BEA

Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

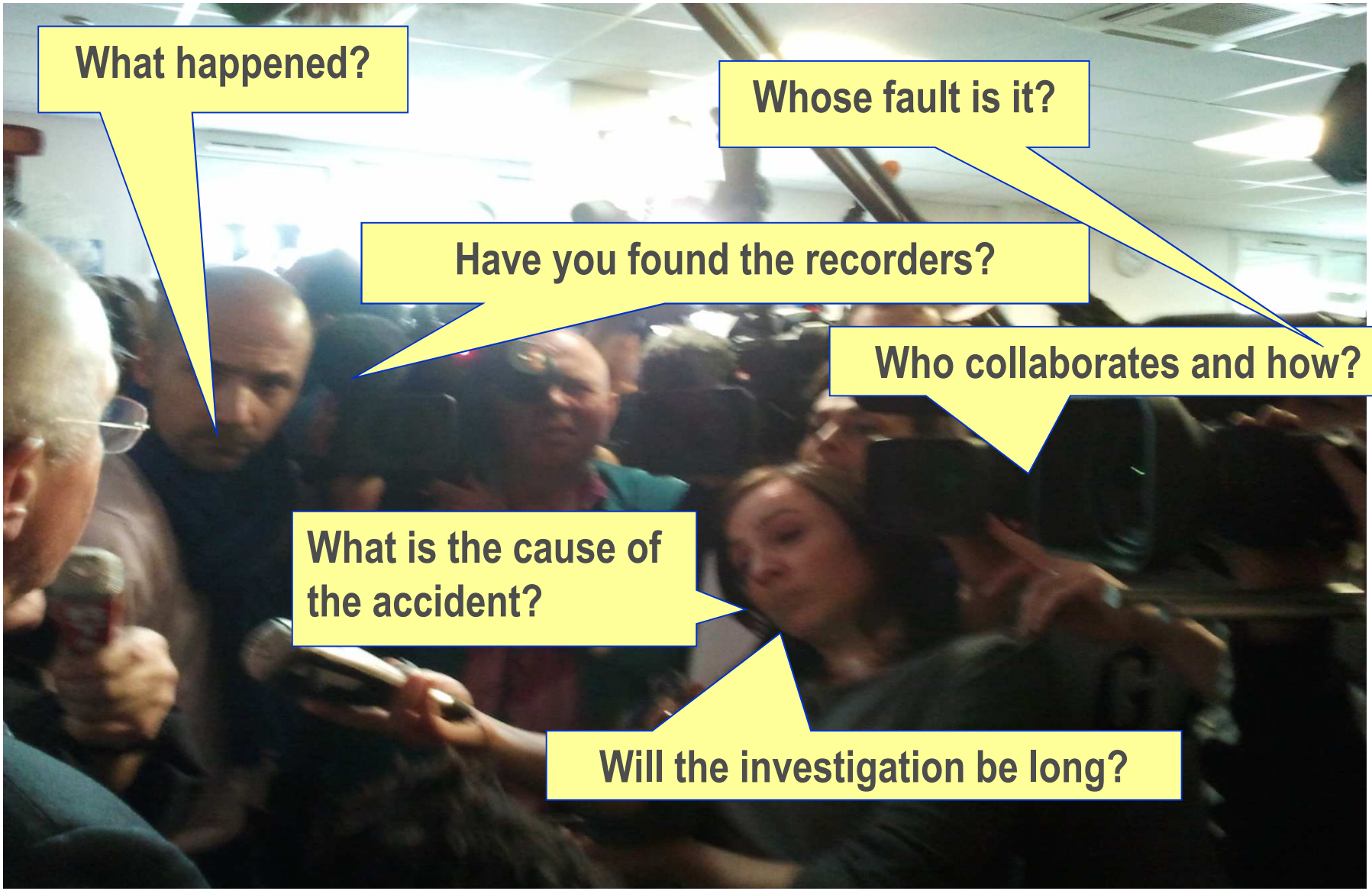
Managing a large scale accident/incident investigation

Gestión de una investigación de accidentes/ incidentes de gran escala

ICAO Accident/Incident Investigation Workshop
Oficina Regional NACC de la OACI – Mexico City
21 July 2015

Arnaud Desjardin
Deputy Head of the Investigations Department

Recurrent questions



Annex 13

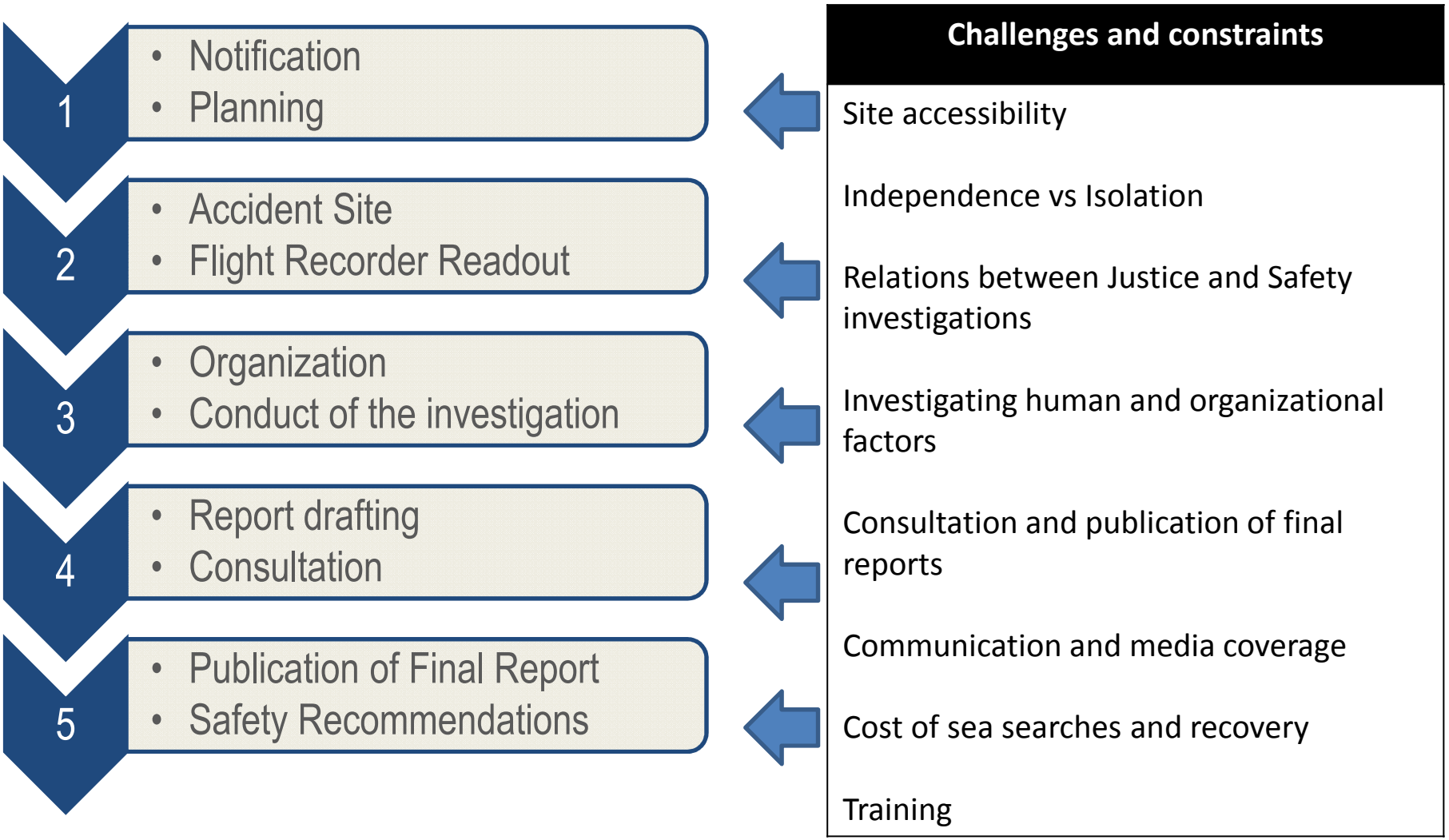
- More than ever, abide by it:
  - Investigations must be conducted in a timely manner with the sole objective of drawing safety lessons;
  - The State conducting the investigation must associate with the investigation other States, in particular the States of Manufacture, Design, Registry and Operation of the aircraft;
  - Investigators must be independent and cannot receive instructions from any authority;
  - If a judicial investigation takes place in parallel with the safety investigation, it must not impede the due course of the safety investigation;
  - Only the authority conducting the investigation can provide information on the investigation. Its report must be made public.
- While respecting the sovereignty of each ICAO contracting state, an accident and its lessons learned belong to the international aviation community.

Steps of an investigation

1. Notification
   - Planning
2. Accident Site
   - Flight Recorder Readout
3. Organization
   - Conduct of the investigation
4. Report drafting
   - Consultation
5. Publication of Final Report
   - Safety Recommendations

Valid for any investigation !

Steps of an large scale investigation



Notification & Planning

- The State of Occurrence shall forward a notification of an accident or serious incident, with a minimum of delay and by the most suitable and quickest means available, to:
  - the State of Registry;
  - the State of the Operator;
  - the State of Design;
  - the State of Manufacture; and
  - ICAO, when the aircraft involved is of a maximum mass of over 2 250 kg or is a turbojet-powered aeroplane

Notification Workflow

Local authorities

Operators

ATC

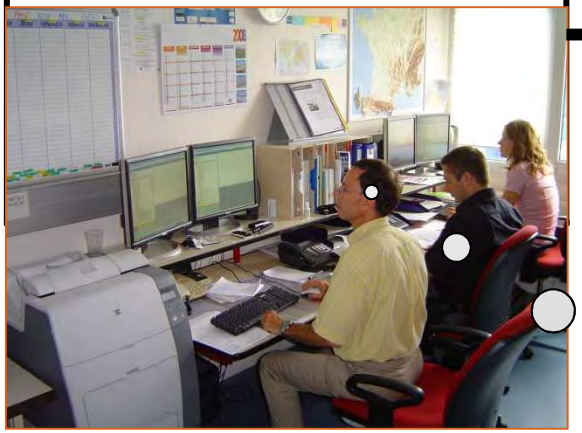
Media + Internet

Manufacturers

Police

1 Info received @ the SIA of the State of Occurrence

- ✓Mail
- ✓Phone
- ✓Fax



2 Treatment

- ✓Ask for more info?
- ✓Launch an investigation?
- ✓Record

How to decide?

3 Notify

- ✓the State of Registry
- ✓the State of the Operator
- ✓the State of Design
- ✓the State of Manufacture
- ✓ICAO

Decision to investigate

- If Accident→ **Investigate**

Accident. An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) a person is fatally or seriously injured as a result of:

— being in the aircraft, or
— direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
— direct exposure to jet blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which:

— adversely affects the structural strength, performance or flight characteristics of the aircraft, and
— would normally require major repair or replacement of the affected component,

except for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

c) the aircraft is missing or is completely inaccessible.

Note 1.— For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified, by ICAO, as a fatal injury.

Note 2.— An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

Investigating Incidents

- **Incident**: An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

➔ **Investigate, if safety lessons are expected to be drawn**

- **Serious Incident**: An incident involving circumstances indicating that there was a high probability of an accident

➔ **Investigate**

Annex 13 – Attachment C

- The incidents listed are typical examples of incidents that are likely to be serious incidents

Near collisions requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate.

Collisions not classified as accidents.

Controlled flight into terrain only marginally avoided.

Aborted take-offs on a closed or engaged runway, on a taxiway[1] or unassigned runway.

Take-offs from a closed or engaged runway, from a taxiway[1] or unassigned runway.

Landings or attempted landings on a closed or engaged runway, on a taxiway[1] or unassigned runway.

Gross failures to achieve predicted performance during take-off or initial climb.

Fires and/or smoke in the cockpit, in the passenger compartment, in cargo compartments or engine fires, even though such fires were extinguished by the use of extinguishing agents.

Events requiring the emergency use of oxygen by the flight crew.

Aircraft structural failures or engine disintegrations, including uncontained turbine engine failures, not classified as an accident.

Multiple malfunctions of one or more aircraft systems seriously affecting the operation of the aircraft.

Flight crew incapacitation in flight.

Fuel quantity level or distribution situations requiring the declaration of an emergency by the pilot, such as insufficient fuel, fuel exhaustion, fuel starvation, or inability to use all usable fuel on board.

Take-off or landing incidents. Incidents such as under-shooting, overrunning or running off the side of runways.

System failures, weather phenomena, operations outside the approved flight envelope or other occurrences which caused or could have caused difficulties controlling the aircraft.

Failures of more than one system in a redundancy system mandatory for flight guidance and navigation.

