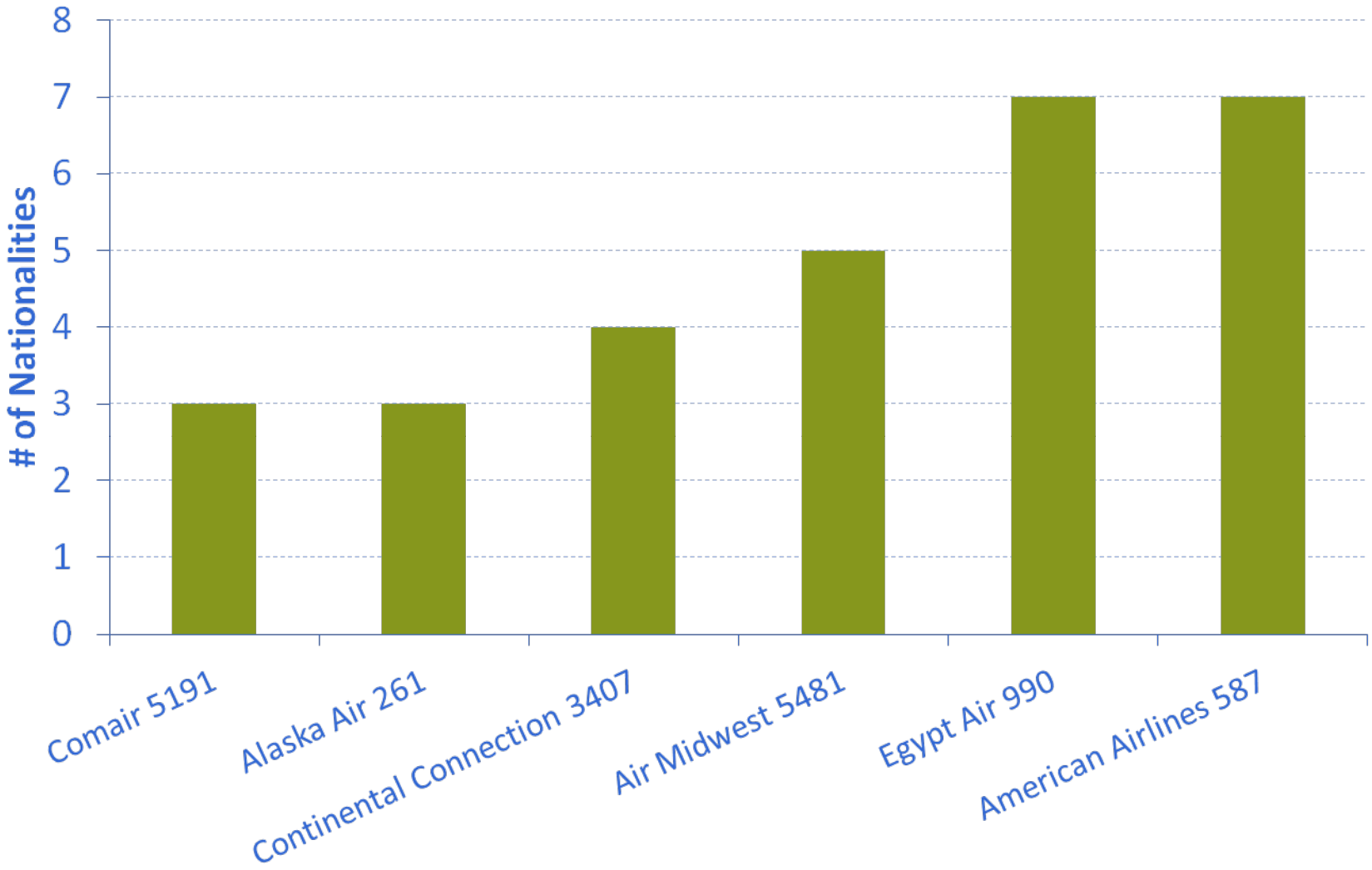
Legislative Background

- Aviation Disaster Family Assistance Act of 1996
  - Foreign Air Carrier Family Support Act of 1997
  - Rail Passenger Disaster Family Assistance Act of 2008

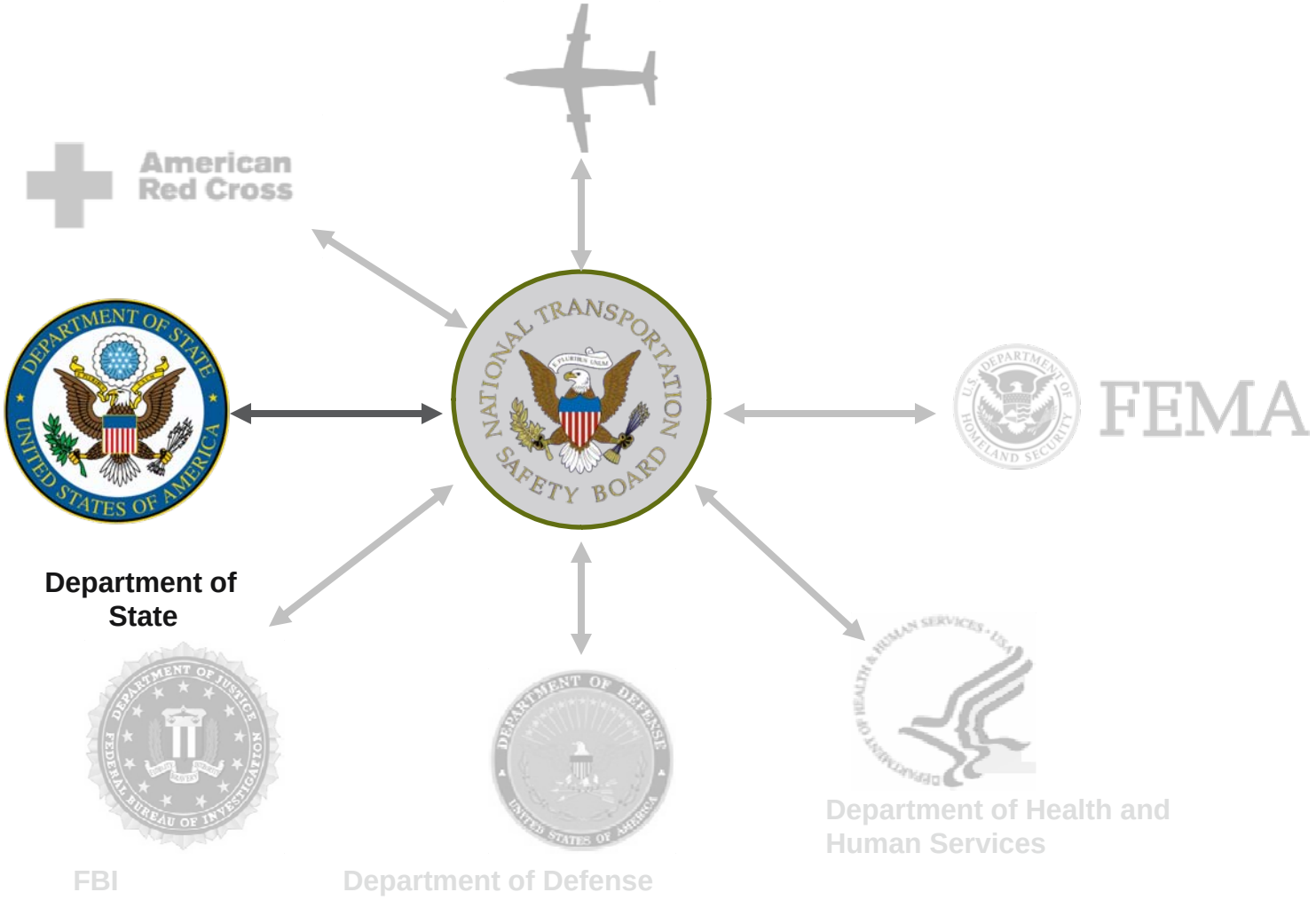
- Accidents in U.S. or territories
- Part 121 or 129 air carrier
- Major loss of life

TDA Primary Partner Agencies

Nationalities in Domestic Accidents



TDA Primary Partner Agencies



Department of State Roles & Responsibilities

- Notification to families
- Crisis response team
- Ombudsman with local government agencies

U.S. Department of State Foreign Affairs Manual Volume 7 – Consular Affairs

7 FAM 1830
AVIATION AND OTHER TRANSPORTATION DISASTERS

(CT:CON-291; 04-07-2009)
(Office of Origin CA/OCS/PRI)

