Extend the Network and Exploit Available Resources
~ Lessons Learnt from Two Major Investigations ~

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Outline

“Every link is important”

◆ About the Aviation Safety Council
  ◆ Technical capabilities
  ◆ Technical research project & exercise
  ◆ International collaboration

◆ Challenges in conducting two major investigations
  ◆ ATR 72-500 (CFIT)
  ◆ ATR 72-600 (LOC-I)

◆ Lessons learnt
About the Aviation Safety Council

ASC was established in 1998: an independent safety agency

Seven board members + Twenty investigators

Since 1998 ASC has investigated 118 cases and issued 937 safety recommendations
Technical capabilities at ASC

ASC Investigation Laboratory

5 investigators

No. of readout in 2014:

103 for investigative purpose

34 for technical assistance purpose

- Flight Recorders Readout
- GPS & NVM Readout
- Site Survey & Underwater Searches
- Performance Analysis & Visualization
- Technical Research & Exercise

No. of readout in 2014:

103 for investigative purpose

34 for technical assistance purpose
Technical research & exercise

high mountain physical training

site survey training

underwater search and recovery of flight recorders
Int’l collaboration- Damaged Recorders Training

Enlarge knowledge to handing damaged flight recorders and data analysis

- Basic training
- On-the-job training
- Advanced training

3-5 days

10 + 3 days
Challenges in conducting two major investigations

1\textsuperscript{ST} CFIT (2014.07.23)
- SOP non-compliance
- Organizations factors (FOQA, SMS, CAA oversight)

ARs: BEA, NTSB, TSB
9 group, 56 people
Factual report- 6 months
Final reports - 19 months

2\textsuperscript{nd} LOC-I (2015.02.04)
- Uncommanded autofeather
- PF shutdown wrong engine, ATPCS policy and training

ARs: BEA, NTSB, TSB
7 group, 38 people
Factual report- 6 months
Final reports - 17 months
ATR 72-500 accident

Synopsis

- ATR72-500 crash on July 23, 2014
- TransAsia Airways passenger flight from Kaohsiung to Makong, in stormy weather
- NPA to RWY 20, limits: VIS 1,600 m, MDA 330 ft.
- No. of fatalities: 48
1) FDR data correction and performance analysis

2) FDA is a key tool for SMS investigation

3) Emerging technologies - UAV and Flight Animation
#1 FDR data correction and performance analysis

**Assistance from BEA and ATR advisors included:**

- **Flight data analysis**
- **TNA’s FOQA issue**

**Conclusion of ASC investigation:**

1. FDR readout document contained unclear information.
2. FDR contained spike data when a/c passed through trees.
3. TNA’s FOQA program was unable to readily identify those risks involving SOP non-compliance.
4. Last 2 min, “light to moderate” turbulence

⇒ 6 findings + 4 safety recommendations
FDR Data Correction – Alt.

A/C passed through trees
Dynamic probe broken
No.1 ENG intake sucked in trees
Obstacles/trees interference
IAS decayed to 0
No.1 NP dropped
Incorrect PA, RA

1st impacted building
Zone 2 Crash Site
Zone 1 Bush Trees
Grooves
TNA’s FOQA issue

GE220 vs. GE222 Flight Path Profiles During Approach Operation
Focus on systematic factors: Flightcrew Fatigue, SOP non-compliances Operator’s SMS, CAA’s safety oversight
#3 Emerging technologies- UAV and Flight Animation

~ **25 GB** UAV collected geo-data

~ **10 GB** Archived sat. image + aerial image + terrain data

Flight animation superposing with geo-data (accuracy **10 cm**)

14
DTM only
(R/S 1m)

DTM + DSM
(R/S 8 cm)

Runway 20

UAV
3d point clouds
ATR 72-600 accident

Synopsis

◆ ATR72-600 crash on 4th Feb. 2015

◆ TransAsia Airways passenger flight from Taipei to Kinmen

◆ No.2 engine flameout during initial climb after takeoff, PF shutdown wrong engine

◆ No. of fatalities: 43
1) To secure perishable evidence is a top priority

2) An intermittent signal discontinuity between the no.2 AFU and the torque sensor

3) Teamwork on the AFU & TQ sensors examination
#1 To secure perishable evidence is a top priority

Assistance from TWN gov. agencies included:

- **Secure perishable evidences**
- **Autopsy**

Day 2: **85%** of a/c wreckage

Day 3: **3 dashboard videos and 7 security camera videos**

Day 4: **1000 items of autopsy and examination**

Day 5: **66 items of NVMs and engine components**
#3 Teamwork on the AFU & TQ sensors examination

AFU_A2 circuit board

solder joints
Pins -33 & 34

J2 connector
Pins J & H

Flex cable

SEMs image
Pins 33,& 34

Cross section image
Pins 33, & 34

From J2 connectors

solder joints are suspect

stable low resistance readings

unstable resistance readings
Emerging technologies - LIDAR and Flight Animation

- City building model
- Aerial image (0.3 m)
- Terrain + LIDAR data
- CIB Lidar data

Emerging technologies - LIDAR and Flight Animation

1. 10:54:14.1 & 10:54:17.7 CM-1 “restart the engine”
2. 10:54:23.2 ~ 54:33.9 CVR stall warning/stick shaker
3. 10:54:24.0 CM-1 “restart the engine”
4. 10:54:27.1 CM-1 “wow pulled back the wrong side throttle”
5. 10:54:30.5 CM-1 “restart the engine”
6. 10:54:31.8 CM-3 “impact impact brace for impact”
7. 10:54:35.9 CVR “pull up” sound, FDR stopped recording
8. 10:54:36.6 CVR stopped recording
Lessons Learnt

◆ Int’l collaboration is the key to success
  ◆ Use all available tools and resources
  ◆ Good chance to share and learn from other parties
  ◆ Assess emerging technologies into investigation

◆ Facilitate and maintain procedures to handle damaged flight recorders and NVMs
  ◆ Contacts AR to have a list of available NVMs at early stage
  ◆ Validated FDR database and qualified investigators are keys to fulfil readout schedule as soon as possible
  ◆ FDA is one of the systematic tools for SMS investigation
Thank you for your attention
GE235 Timeline for Recorders Group

**Accident**
- NVM list
- FDR Doc.
- ATR technical Doc.

**AR**
- Created FDR DB in Oct. 2012
- Checked FDR DB (750 P)
- FA2100 Golden chassis
- AIK preparation

**ASC LAB**
- Damaged recorder handling procedure
  - CVR / FDR readout
  - Synchronized FDR with ATC transcript, radar data

**On-scene**
- Recorders located
- Recorders recovered
- “in water” transportation

**Day 2**
- ARs and TAs arrived ASC

**Day 3**
- Generated Sequence of Events (SOE)
  - Flight animation with key features

**Day 4**
- ATPCS Logic meeting
  - Cleaned & dried NVMs
  - NVMs readout plan (packing, shipping, readout)

**Day 5**
- Press release on initial findings
  - NVMs recovered

- QAR & NVMs located
- Wreckage DB