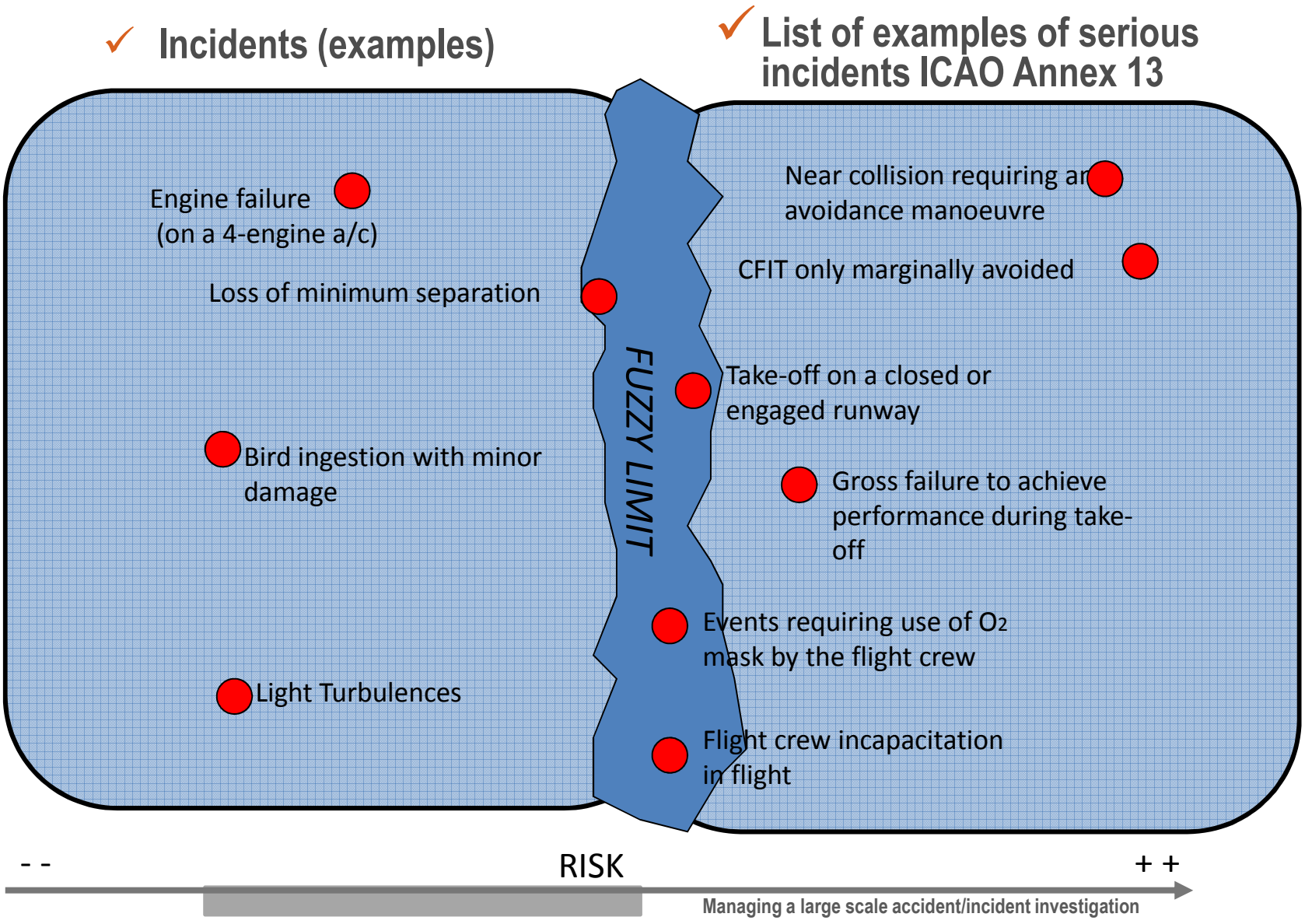
The unintentional or, as an emergency measure, the intentional release of a slung load or any other load carried external to the aircraft.

Accident / Incident Example

✓ A380 Le Bourget?

✓ Media visibility should not impact the classification of the event

Incidents vs. Serious Incidents



When to investigation Incidents?

- Like for SMS
- Takes into account:
  - Consequence
  - Probability of occurrence
  - Robustness of protection mechanisms (soft and hard)
  - Procedures
  - Training
  - Best practices
  - Systems (TCAS, GPWS…)

Risk Assessment

- ERC matrix: Event Risk Classification

Question 2

What was the effectiveness of the remaining barriers between this event and the most credible accident scenario?

Effective	Limited	Minimal	Not effective
50	102	502	2500
10	21	101	500
2	4	20	100
1			

Question 1

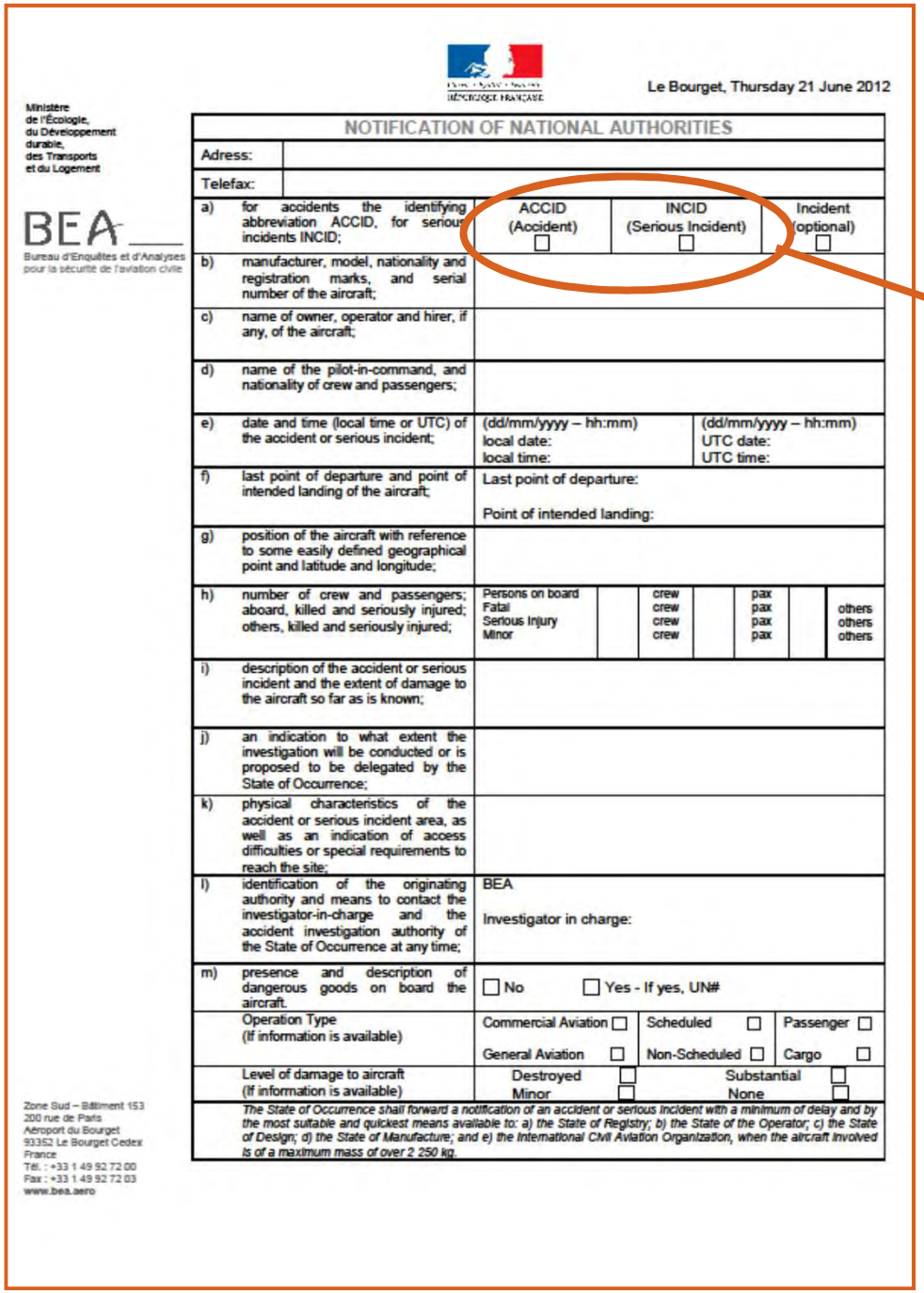
If this event had escalated into an accident outcome, what would have been the most credible outcome?		Typical accident scenarios
Catastrophic Accident	Loss of aircraft or multiple fatalities (3 or more)	Loss of control, mid air collision, uncontrollable fire on board, explosions, total structural failure of the aircraft, collision with terrain
Major Accident	1 or 2 fatalities, multiple serious injuries, major damage to the aircraft	High speed taxiway collision, major turbulence injuries
Minor Injuries or damage	Minor injuries, minor damage to aircraft	Pushback accident, minor weather damage
No accident outcome	No potential damage or injury could occur	Any event which could not escalate into an accident, even if it may have operational consequences (e.g. diversion, delay, individual sickness)

Source: Methodology for Operational Risk Assessment - ARMS Working Group, 2007-2010

Benefits of Incident Investigations

- SIA may have an added value:
  - Better access to systemic issues (Operator's SMS may be limited to internal information)
  - Make safety lessons public
- Benefits of accident investigations, without the main drawbacks:
  - The crew is still here to be interviewed
  - FDR and other avionics equipment available for download
  - Less pressure to explore systemic issues
  - BUT: CVR often overwritten!
    - Messages about CVR circuit breakers after an incident
    - Extension of CVR duration to 25 hours

Notification Letter



Ministère de l'Écologie, du Développement durable, des Transports et du Logement

BEA
Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile

Le Bourget, Thursday 21 June 2012

NOTIFICATION OF NATIONAL AUTHORITIES

Adress:

Telefax:

a)	for accidents the identifying abbreviation ACCID, for serious incidents INCID;	ACCID (Accident) ☐	INCID (Serious Incident) ☐	Incident (optional) ☐
b)	manufacturer, model, nationality and registration marks, and serial number of the aircraft;			
c)	name of owner, operator and hirer, if any, of the aircraft;			
d)	name of the pilot-in-command, and nationality of crew and passengers;			
e)	date and time (local time or UTC) of the accident or serious incident;	(dd/mm/yyyy – hh:mm) local date: local time:	(dd/mm/yyyy – hh:mm) UTC date: UTC time:	
f)	last point of departure and point of intended landing of the aircraft;	Last point of departure: Point of intended landing:		
g)	position of the aircraft with reference to some easily defined geographical point and latitude and longitude;			
h)	number of crew and passengers; aboard, killed and seriously injured; others, killed and seriously injured;	Persons on board / Fatal / Serious Injury / Minor	crew crew crew	pax pax pax	others others others
i)	description of the accident or serious incident and the extent of damage to the aircraft so far as is known;			
j)	an indication to what extent the investigation will be conducted or is proposed to be delegated by the State of Occurrence;			
k)	physical characteristics of the accident or serious incident area, as well as an indication of access difficulties or special requirements to reach the site;			
l)	identification of the originating authority and means to contact the investigator-in-charge and the accident investigation authority of the State of Occurrence at any time;	BEA Investigator in charge:		
m)	presence and description of dangerous goods on board the aircraft.	☐ No ☐ Yes - If yes, UN#		
	Operation Type (If information is available)	Commercial Aviation ☐ / General Aviation ☐	Scheduled ☐ / Non-Scheduled ☐	Passenger ☐ / Cargo ☐
	Level of damage to aircraft (If information is available)	Destroyed ☐ / Minor ☐	Substantial ☐ / None ☐	

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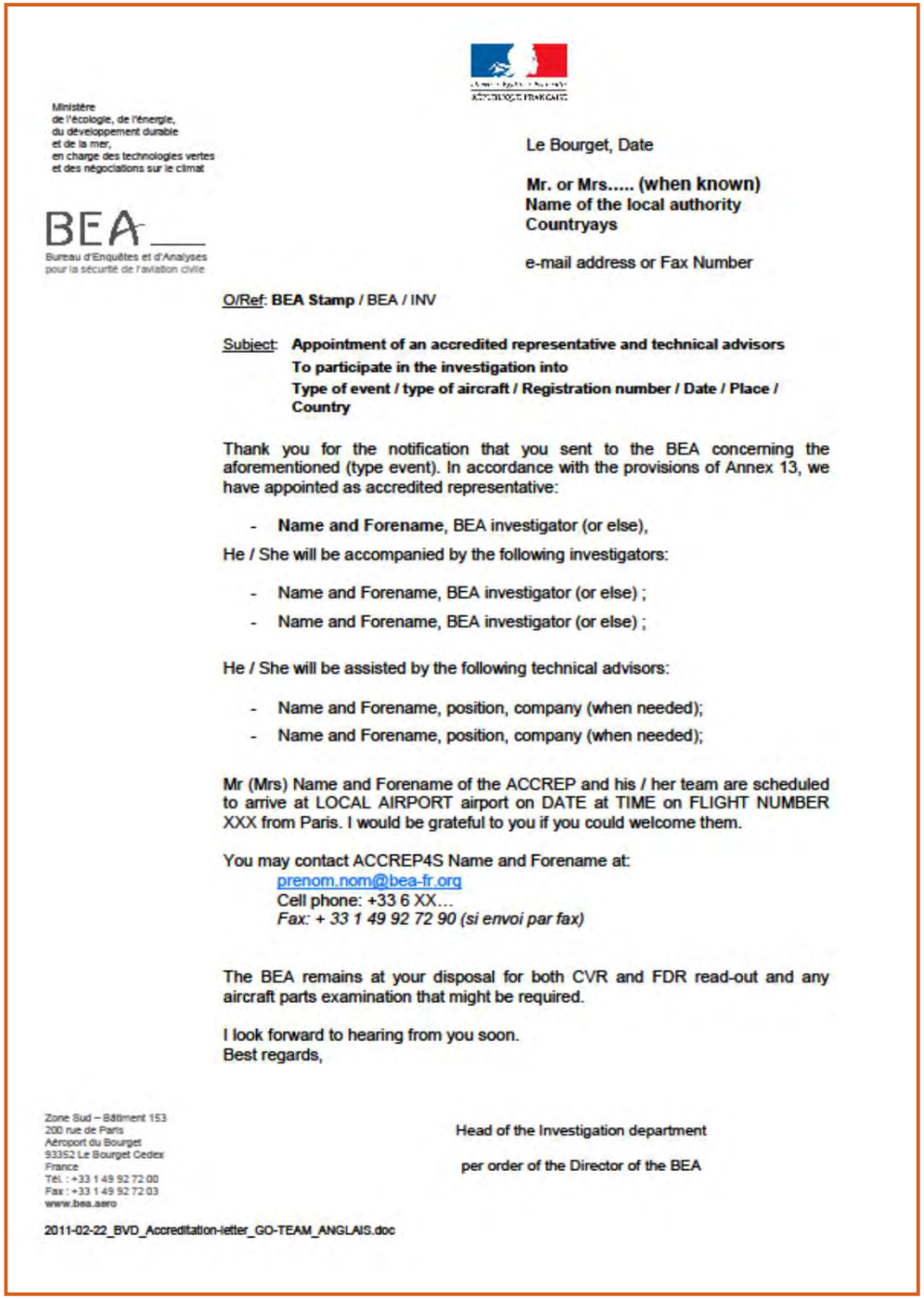
- ✓ ACCID = Accident
- ✓ INCID = Serious Incident