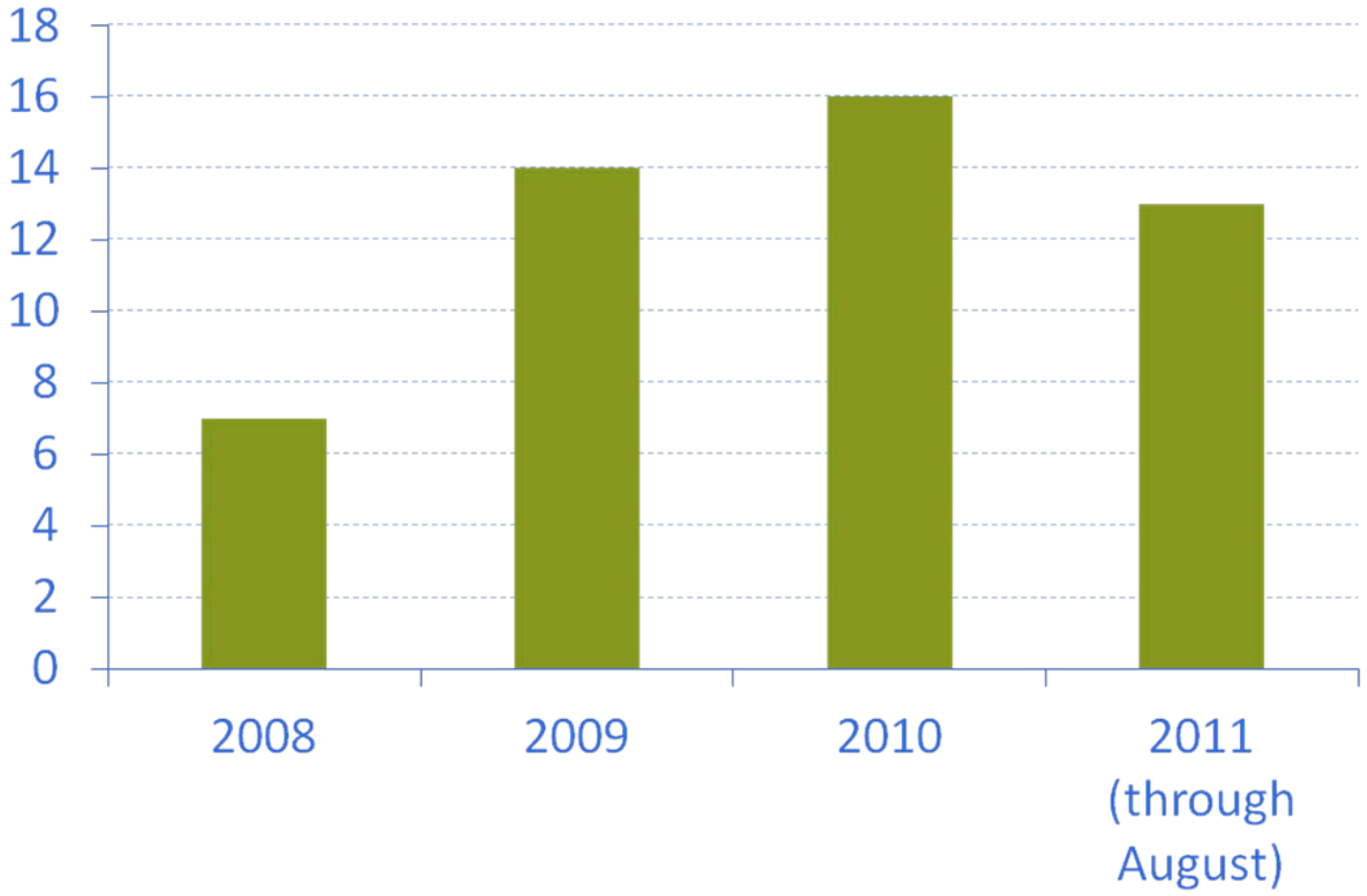
7 FAM 1831 INTRODUCTION

(CT:CON-212; 11-20-2007)

a. The U.S. Department of State is responsible for coordinating and managing the federal response to aviation disasters involving U.S. citizens abroad. In recent years the Department has made significant changes to the way that it handles aviation disasters that involve U.S. citizens outside the United States. These changes are highlighted in this subchapter and include:

http://www.state.gov/documents/organization/86830.pdf

TDA Caseload Supporting International Accidents



International Accidents Supported by TDA

- Zacapa, Guatemala
- August 24, 2008
- 11 fatal, 3 serious
  - -10 U.S. citizen aid workers
- Cessna 208

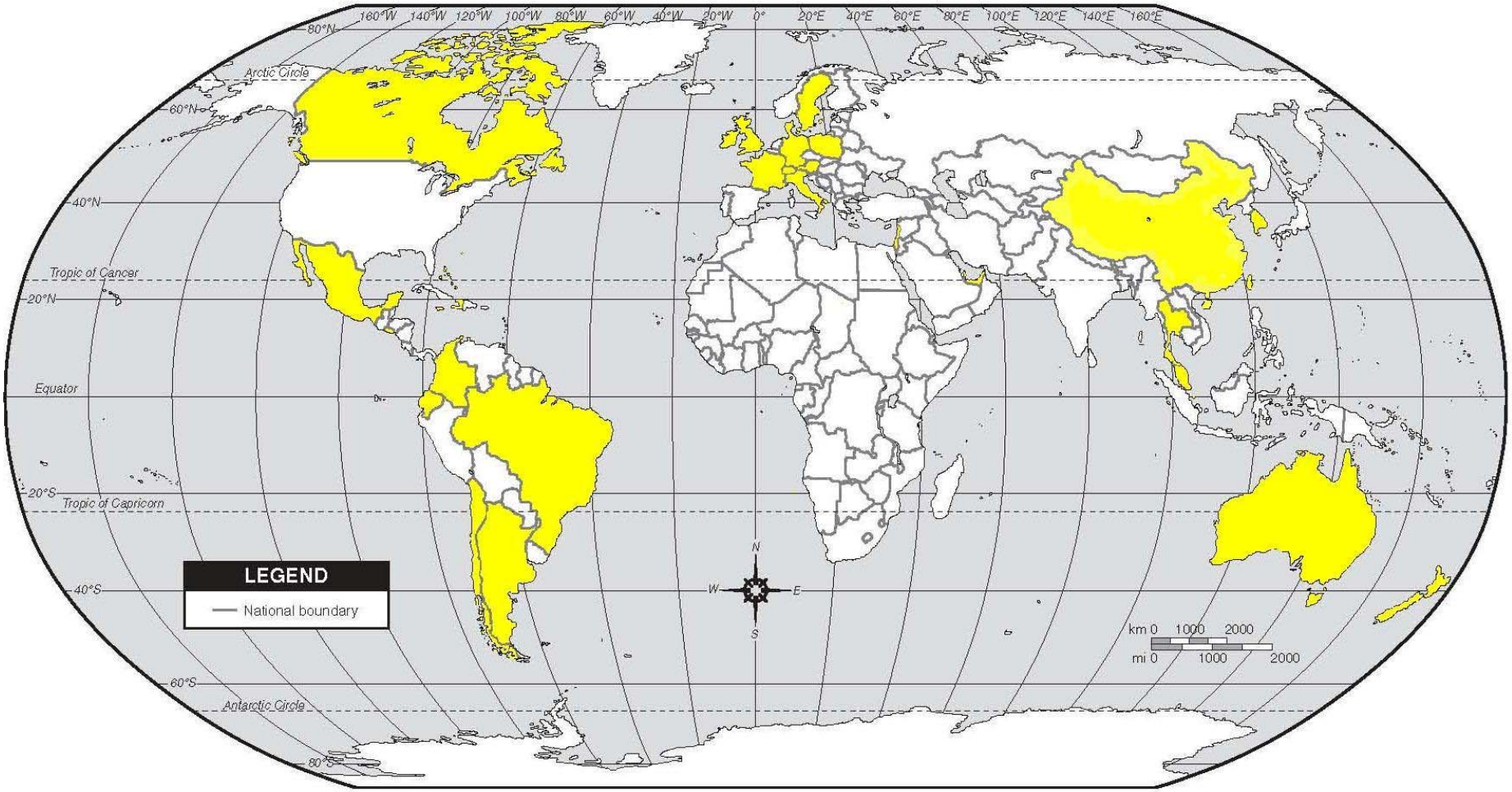
- Dubai, UAE
- September 3, 2010
- 2 fatal – both U.S. citizens
- Boeing 747-44AF

Family Assistance: Promoting an International Approach for the Transportation Industry