Ministère
de l'écologie, de l'énergie,
du développement durable
et de la mer,
en charge des technologies vertes
et des négociations sur le climat

BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

Le Bourget, Date

Mr. or Mrs..... (when known)
Name of the local authority
Countryays

e-mail address or Fax Number

O/Ref: **BEA Stamp** / BEA / INV

Subject: **Appointment of an accredited representative and technical advisors**
To participate in the investigation into
Type of event / type of aircraft / Registration number / Date / Place / Country

Thank you for the notification that you sent to the BEA concerning the aforementioned (type event). In accordance with the provisions of Annex 13, we have appointed as accredited representative:

- **Name and Forename**, BEA investigator (or else),

He / She will be accompanied by the following investigators:

- Name and Forename, BEA investigator (or else) ;
- Name and Forename, BEA investigator (or else) ;

He / She will be assisted by the following technical advisors:

- Name and Forename, position, company (when needed);
- Name and Forename, position, company (when needed);

Mr (Mrs) Name and Forename of the ACCREP and his / her team are scheduled to arrive at LOCAL AIRPORT airport on DATE at TIME on FLIGHT NUMBER XXX from Paris. I would be grateful to you if you could welcome them.

You may contact ACCREP4S Name and Forename at:
prenom.nom@bea-fr.org
Cell phone: +33 6 XX...
Fax: + 33 1 49 92 72 90 (si envoi par fax)

The BEA remains at your disposal for both CVR and FDR read-out and any aircraft parts examination that might be required.

I look forward to hearing from you soon.
Best regards,

Head of the Investigation department

per order of the Director of the BEA

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Fax : +33 1 49 92 72 03
www.bea.aero

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Answer to a Notification

- ✓ Appoint a Accredited Representative
- ✓ Name the Technical Advisers

➔ **Provide a precise response regarding your participation**

Planning

- The right team size
- The right skills

Professional	+	Human qualities
Technical expertise Analytical skills Professional secrecy Linguistic abilities Written & Oral Communication Presentation Skills Planning and Evaluating		Curiosity Good judgment Common sense Perseverance Impartiality Integrity Negotiating skills