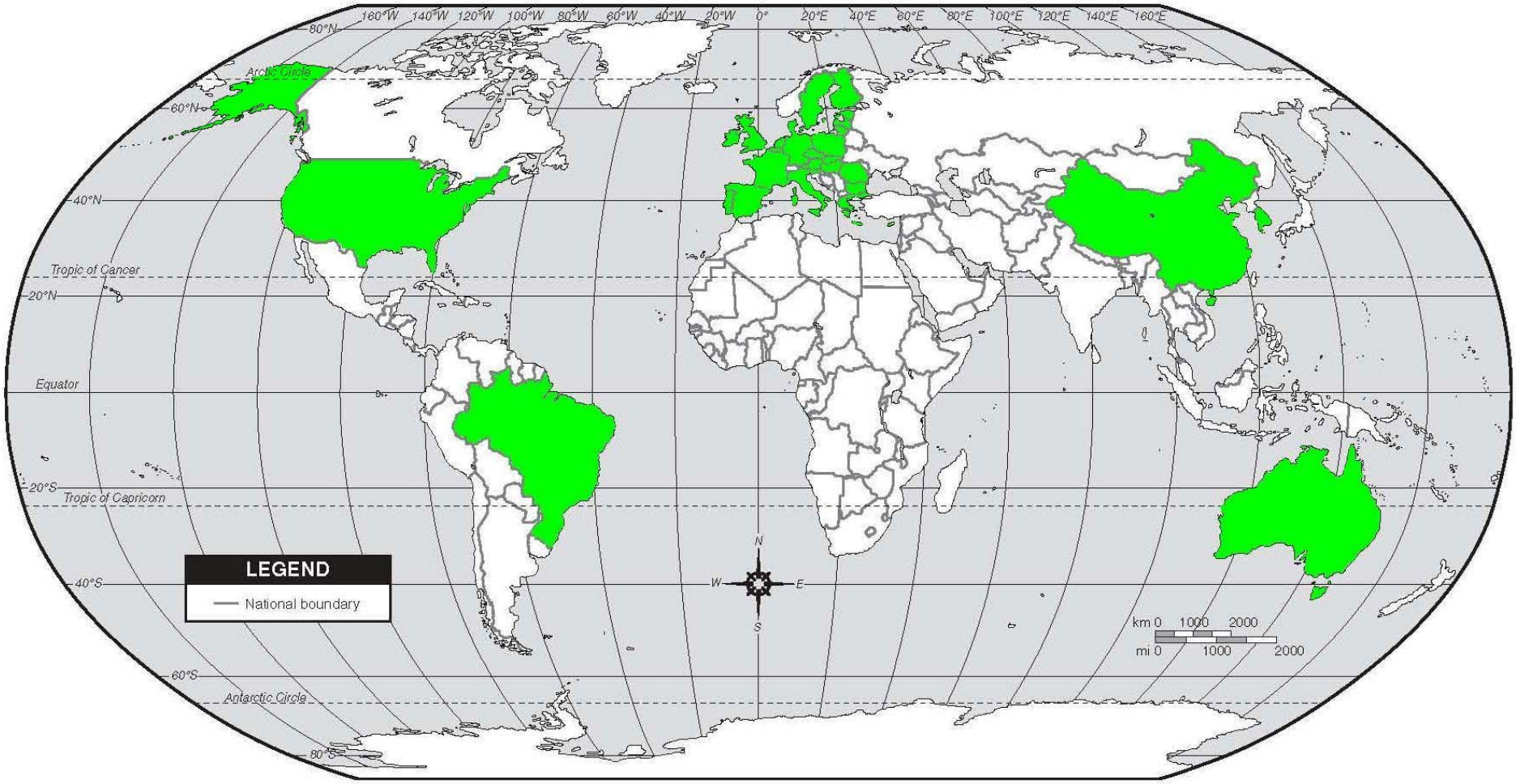
Family Assistance

Promoting an International Approach for the Transportation Industry

TDA Trainings - International Attendees (2005-2011)

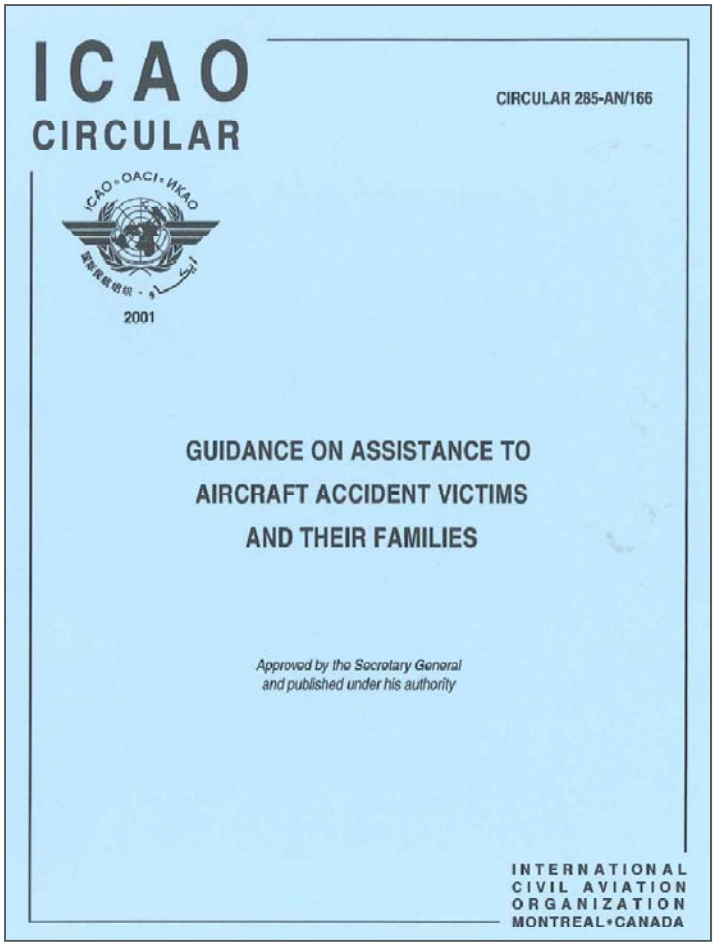


International Family Assistance Legislation



Data sources: Airports Council International; ICAO

ICAO Circular 285 Revision


ICAO
CIRCULAR

CIRCULAR 285-AN/166

2001

GUIDANCE ON ASSISTANCE TO
AIRCRAFT ACCIDENT VICTIMS
AND THEIR FAMILIES

Approved by the Secretary General and published under his authority

INTERNATIONAL
CIVIL AVIATION
ORGANIZATION
MONTREAL•CANADA

- Executive Summary
- Terminology
- Recipients of family assistance
- Guidelines for the provision of
- Types of family assistance
- When family assistance should be provided
- Family assistance providers
- Preparation of a family assistance plan
- Conclusion
- Appendices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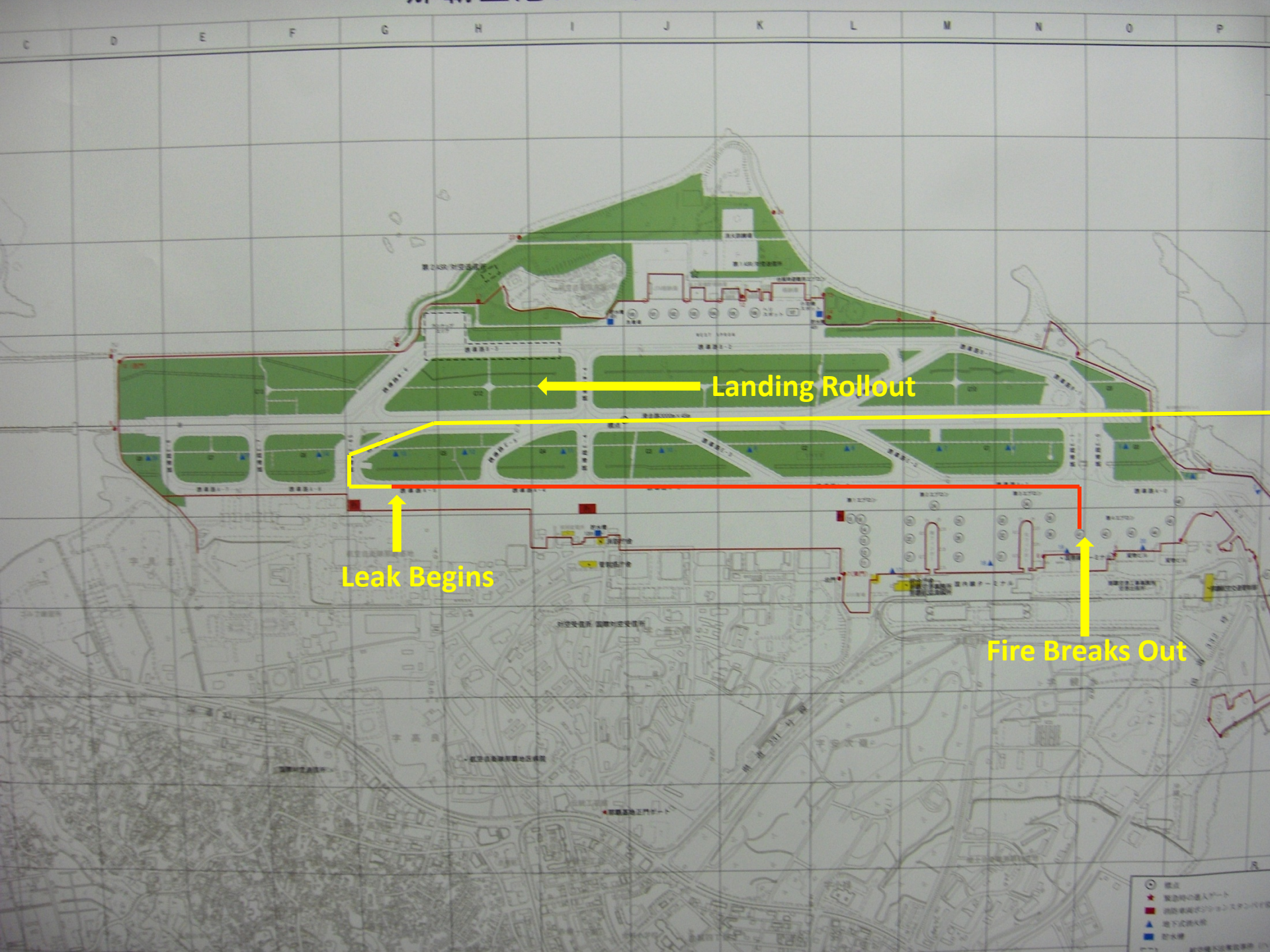
Global Collaboration with Domestic Impact