Roles

SAFETY ROLE

Collect and validate facts

Analyze the facts

Determine the causes

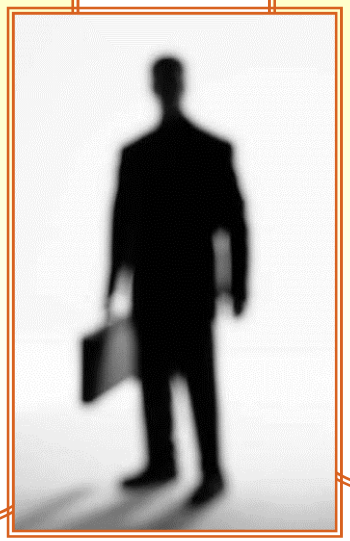
Issue Safety Recommendations

↓

Authorities

Operators

+



SOCIAL ROLE

Handle the confusion

Inform

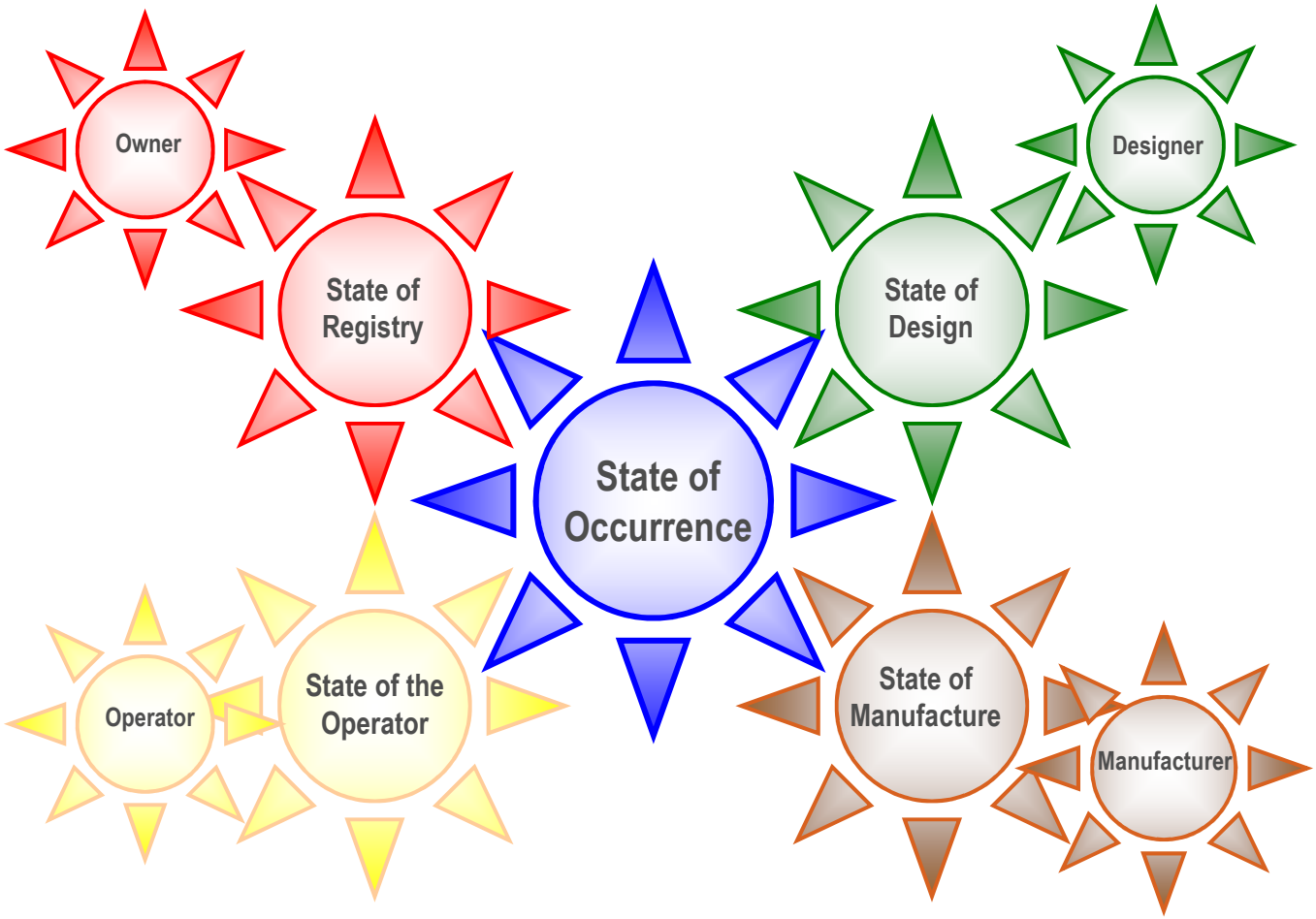
Explain

↓

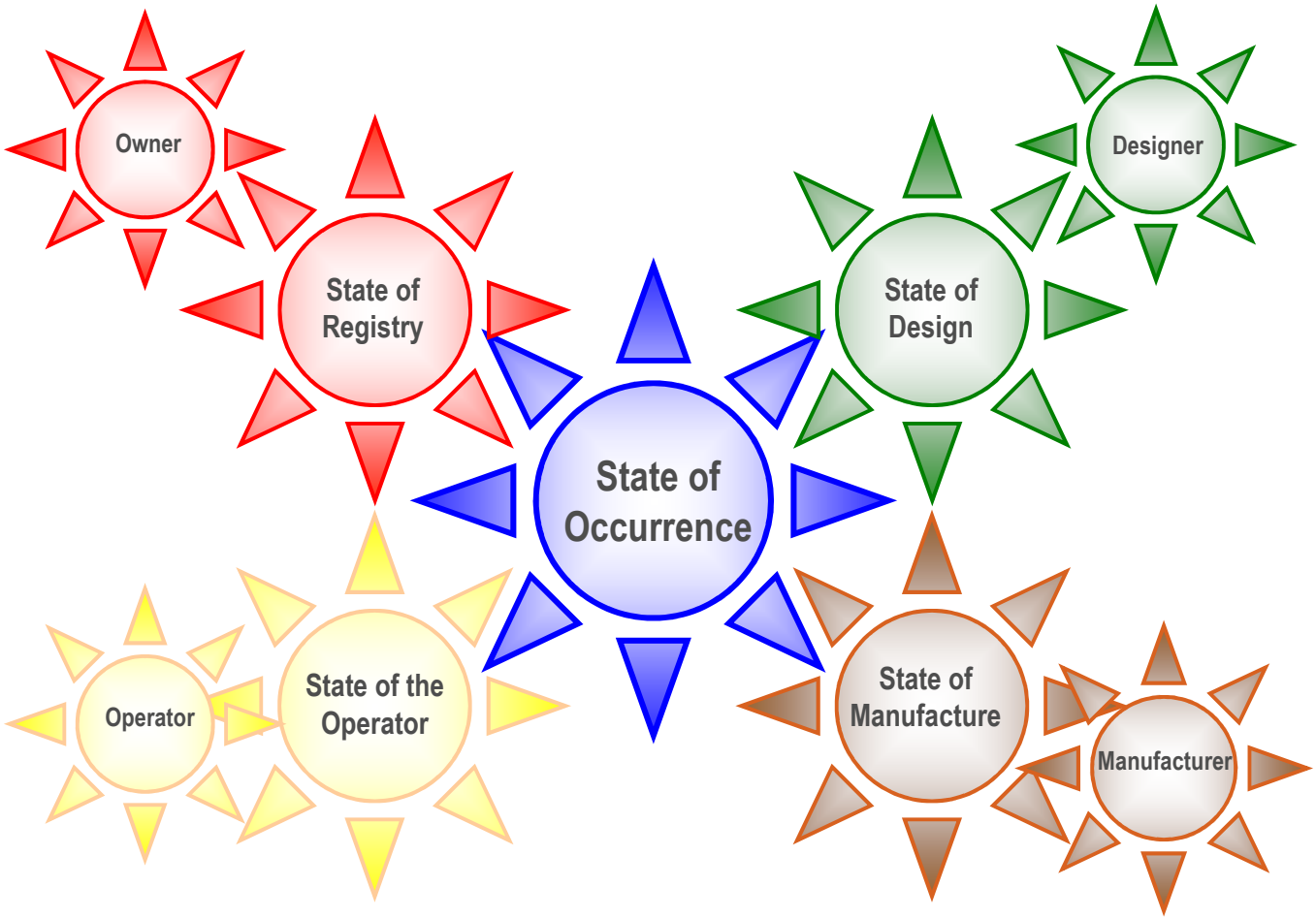
Families

Media / Public

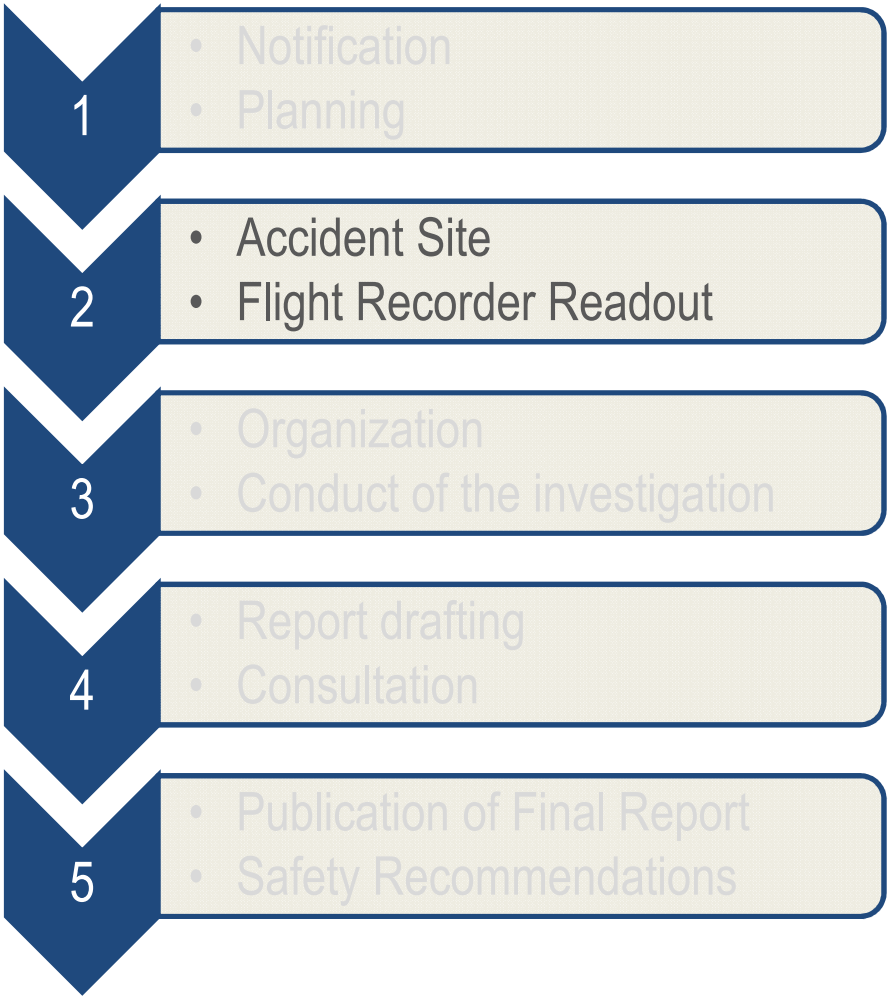
International Organisation



International Organisation



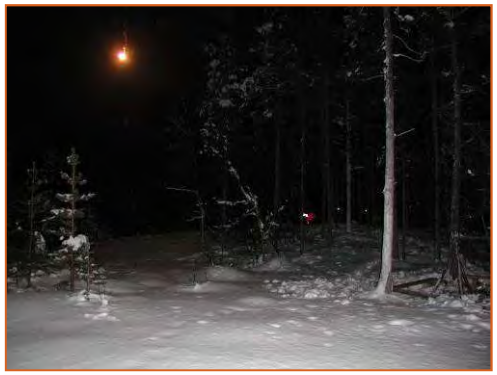
Site & Recorder readout



- Go-Team
  - Bio-Hazards + protection equipment
  - Travel & Hotel
- Site documentation
  - Wreckage analysis
  - Flight Recorder search
- Briefing within your team morning and evening
  - Safety on site
  - Objectives of the day
- Do plan to talk to the media

Planning

- Site access



Planning for site activities

- Get a meeting room near the crash site
- Will be the site investigation headquarters
  - Will be the destination point for everybody travelling to the site

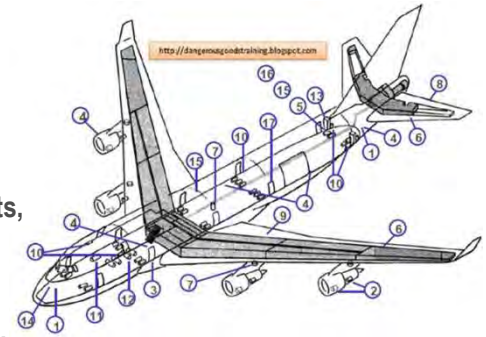
© Can Stock Photo - csp4831420

Site

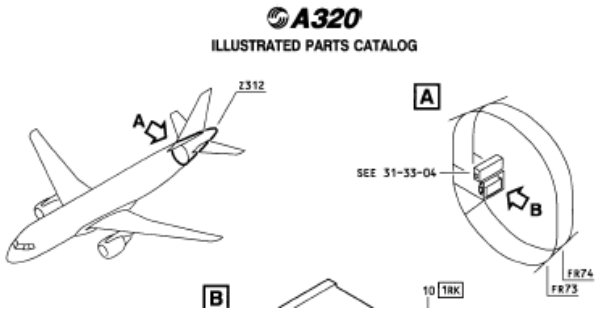
- Provide help cards for people on site

Dangerous goods

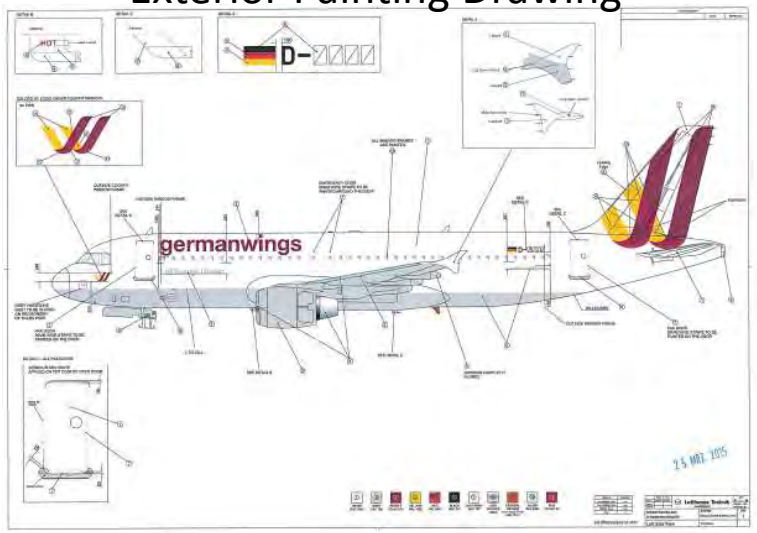
1 Batteries, Aircraft Quantity 2
2 Engine Oil
3 Escape Slides/Life Rafts
4 Fire Bottles (APU, engines,lower cargo compartment,lavatory waste containers)
5 Fire extinguishers (attendant stations, closets, galleys, etc.)
6 Fuel
7 Hydraulic Fluid, Reservoirs (waste only)
8 Uranium,(depleted,Depleted Uranium Control Balance Aircraft Batteries counter-balance weights)
9 Ordnance Devices (off-wing escape)
10 Oxygen Bottles,Portable,Gaseous
11 Oxygen Bottles,Crew System Gaseous
12 Oxygen Bottles,Passenger System Gaseous
13 Oxygen Generators (optional: each PSU standard: each:attendant station and lavatory)
14 Rain Repellent
15 Refrigerant (located in each galley)
16 Smoke Hoods
17 Tritium Signs(aisles emergency exit doors)



Flight Recorder Location



Exterior Painting Drawing

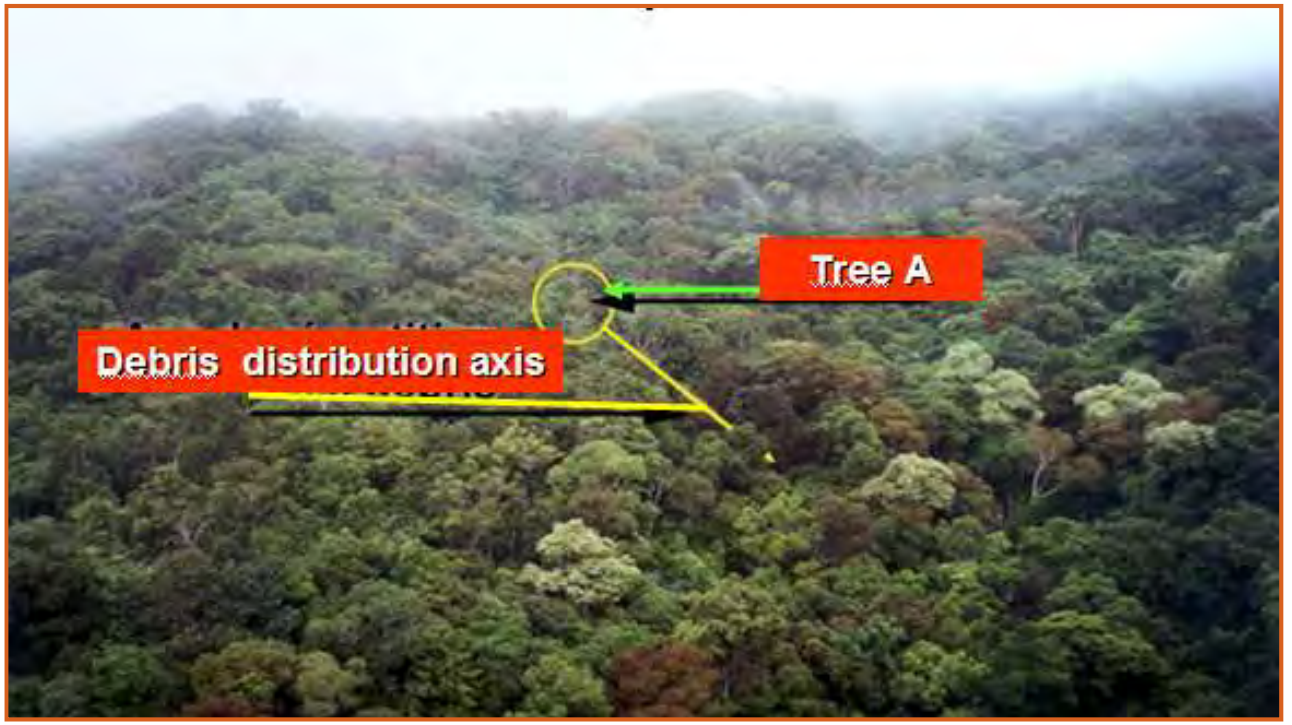


Site

- Location and identification of major components and pieces
- Ground fire areas
- Ground scars

Site

- Establish the direction of flight at impact



- Determine impact angle, aircraft attitude, aircraft track

Site

- Check for clues of fire before impact

- Establish engine power at impact

Site

- Determine aircraft configuration (gear, flaps, spoilers)
- Determine the need for specialist examinations of components, systems, instruments, fractures
- Document cockpit configuration (handles, levers, switches), instruments, warning panels and lights

Site

- Estimate aircraft speed and rate of descent
- Establish general failure mode of airframe
- Take samples of all fluids

Site organization

- Plan 2 meetings per day
  - Morning briefing: what is planned for the day, and who
  - Evening briefing: results of the day
- Organize by themes:
  - “Administrative” items: site access, who is who?
  - Aircraft aspects
  - OPS aspects
  - Systems aspects
- With all the Acc. Reps, Tech. Advisers, and others
- 1 hour max!

Interview of witnesses

- Interview the witnesses (check their location) including crew and passengers, where available

- Interview Plan:
  - Opening
  - 2 - Main Body
    - Free recall
    - Specific questions
  - 3 - Closing

Interview Opening

- Introduce yourself, your agency and the purpose of the investigation (no blame)
- Explain how you will conduct the interview
- Ask for the permission to write down notes
- Be polite and relax
- Keep in mind that:
  - You should only intervene to steer the conversation in the desired direction
  - You must display a sincere interest
  - You are not a policeman

Interview – Main Body

- Free Recall
  - Let the witness talk about what he/she knows of the accident
  - Just wait and be quiet; don't fill in the gaps
  - You may have to say: "Please continue, what happened then?"
  - Never interrupt the witness; write down the questions that may come to your mind

Interview – Main Body

- Questions
  - Specific questions may prompt the witness to remember further details
  - Open-ended questions evoke a description of the events and lead to witness participation ≠ Closed questions may produce only “yes” or “no” answers
  - Questions containing the expected answers may influence the witness and be judgmental:
  - *“Which direction was the aircraft flying to?” ≠ “Was the aircraft flying to the west?”*
- Do not mention subjects before the witness mentions them
- Do not use technical terms the witness is not familiar with
- If necessary, take a break

Interview Closing

- Summarize the key points
- Read back your written notes
- Give the witness an opportunity:
  - To precise any point
  - To add further points he/she feels significant
- Reassure and thank the witness
- Ask for possible follow-up interview if need be
- Can end by "*Do you have any questions for me*"

Flight Recorders

- On site recovery

Various shape of recorders

Flight Recorders

- Even if damaged, can be easily recognized…

- but the memory module may be separated from its case

Flight Recorders

- and sometimes not so easy to recognize ….

FDR from the Germanwings Accident – France, 24 March 2015

- Should be placed and transported in a container of water if recovered at sea / lake

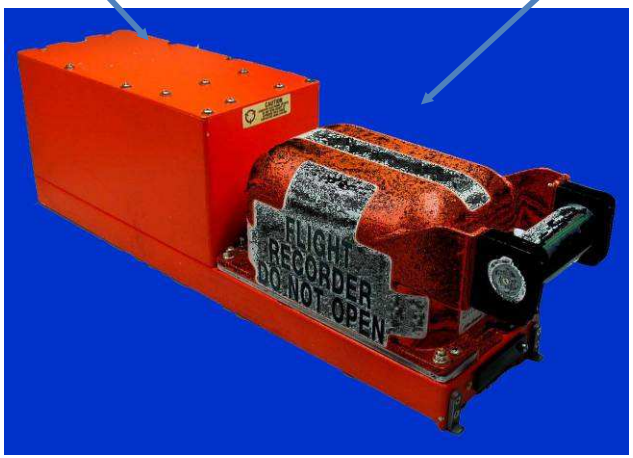
⇒ **Recorder specialist may be needed on site**

Damaged Solid State Recorder Readout

Electronic part
of a safe recorder

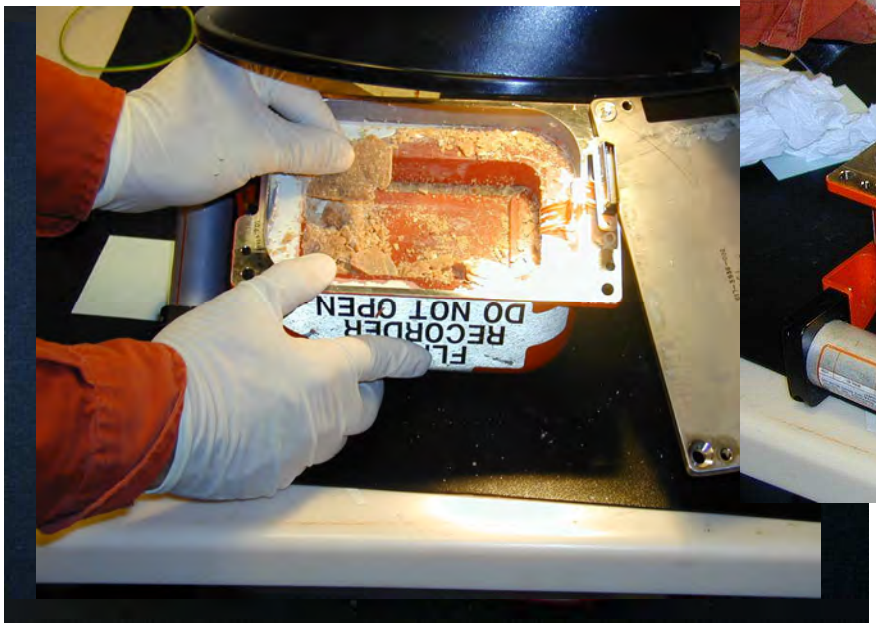
Memory module
from accident recorder

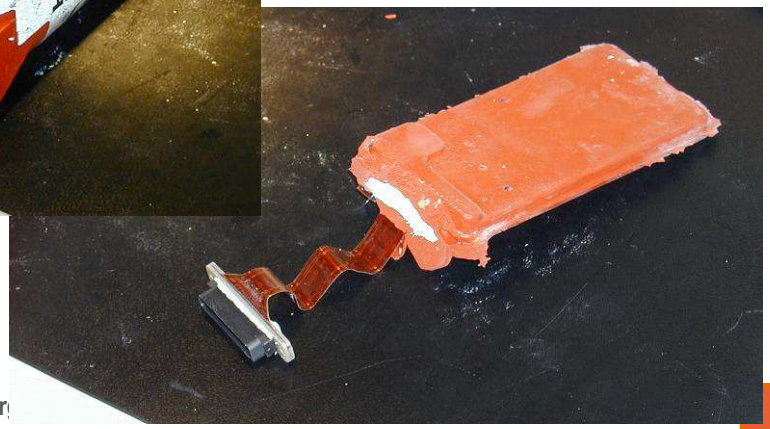
The electronic part
of a safe (and modified)
recorder is used
as an interface



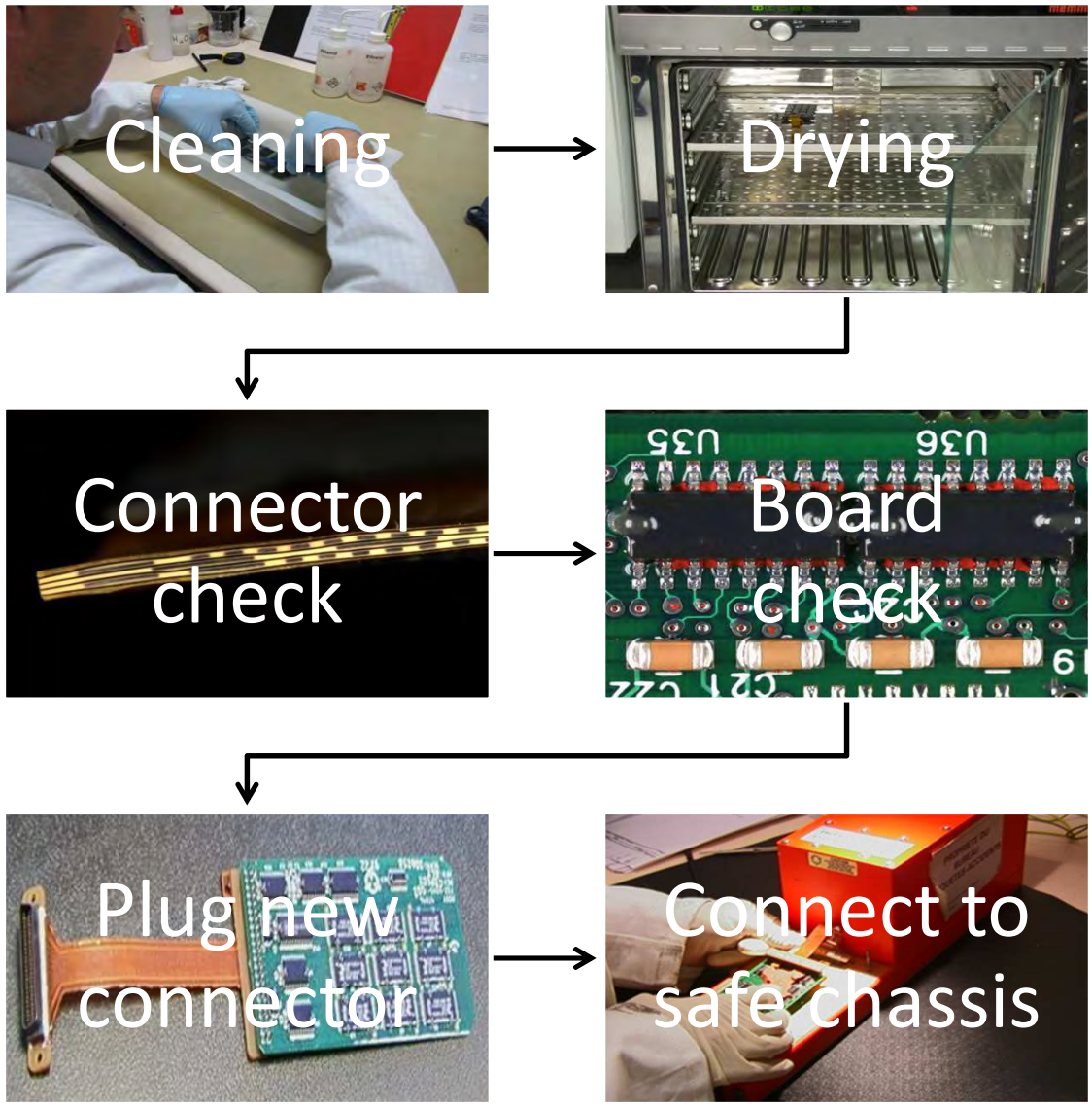
…or if really damaged

- The memory is extracted from the module…



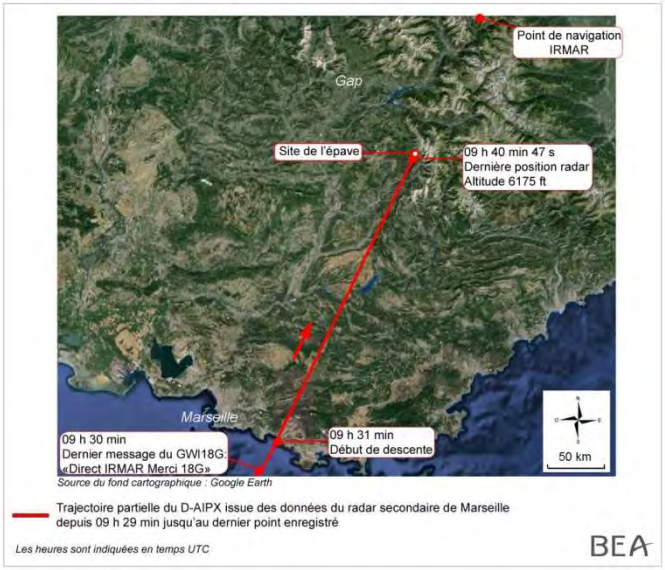


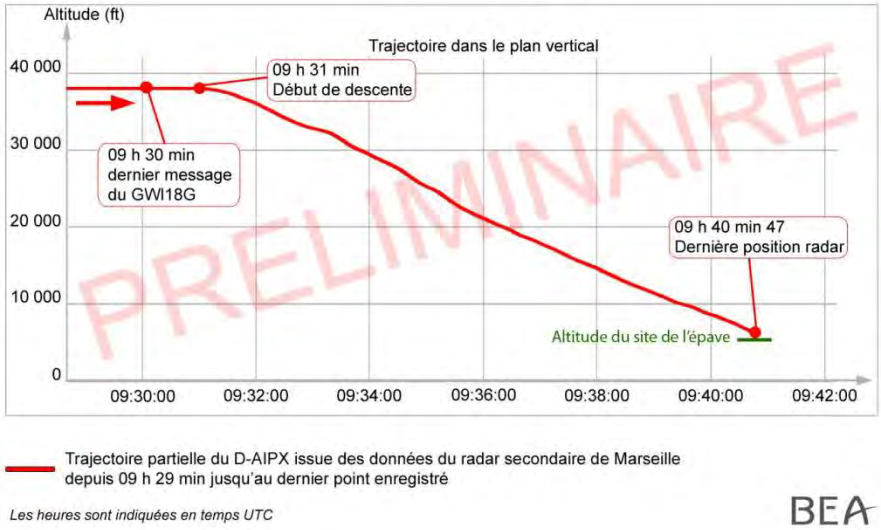
Readout of the memory board



Press conference

- After readout, plan for a press conference
  - Talk about the data that was extracted
  - Give a preliminary plots / history of flight





Organization & Conduct of the Investigation

1. Notification
   - Planning
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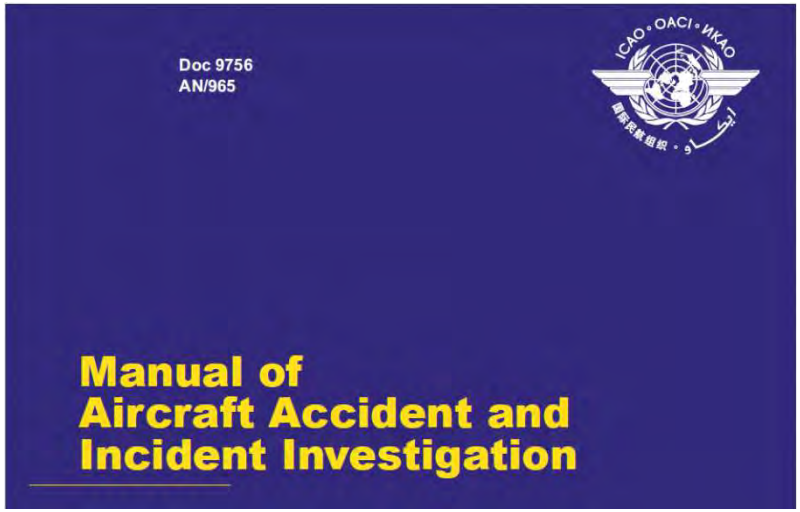
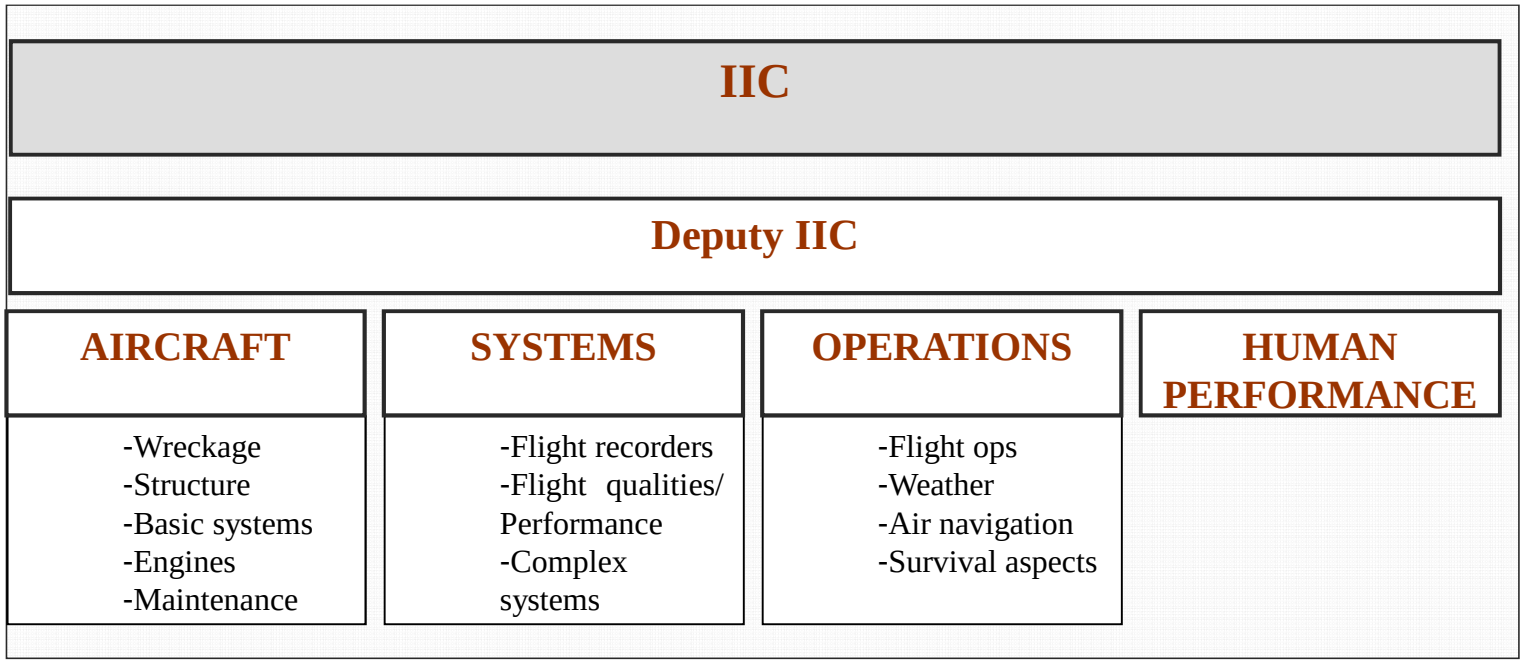