Naha, Okinawa – China Airlines Boeing 737 Fuel Leak and Fire

Robert Benzon

Basic Information

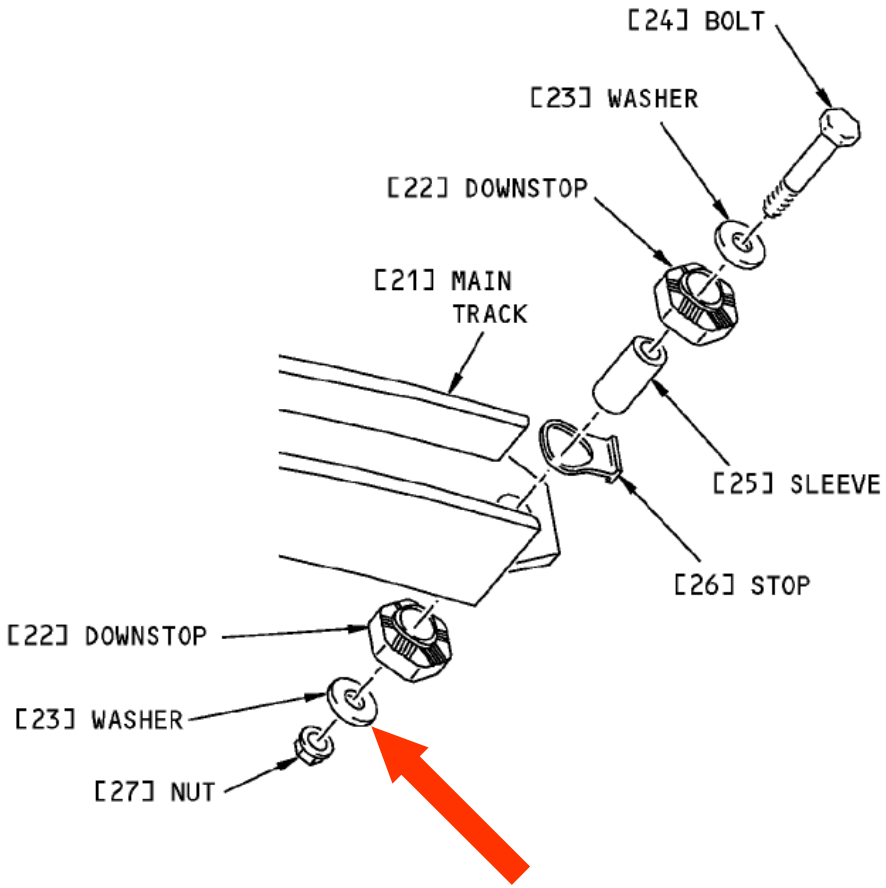
- August 20, 2007 10:35 AM
- China Airlines Flight 120
- 157 passengers, 8 crewmembers (no injuries)
- Taipei, Taiwan, to Naha, Okinawa
- Investigated by Japan Aviation and Railroad Accident Investigation Committee


Landing Rollout
Leak Begins
Fire Breaks Out

Video of Fire

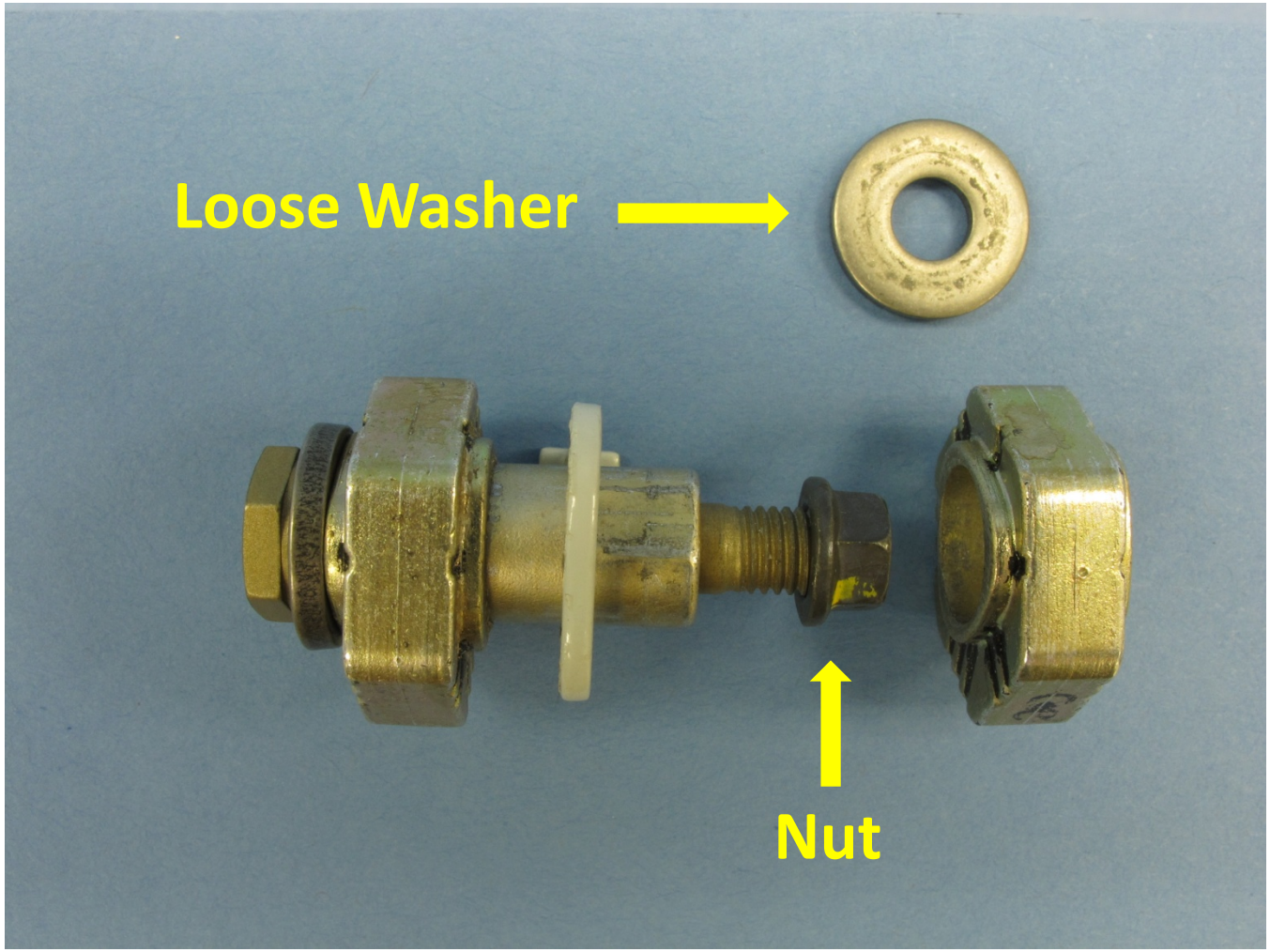

ハナさんHANAsan
http://rchide.web.fc2.com/

Slat Track Downstop Assembly



WASHER NOT INSTALLED DURING EARLIER MAINTENANCE

Damaged Can


Loose Washer
Nut

Immediate Government Actions

- Japan Civil Aviation Bureau Emergency Airworthiness Directive
- Taiwan Civil Aviation Authority Emergency Airworthiness Directive
- U.S. Federal Aviation Administration Emergency Airworthiness Directive

Manufacturer Actions

- **Rapid Boeing redesign of bolt/nut assembly**
- **Immediate Boeing cross-model safety review (B707/DC-9 through B777)**

FAA Emergency AD Results

- 21 missing/loose washers discovered on U.S. Boeing 737s
- Any of these anomalies, if not discovered, could have led to an in-flight fuel leak and/or ground fuel leak, and subsequent fire.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International Investigations

Global Collaboration with Domestic Impact

Dubai UAE – UPS Boeing 747F, In-Flight Fire

Bill English

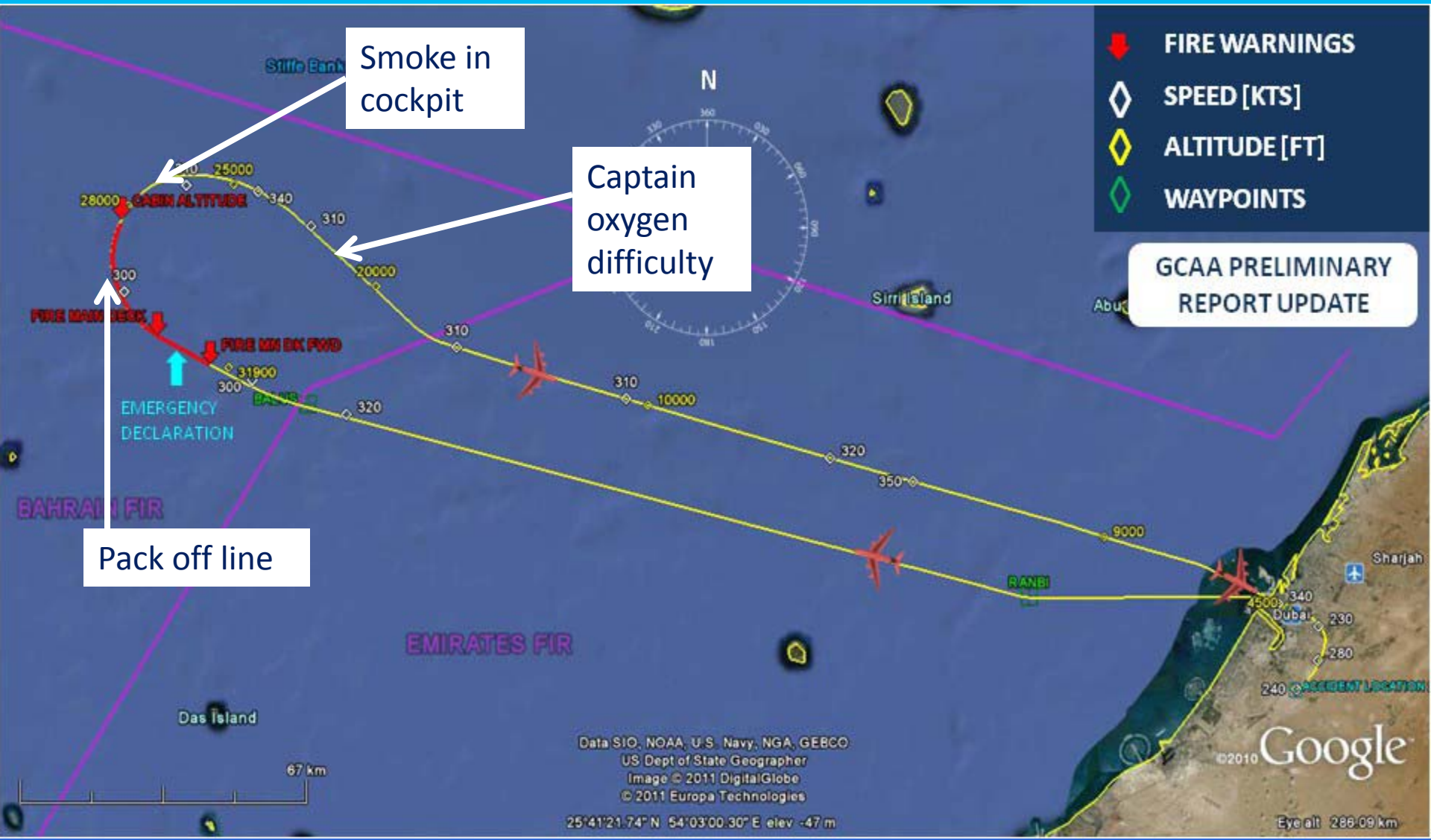
Investigation Information

- UAE GCAA leads investigation
  - ICAO Annex 13
- U.S. Involvement
  - State of Manufacture, Registry, Operator
- Open investigation
  - no conclusions
- NTSB, FAA, UPS, Boeing, IPA responded

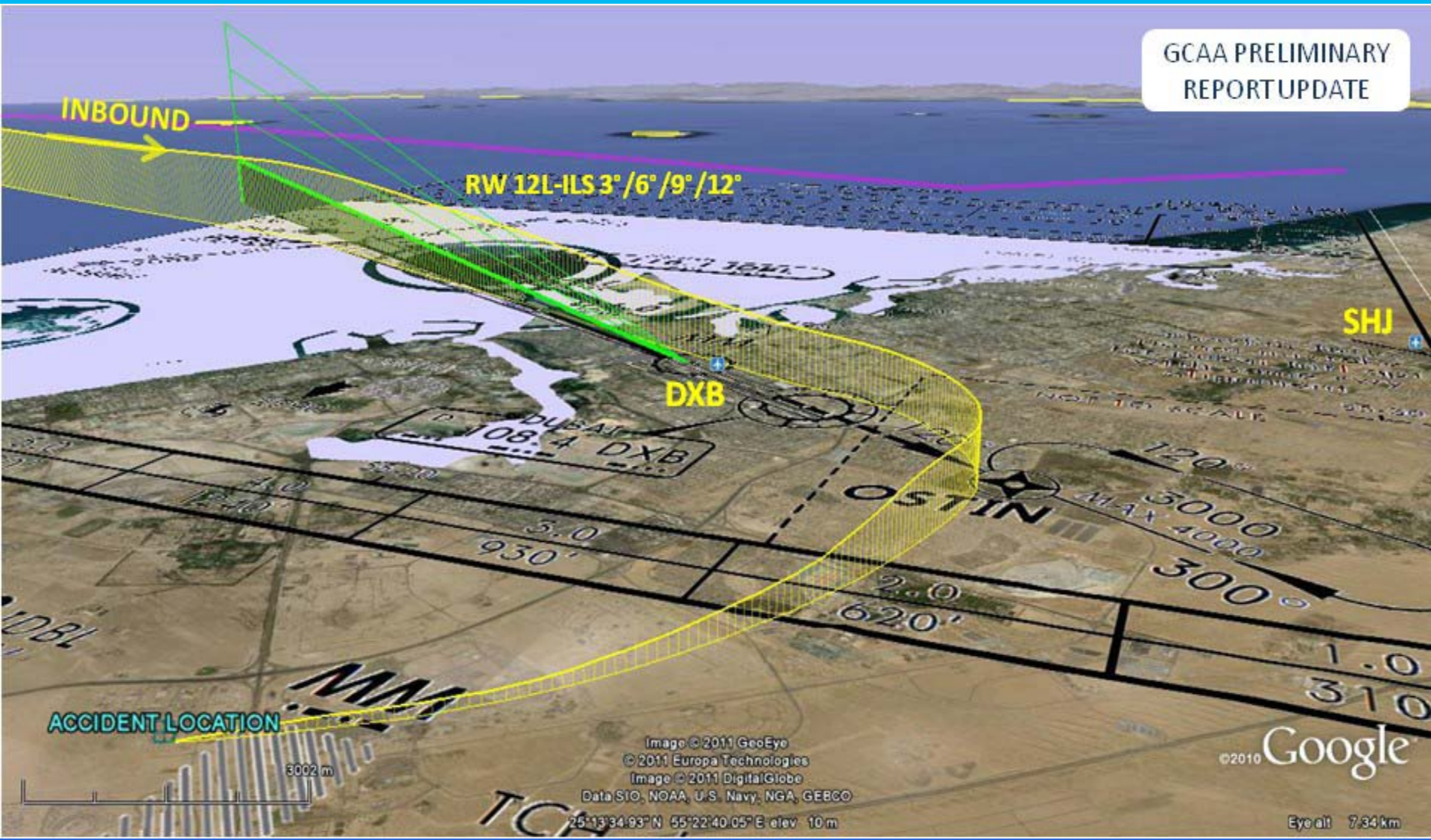
Initial Information

- Scheduled cargo flight to Cologne
  - Many shipments of lithium batteries
- At FL320, crew reported fire alarm
- Turned back to Dubai (120 nm)
- Began descent and initiated FIRE MAIN DECK checklist
  - Depressurizes cargo deck
  - Donned masks and goggles