- **Part I** Organization and Planning
- **Part II** Procedures and Checklists
- **Part III** Investigation
- **Part IV** Reporting

Organization

- Working Groups:



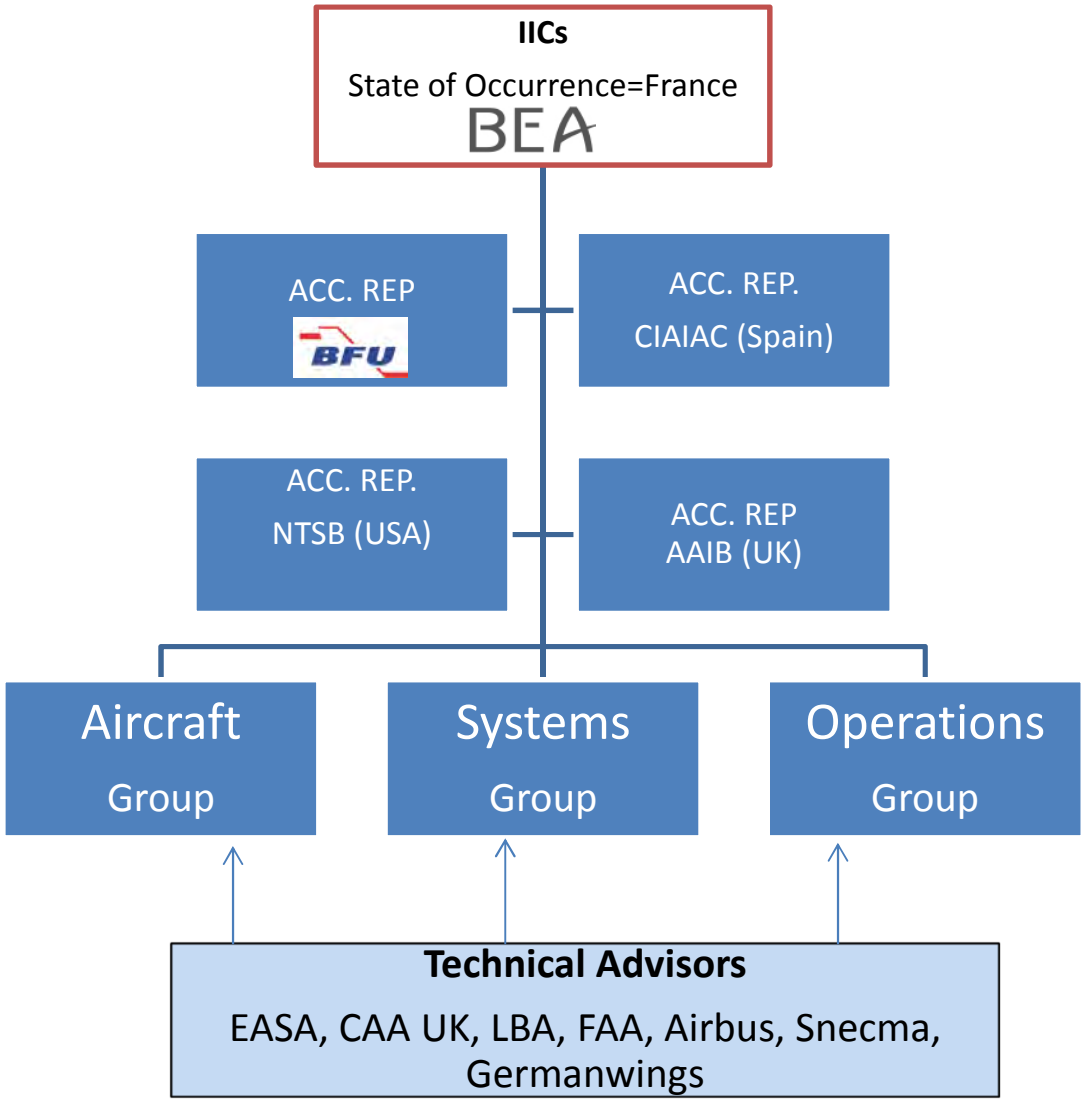
- IIC should establish objectives for each group
- Group leaders responsible for their Group report

BEA

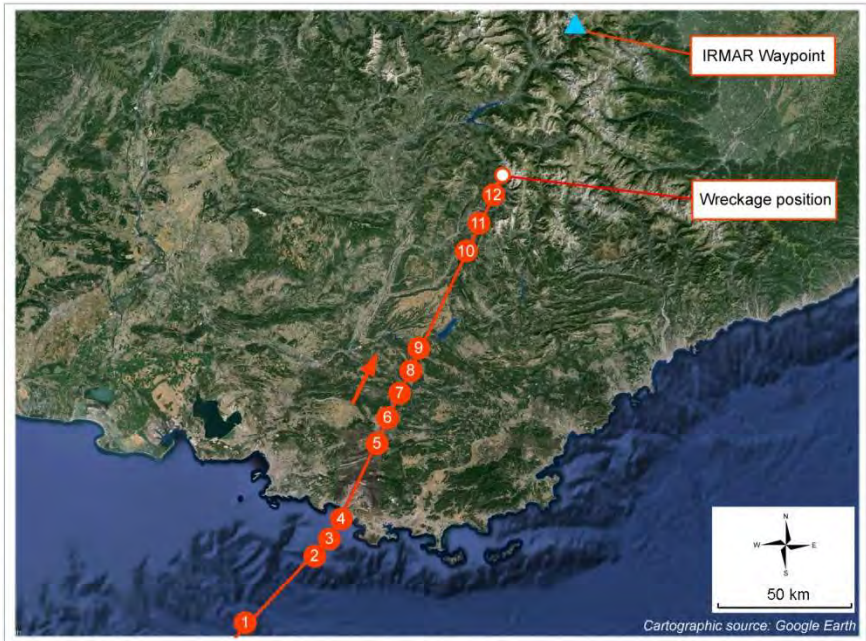
Case Study

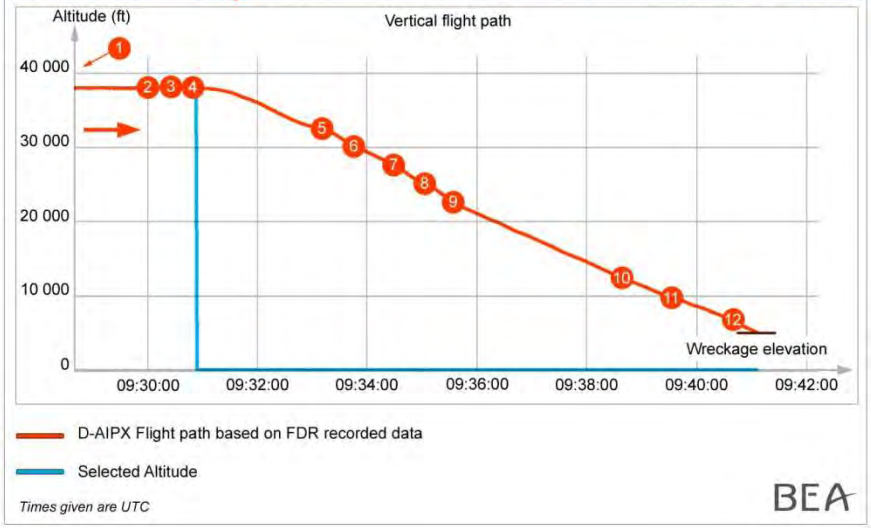
Accident
Airbus A320 registered
D-AIPX operated by
Germanwings on 24 March 2015

Germanwings Accident Investigation



Circumstances



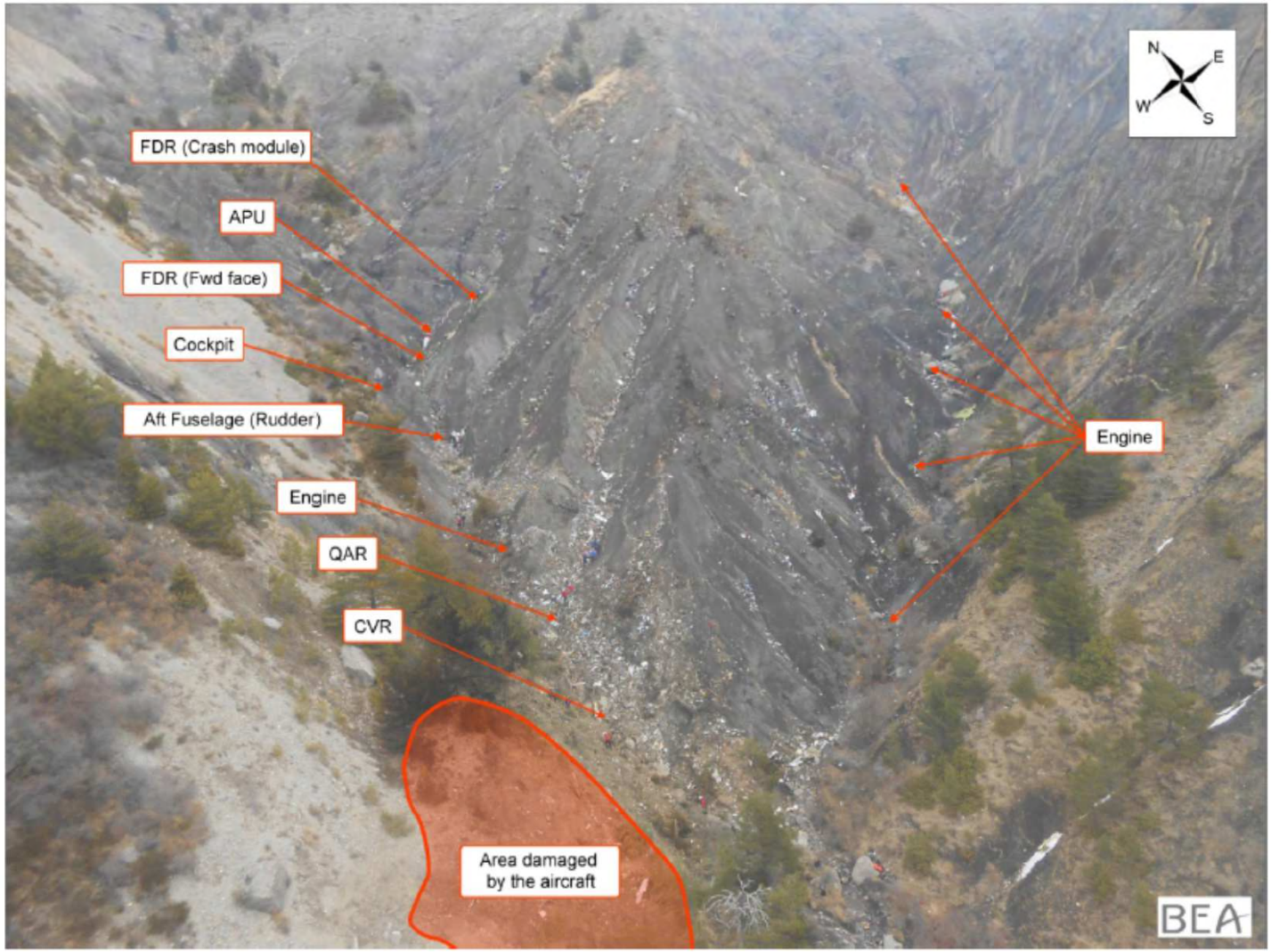


- Flight Barcelona => Düsseldorf
- 144 pax, 6 crew
- Copilot alone in the cockpit during cruise (point # 3)
- Autopilot commanded to descent until terrain (point #4)
- Cockpit door locked despite requests for access via keypad, cabin interphone and knocks on the door (point #7, #9, #11)

- *Note: Several altitude selections towards 100 ft were recorded during descent on the flight that preceded the accident flight, while the co-pilot was alone in the cockpit*

Factual information about the accident

- General view



Factual information about the accident

Wreckage site – general view

Human means and equipments

- More than 300 gendarmes and policemen on site (including high mountain specialists)
- 380 firemen
- French army
- Emergency physicians and psychologists
- 7 BEA investigators (inlcuding 2 wreckage and 2 recorders specialists)
- 3 BFU, 2 CIAIAC, 1 EASA, 10 GWI + LH, 6 Airbus, 2 SNECMA

Human means and equipments

- 5 helicopters from gendarmerie (on site operations)
- 1 plane for radiocommunications
- 13 helicopters from French Army (no-fly zone, SAR, VIP and specialits transport)
- 3 helicopters and 1 reco plane from firemen services

Human means and equipments

- Hotel 30 min from base camp (Seyne les Alpes A/D)
- Meeting room nearby village (wifi, photocopier, video projector)

Offroad trucks

Mobile Headquarters

Human means and equipments

- Fatigue management
  - 2 Wreckage Specialists day 1 to 7
  - 2 WS + 2 Relief team day 8
  - Only relief team the following days
- 8 am to 5 pm non stop (no restroom)
  - Lunch on site (quick snack)
  - Dinner at base camp offered by voluntary association

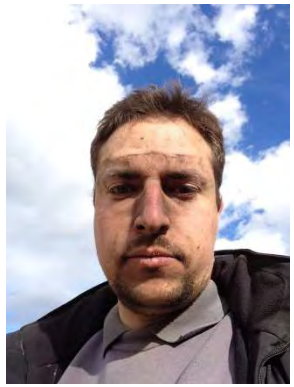
Human means and equipments

- Transportation
  - Helicopter winching
  - Offroad truck and walking
  - By road from

Human means and equipments

- Safety on site
  - FFP3 disposable mask
  - Protective footware (crushing)
  - Gloves (Kevlar + nitril + leather)
    (cut + fluid + perforation)

During



After

  - Helmet and harness

(provided by high mountain specialists)

  - Team = 1 BEA + 1 specialist

(with rope + crampon + ice axe)

Managing a large scale accident/incident investigation

Human means and equipments

- Dangers on site
  - Poisoning by fuel (smell remaining during 8 days)
  - Composite material (low risk – no massive fire)
  - Psychological risk (body parts)
  - Slippery surface more difficult going up (increasing slope and unsteady ground)

Human means and equipments

- End of site phase: 2 April 2015 (FDR recovery)
  - ↪ No injury or damages except one investigator shoe

Safety & Judicial Investigations

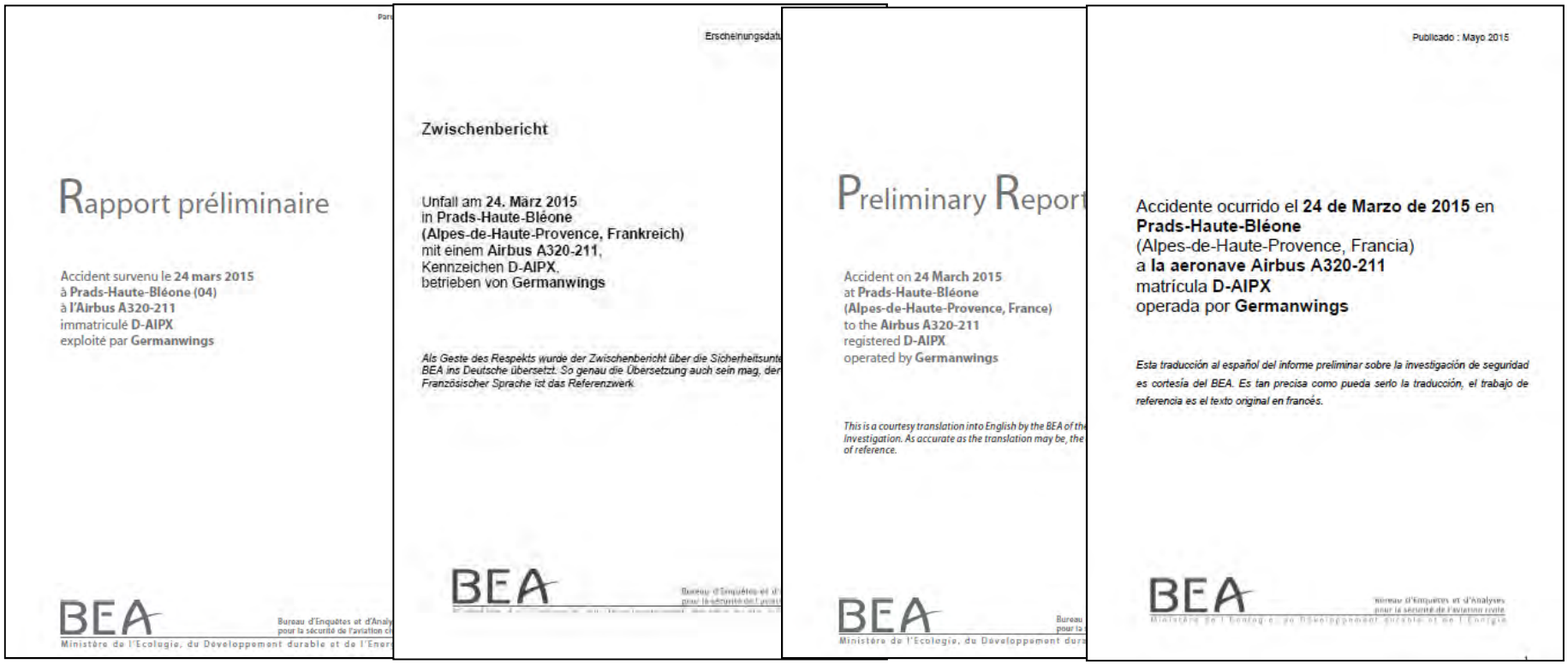
- European regulation (EU) 996/2010 – Article 12.2

Where, in the course of the safety investigation, it becomes known or it is suspected that an act of unlawful interference as provided for under national law, such as national law on accident investigations, was involved in the accident or serious incident, the investigator-in-charge shall immediately inform the competent authorities thereof. Subject to Article 14, the relevant information collected in the safety investigation shall be shared with those authorities immediately and upon request, relevant material may also be transferred to those authorities. The sharing of that information and that material shall be without prejudice to the right of the safety investigation authority to continue the safety investigation, in coordination with the authorities to which the control of the site may have been transferred.

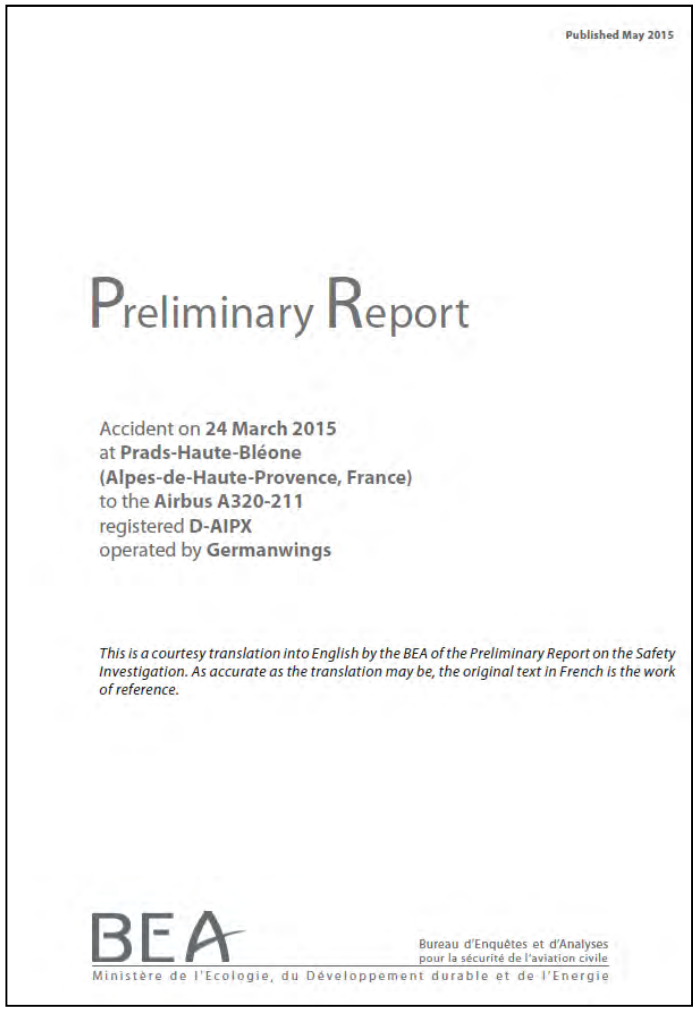
↪ **The BEA decided to continue the safety investigation**

Preliminary Report

- Date published: 6 May 2015, in 4 languages
- http://www.bea.aero/fr/enquetes/vol.gwi18g/vol.gwi18g.php



Initial Findings



Published May 2015

Preliminary Report

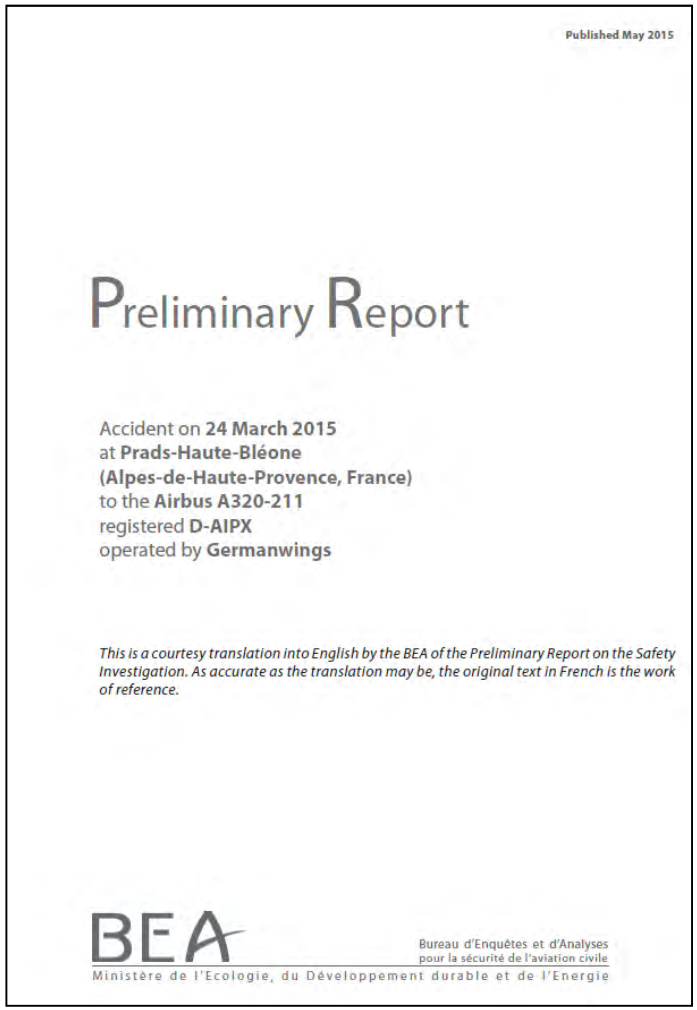
Accident on **24 March 2015**
at **Prads-Haute-Bléone**
(Alpes-de-Haute-Provence, France)
to the **Airbus A320-211**
registered **D-AIPX**
operated by **Germanwings**

This is a courtesy translation into English by the BEA of the Preliminary Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.

BEA
Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile
Ministère de l'Ecologie, du Développement durable et de l'Energie

- The flight crew possessed the licenses and ratings required to perform the flight.
- The co-pilot obtained his class 1 medical certificate without restrictions in April 2008, valid for one year.
- An episode of depression and the taking of medication to treat it delayed the renewal of the copilot's class 1 medical certificate between April and July 2009.
- From July 2009, the co-pilot's medical certificate was endorsed with the note *"Note the special conditions/restrictions of the waiver FRA 091/09 -REV-"*. His pilot's license had been endorsed with the note *"***SIC**incl. PPL***"*.

Ongoing Investigation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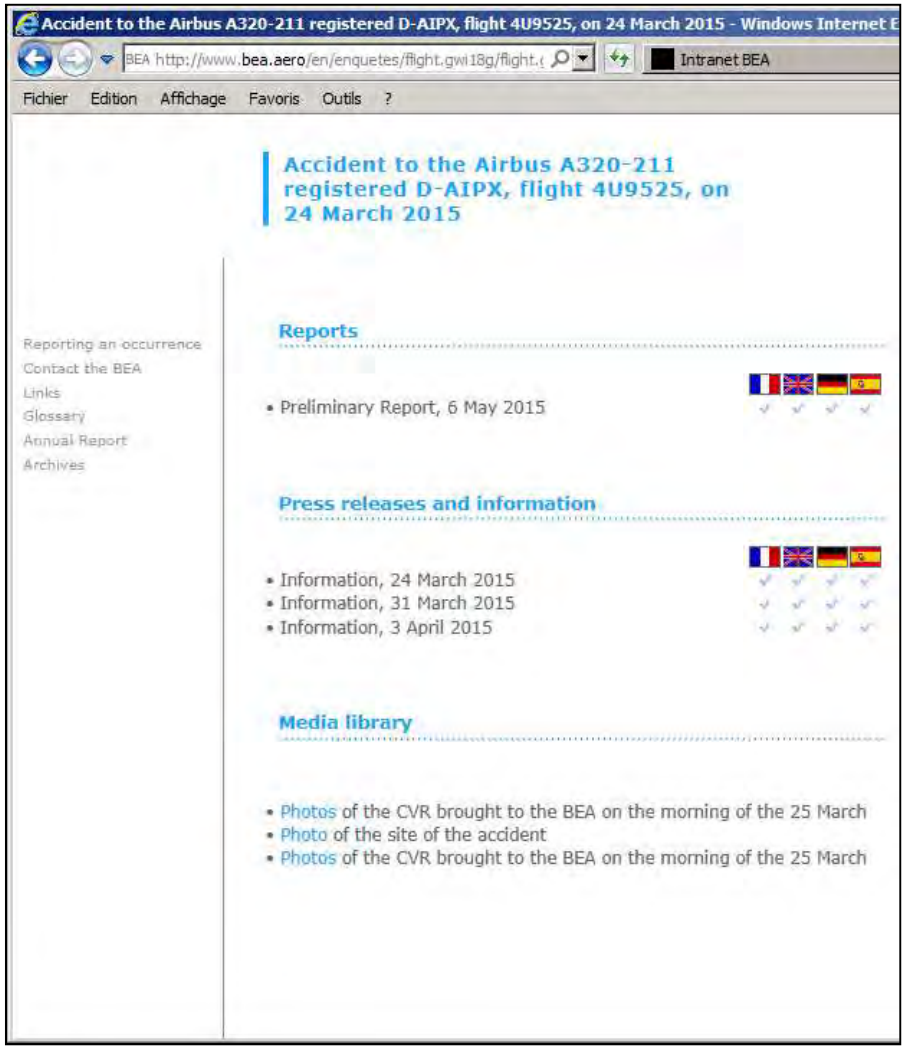
- Medical aspects: current balance between medical confidentiality and flight safety. How and why pilots can be in a cockpit with the intention of causing the loss of the aircraft and its occupants, despite the existence of:
  - regulations setting mandatory medical criteria for flight crews, especially in the areas of psychiatry, psychology and behavioral problems;
  - recruitment policies, as well as the initial and recurrent training processes within airlines.
- Cockpit security: compromises between the requirements of security, specifically those that followed the attacks on 11 September 2001, and the requirements of flight safety. In this context, the investigation will include a focus on cockpit door locking systems and cockpit access and exit procedures.