Flightpath


Smoke in cockpit
Captain oxygen difficulty
Pack off line
EMERGENCY DECLARATION
FIRE WARNINGS
SPEED [KTS]
ALTITUDE [FT]
WAYPOINTS
GCAA PRELIMINARY REPORT UPDATE
28000
CABIN ALTITUDE
25000
340
310
20000
300
FIRE MAIN DECK
FIRE MN DK FWD
31900
310
10000
320
350
9000
RANBI
BAHRAIN FIR
EMIRATES FIR
Das Island
Sirri Island
Sharjah
Dubai
340
230
280
240
67 km
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
US Dept of State Geographer
Image © 2011 DigitalGlobe
© 2011 Europa Technologies
25°41'21.74" N 54°03'00.30" E elev -47 m
©2010 Google
Eye alt 286.09 km

Flightpath


GCAA PRELIMINARY
REPORT UPDATE
INBOUND
RW 12L-ILS 3°/6°/9°/12°
DXB
SHJ
ACCIDENT LOCATION
OSTIN
3002 m
Image © 2011 GeoEye
© 2011 Europa Technologies
Image © 2011 DigitalGlobe
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
25°13'34.93" N 55°22'40.05" E elev 10 m
©2010 Google
Eye alt 7.34 km

Wreckage

Wreckage path coming out of screen, housing in background

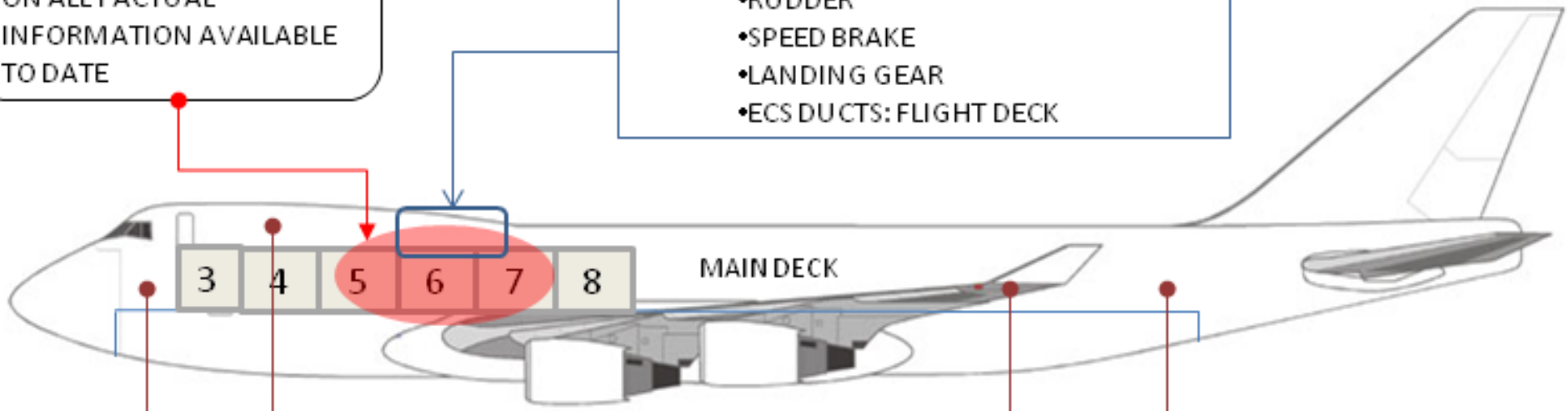
Follow-on Work

- Recorders
  - FDR, CVR, AHM
- Groups formed
  - Operations/Human Performance
  - Cargo
  - Systems
  - Fire

UPS B747-400F Layout

APPROXIMATE LOCATION OF ONBOARD FIRE BASED ON ALL FACTUAL INFORMATION AVAILABLE TO DATE

MECH CONTROL/ECS DUCTING LOCATION:
- •ELEVATOR
- •RUDDER
- •SPEED BRAKE
- •LANDING GEAR
- •ECS DUCTS: FLIGHT DECK



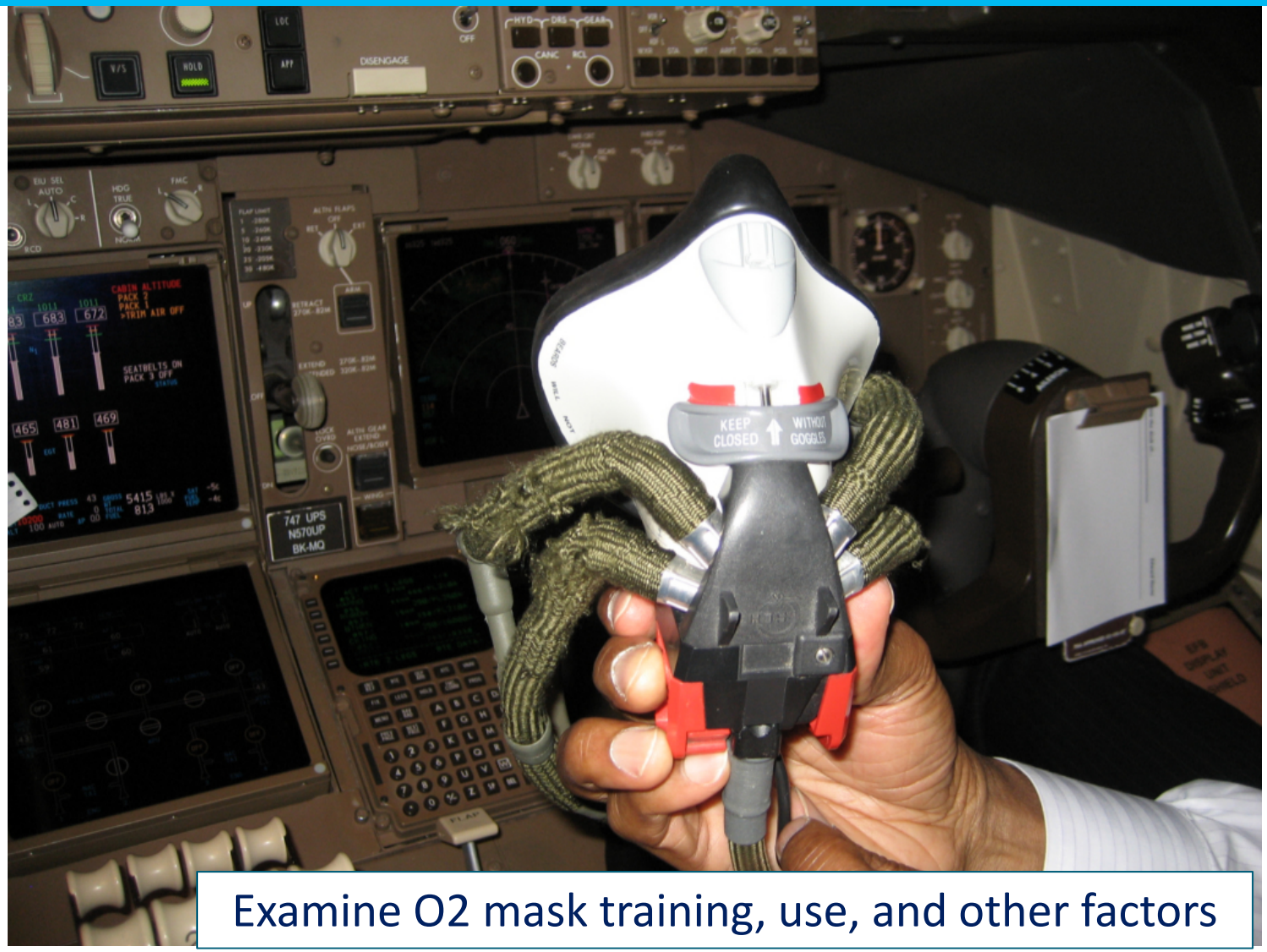
MAIN CARGO DECK SMOKE DETECTION	
TIME (UTC)	DFDR EVENT
15:12:54	FIRE MAIN DECK FWD
15:13:46	FIRE MAIN DECK
15:14:40	MAIN CARGO ZONE 12
15:15:15	CREW REST SMOKE
15:15:28	FIRE MAIN DECK AFT

Examine fire origin, detection and containment

Common Point of Failures

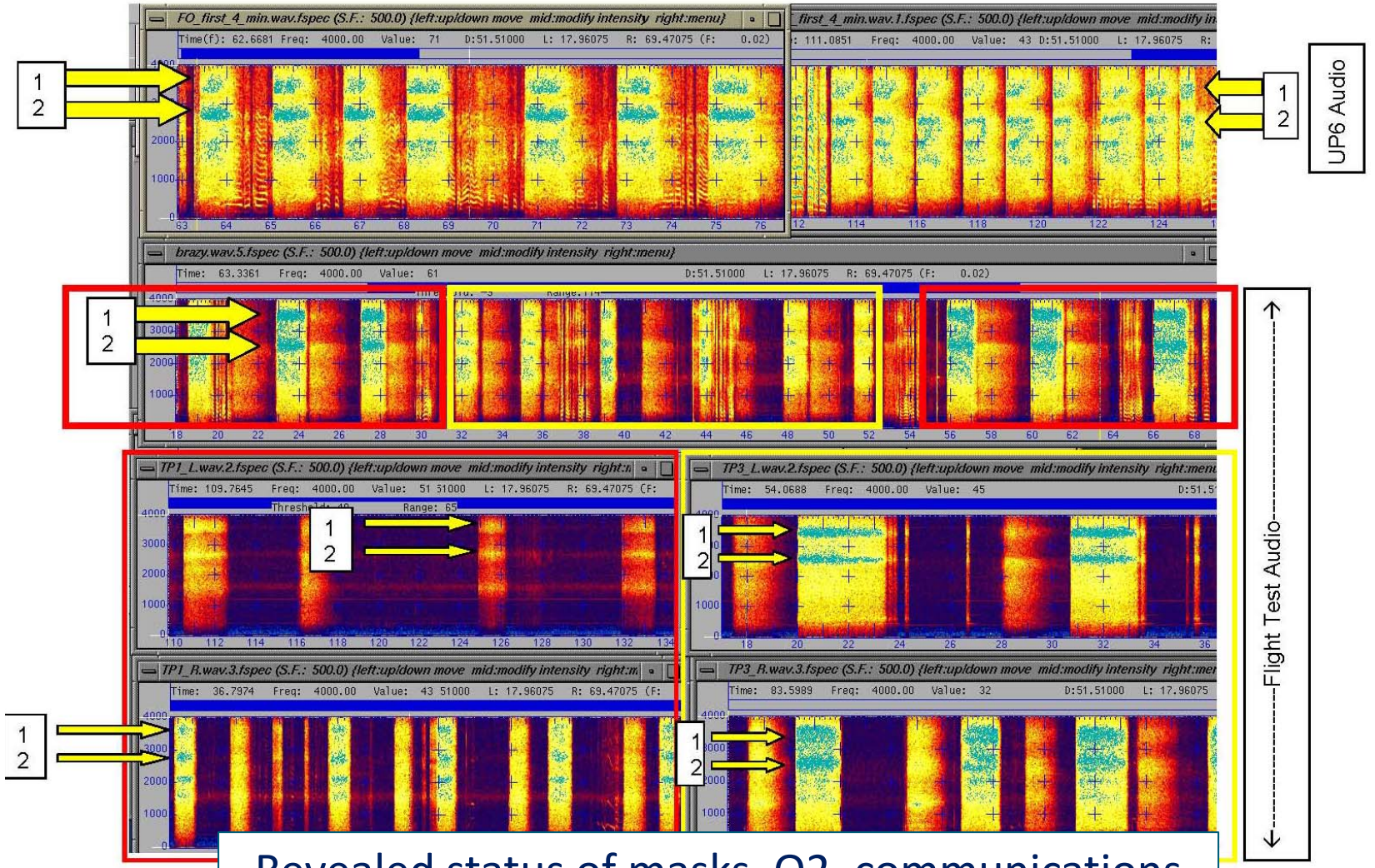
Examine aircraft systems between cargo and cockpit

Investigation Activities



Examine O2 mask training, use, and other factors

Sound Spectrum Study



Revealed status of masks, O2, communications

Fire Threat Investigation

Quantify the actual threats in air cargo

Safety Actions

- GCAA Updates and Releases
- FAA Lithium Battery SAFO
  - Rulemaking/ICAO WP pending
- ICAO/EASA lithium carriage
- Boeing/UPS checklist changes 747F
- Recommendations – crew training, mask use, etc.

Follow-on Testing Support

- GCAA lead
- Boeing – simulator, timelining, systems and FDR analysis, etc.
- UPS – test flights, cargo information
- IPA – flight operations
- FAA – hazmat, aircraft certification, tech center
- BATFE – fire testing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International Investigations

Global Collaboration with Domestic Impact

United States – Pilatus PC-12, Butte, Montana

Dennis Diaz

Investigation

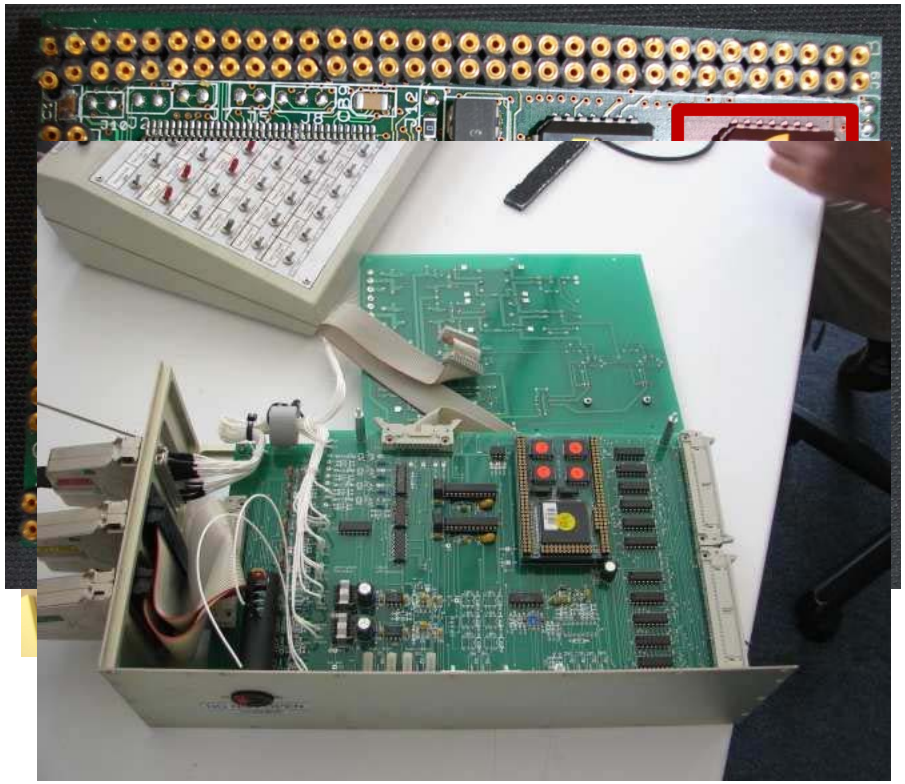
- Documentation and data gathering
- Wreckage exhibited extensive impact damage and fire-related damage
- No flight data or cockpit voice recorders on board
- Several components containing nonvolatile memory (NVM) recovered from wreckage

Focus on Components

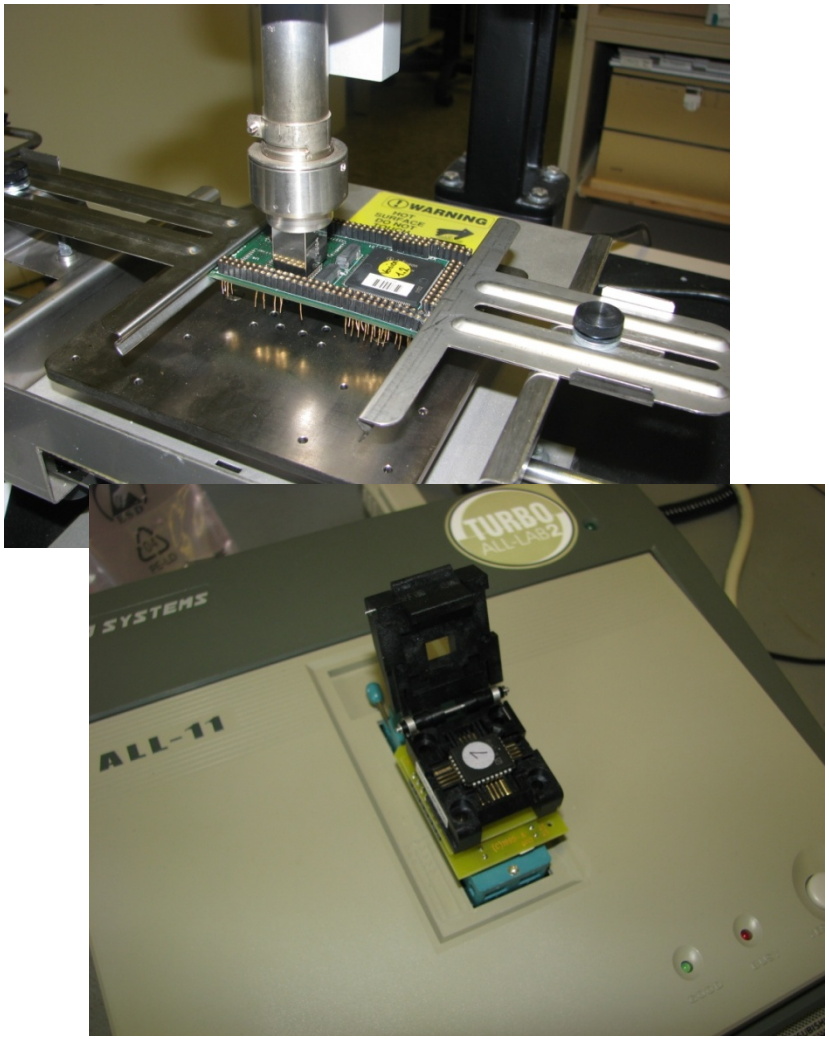
- One component with NVM was the central advisory and warning system (CAWS) computer
- CAWS provided system status indications and recorded event activation/deactivation in memory

Focus on Components

- CAWS computer was damaged by fire and impact
- Board containing memory chips survived
- Log data contained on chips ‘3’ and ‘4’
- Data recovery attempted at manufacturer using surrogate CAWS
- Damage precluded data download



Assistance From Abroad



- German Federal Bureau of Aircraft Accident Investigation (BFU)
- After attending initial download attempt, offered to assist
- Extracted chips from board
- Downloaded data from chips directly

Assistance From Abroad

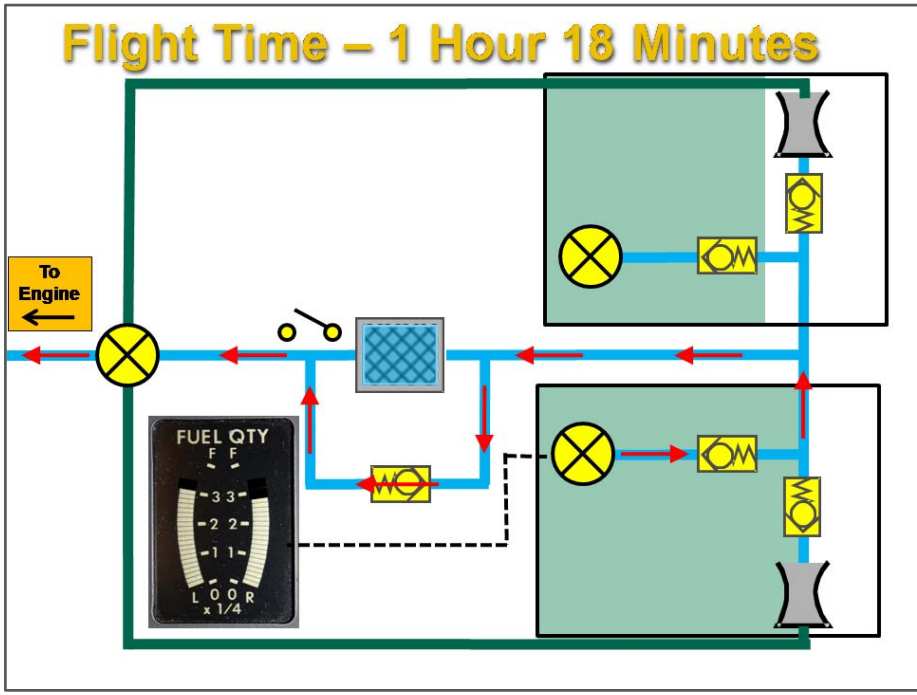
```
Ety: 107904 FlNo: 1559 Date: 31.05 0001 Time: 23:30:01 WNo 43 : A/P TRIM          :Activated
Ety: 107905 FlNo: 1559 Date: 31.05 0001 Time: 23:30:02 WNo 43 : A/P TRIM          :Cleared
Ety: 107906 FlNo: 1559 Date: 31.05 0001 Time: 23:30:10 WNo 43 : A/P TRIM          :Activated
Ety: 107907 FlNo: 1559 Date: 31.05 0001 Time: 23:30:11 WNo 43 : A/P TRIM          :Cleared
Ety: 107908 FlNo: 1559 Date: 31.05 0001 Time: 23:30:17 WNo 43 : A/P TRIM          :Activated
Ety: 107909 FlNo: 1559 Date: 31.05 0001 Time: 23:30:18 WNo 43 : A/P TRIM          :Cleared
Ety: 107910 FlNo: 1559 Date: 31.05 0001 Time: 23:34:49 WNo 43 : A/P TRIM          :Activated
Ety: 107911 FlNo: 1559 Date: 31.05 0001 Time: 23:34:49 WNo 43 : A/P TRIM          :Cleared
Ety: 107912 FlNo: 1559 Date: 31.05 0001 Time: 23:35:43 WNo 43 : A/P TRIM          :Activated
Ety: 107913 FlNo: 1559 Date: 31.05 0001 Time: 23:35:44 WNo 43 : A/P TRIM          :Cleared
Ety: 107914 FlNo: 1559 Date: 31.05 0001 Time: 23:38:49 WNo 43 : A/P TRIM          :Activated
Ety: 107915 FlNo: 1559 Date: 31.05 0001 Time: 23:38:49 WNo 43 : A/P TRIM          :Cleared
Ety: 107916 FlNo: 1559 Date: 31.05 0001 Time: 23:39:06 WNo 43 : A/P TRIM          :Activated
Ety: 107917 FlNo: 1559 Date: 31.05 0001 Time: 23:39:06 WNo 43 : A/P TRIM          :Cleared
Ety: 107918 FlNo: 1559 Date: 31.05 0001 Time: 23:45:06 WNo 43 : A/P TRIM          :Activated
Ety: 107919 FlNo: 1559 Date: 31.05 0001 Time: 23:45:06 WNo 43 : A/P TRIM          :Cleared
Ety: 107920 FlNo: 1559 Date: 31.05 0001 Time: 23:48:55 WNo 43 : A/P TRIM          :Activated
Ety: 107921 FlNo: 1559 Date: 31.05 0001 Time: 23:48:56 WNo 43 : A/P TRIM          :Cleared
Ety: 107922 FlNo: 1559 Date: 31.05 0001 Time: 23:50:14 WNo 43 : A/P TRIM          :Activated
Ety: 107923 FlNo: 1559 Date: 31.05 0001 Time: 23:50:14 WNo 43 : A/P TRIM          :Cleared
```

```
000000660:  00 30 01 00 05 23 22 51 34 08 38 04 5F E0 00 00  .0...#"Q4.8._à..
000000670:  00 30 01 00 05 23 22 51 34 00 38 04 60 E0 00 00  .0...#"Q4.8.`à..
000000680:  00 30 01 00 05 23 22 51 38 08 38 04 61 E0 00 00  .0...#"Q8.8.aà..
000000690:  00 30 01 00 05 23 22 51 39 00 38 04 62 E0 00 00  .0...#"Q9.8.bà..
0000006A0:  00 30 01 00 05 23 22 51 42 08 38 04 63 E0 00 00  .0...#"QB.8.cà..
0000006B0:  00 30 01 00 05 23 22 51 43 00 38 04 64 E0 00 00  .0...#"QC.8.dà..
0000006C0:  00 30 01 00 05 23 22 51 46 08 38 04 65 E0 00 00  .0...#"QF.8.eà..
0000006D0:  00 30 01 00 05 23 22 51 47 00 38 04 66 E0 00 00  .0...#"QG.8.fà..
0000006E0:  00 30 01 00 05 23 22 51 51 08 38 04 67 E0 00 00  .0...#"QQ.8.gà..
0000006F0:  00 30 01 00 05 23 22 51 52 00 38 04 68 E0 00 00  .0...#"QR.8.hà..
000000700:  00 30 01 00 05 23 22 52 16 08 38 04 69 E0 00 00  .0...#"R..8.ià..
000000710:  00 30 01 00 05 23 22 52 16 00 38 04 6A E0 00 00  .0...#"R..8.jà..
000000720:  00 11 01 00 05 23 22 53 03 0C 38 04 6B E0 00 00  .....#"S..8.kà..
000000730:  00 11 01 00 05 23 22 53 28 00 38 04 6C E0 00 00  .....#"S(.8.là..
000000740:  00 34 01 00 05 24 00 26 14 00 38 04 6D E0 00 00  .4...$.&..8.mà..
000000750:  00 00 01 00 05 24 00 26 19 10 39 04 6E E0 00 00  .....$.&..9.nà..
000000760:  00 30 01 00 05 24 00 27 30 08 39 04 6F E0 00 00  .0...$.'0.9.oà..
000000770:  00 30 01 00 05 24 00 27 31 00 39 04 70 E0 00 00  .0...$.'1.9.pà..
000000780:  00 30 01 00 05 24 00 28 05 08 39 04 71 E0 00 00  .0...$.(..9.qà..
000000790:  00 30 01 00 05 24 00 28 06 00 39 04 72 E0 00 00  .0...$.(..9.rà..
0000007A0:  00 30 01 00 05 24 00 30 18 08 39 04 73 E0 00 00  .0...$.0..9.sà..
0000007B0:  00 30 01 00 05 24 00 30 18 00 39 04 74 E0 00 00  .0...$.0..9.tà..
```

- Extracted files returned to CAWS manufacturer
- Manufacturer compiled software to decode data
- Decoded data returned to NTSB team

Putting the Pieces Together

- Analysis of data validated by and supported with other information led investigation in new direction
- New understanding of accident flight system behaviors and operational factors
- Data proved pivotal in determining probable cause

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