Similar events

- In progress

Date	Aircraft	Operator	State of Occurrence	Deaths	Circumstances
29/11/2013	ERJ 190	LAM	Namibia	33	The aeroplane was in cruise at flight level FL380 when the co-pilot left the cockpit to go to the toilet, leaving the Captain alone. On three occasions, different altitudes were selected to order a descent to the ground with autopilot. The CVR showed variable levels of aural warnings, as well as noises of repeated knocking and calls, corresponding to attempts to get into in the cockpit.
27/03/2012 **NEW**	A320?	JetBlue	USA	0	The Captain's erratic behaviour during flight between New York and Las Vegas prompted an unscheduled landing in Amarillo, TX after crew and passengers intervened to subdue the pilot.
28/01/2008 **NEW**	B767	Air Canada	North Atlantic Ocean	0	The aircraft was operating a scheduled passenger service from Toronto (Pearson) to London (Heathrow). On first contact with Shannon ATC the Commander made a PAN call and requested a diversion to Shannon Airport due to a medical emergency. The First Officers behaviour became belligerent and uncooperative which convinced the Commander he was now dealing with a crewmember who was effectively incapacitated The aircraft landed safety at Shannon where medical assistance was waiting to meet the aircraft.
31/10/1999	B767	EgyptAir	North Atlantic Ocean	217	The aeroplane was in cruise at flight level FL330 with a flight crew consisting of a Captain, a duty co-pilot and a relief co-pilot. The duty co-pilot left the cockpit, and the relief co-pilot took his place in the right seat. Eight minutes later, the Captain left the cockpit in turn, leaving the relief co-pilot alone. The autopilot was then disengaged and nose-down inputs were recorded on the FDR. The aeroplane descended. The engines were shut down. The Captain returned to the cockpit and tried to take back control of the aeroplane. The Captain repeatedly asked the co-pilot to help him to pitch up the aeroplane ("pull with me") but the latter continued to command the elevator to pitch nose down. The aeroplane regained altitude before descending again. It collided with the surface of the ocean. The reasons that led the co-pilot to take these actions could not be determined.
11/10/1999	ATR-42	Air Botswana	Botswana	1	The pilot, the only person on board, deliberately flew the aeroplane into the ground by crashing at Gaborone airport. The validity of his licence had been revoked for medical reasons.
19/12/1997	B737	Silk Air	Indonesia	104	While the aircraft was in cruise at 35,000 ft, the flight recorders stopped recording one after the other. The aeroplane suddenly started to descend. No Mayday message was transmitted before or during the descent. The aircraft crashed into a river. The safety investigation was not able to identify any technical problem that would make it possible to explain the accident.
21/08/1994	ATR42	Royal Air Maroc	Morocco	44	The Captain disengaged the autopilot and deliberately directed the aircraft towards the ground. The co-pilot was in the cockpit but was not able to counter the Captain's actions.
09/02/1982	DC-8	Japan Airlines	Japan	24	After having disengaged the autopilot on final approach at a height of 164 ft, the pilot pushed the control column forward and set the thrust levers on idle. He then moved the thrust levers of engines 2 and 3 to the reverse idle position. While the aircraft's attitude decreased, the co-pilot tried to pull on the control column. The co-pilot was unable to raise the nose of the aeroplane because the Captain was pushing forward on the control column with both hands. The aircraft crashed into the sea 510 m short of the runway. The investigation showed that the pilot's actions resulted from a mental problem. He was suffering from schizophrenia.

Investigation Communication Timeline



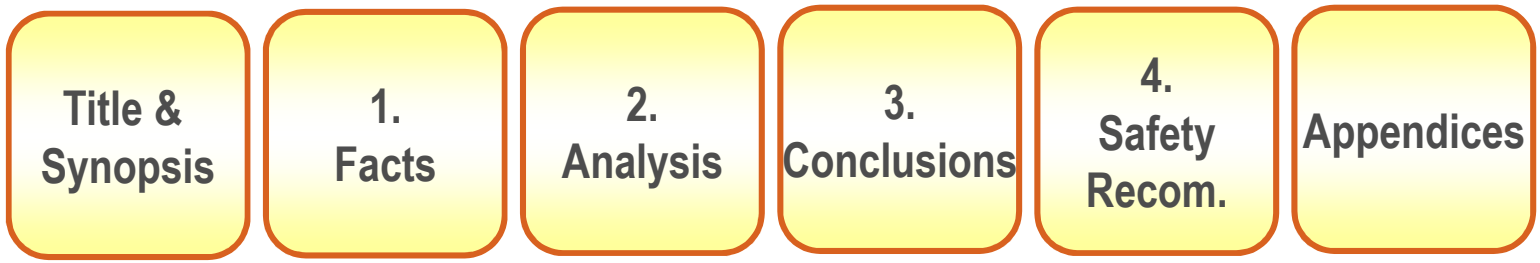
+ Press Conference – 25 March 2015

Report Drafting & Consultation

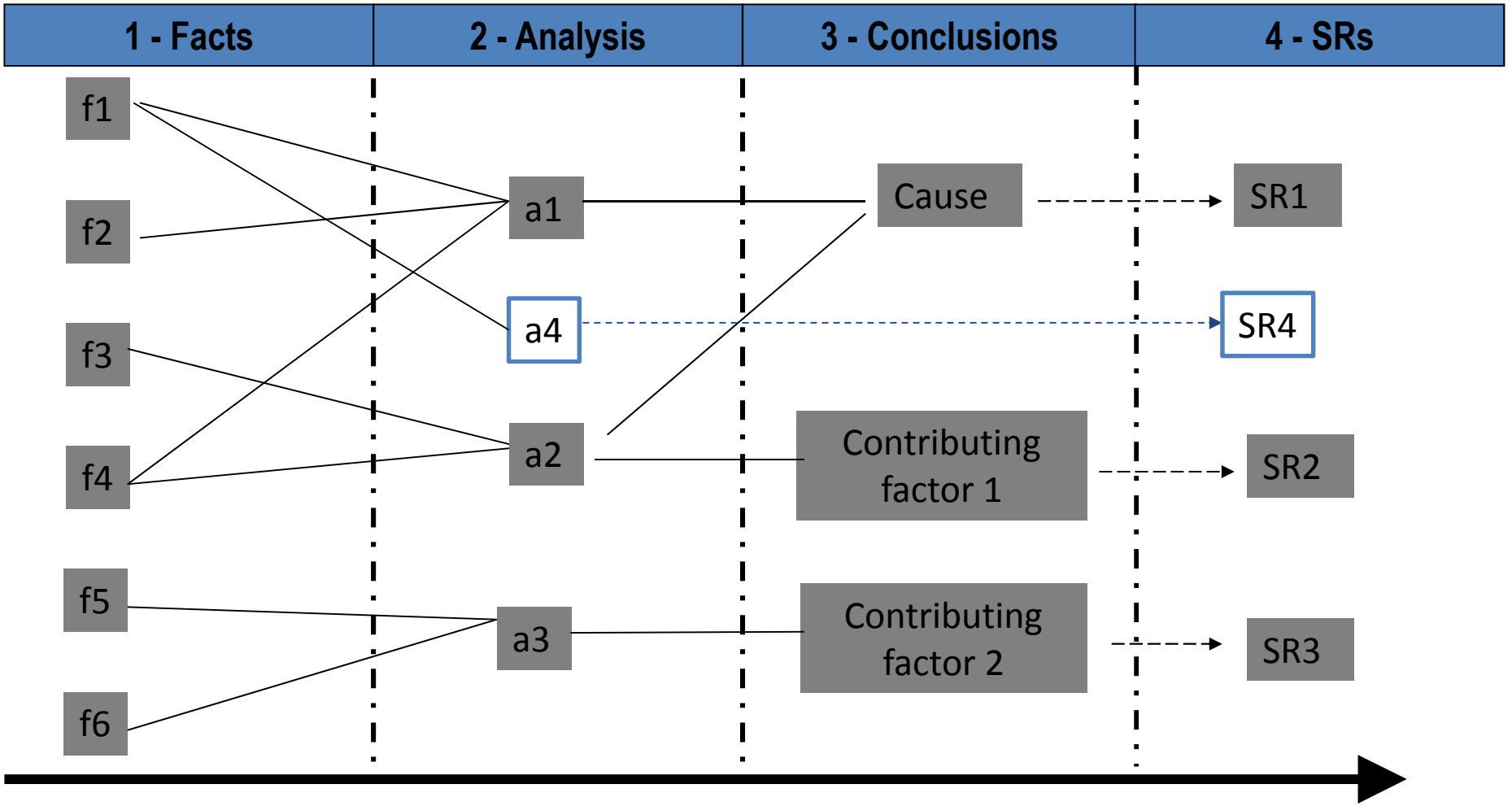
- A well-structured report
  - Means a well-structured methodology
- Consultation
  - Break the isolation
  - But remain independent

Report Format

- Extent of the investigation linked to the lessons expected to be drawn for the improvement of aviation safety
  - Full-ICAO Annex 13 reports
  - Simplified reports (“accident brief”, “bulletin”…)



Report Structure

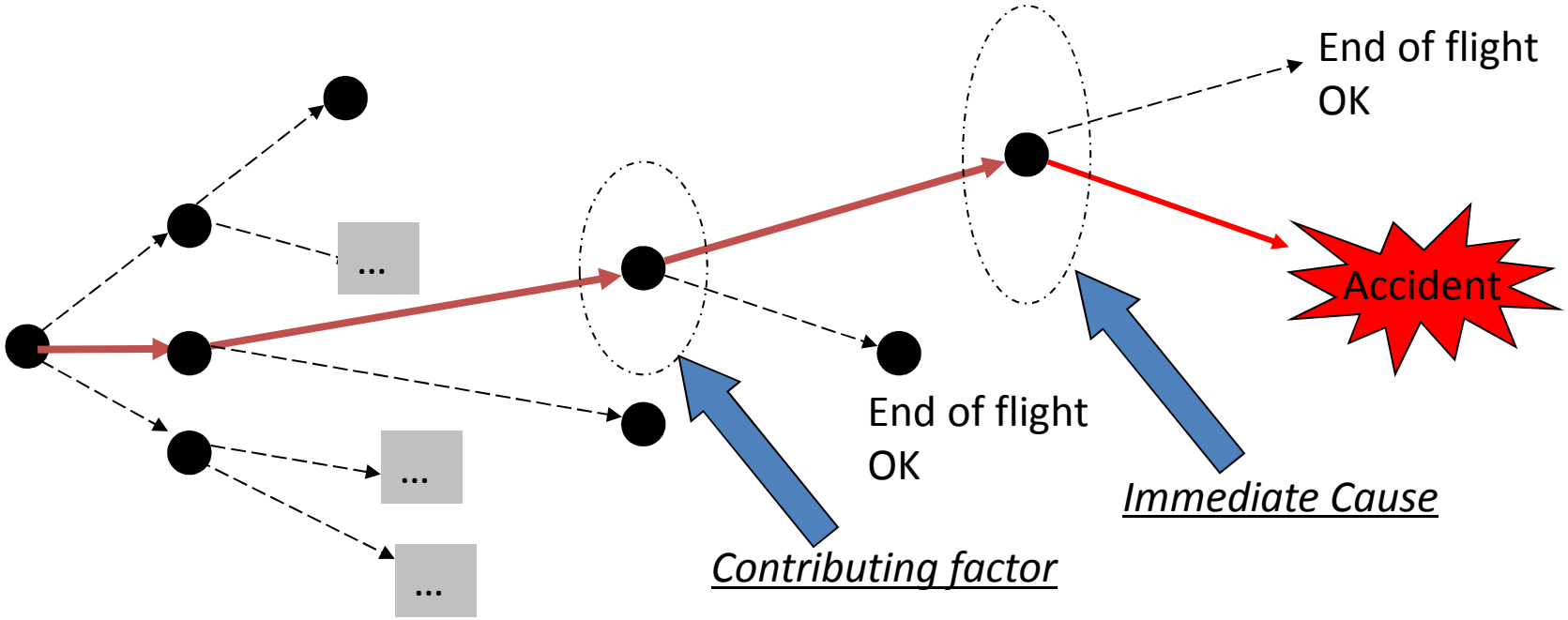


What is a « cause » or « contributing factor »

- Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident
  - Act or condition against which one should fight against in order to prevent similar accidents/incidents
- Answer to the question "WHY?"
  - NOT the question "WHAT?"
  - CFIT, LOC-I, System failure… describe what happened, not why
- Should be formulated with preventive action in mind, and linked to appropriate safety recommendations
  - The reader should be able to "guess" the SRs once the causes have been read

How to determine cause & contributing factors

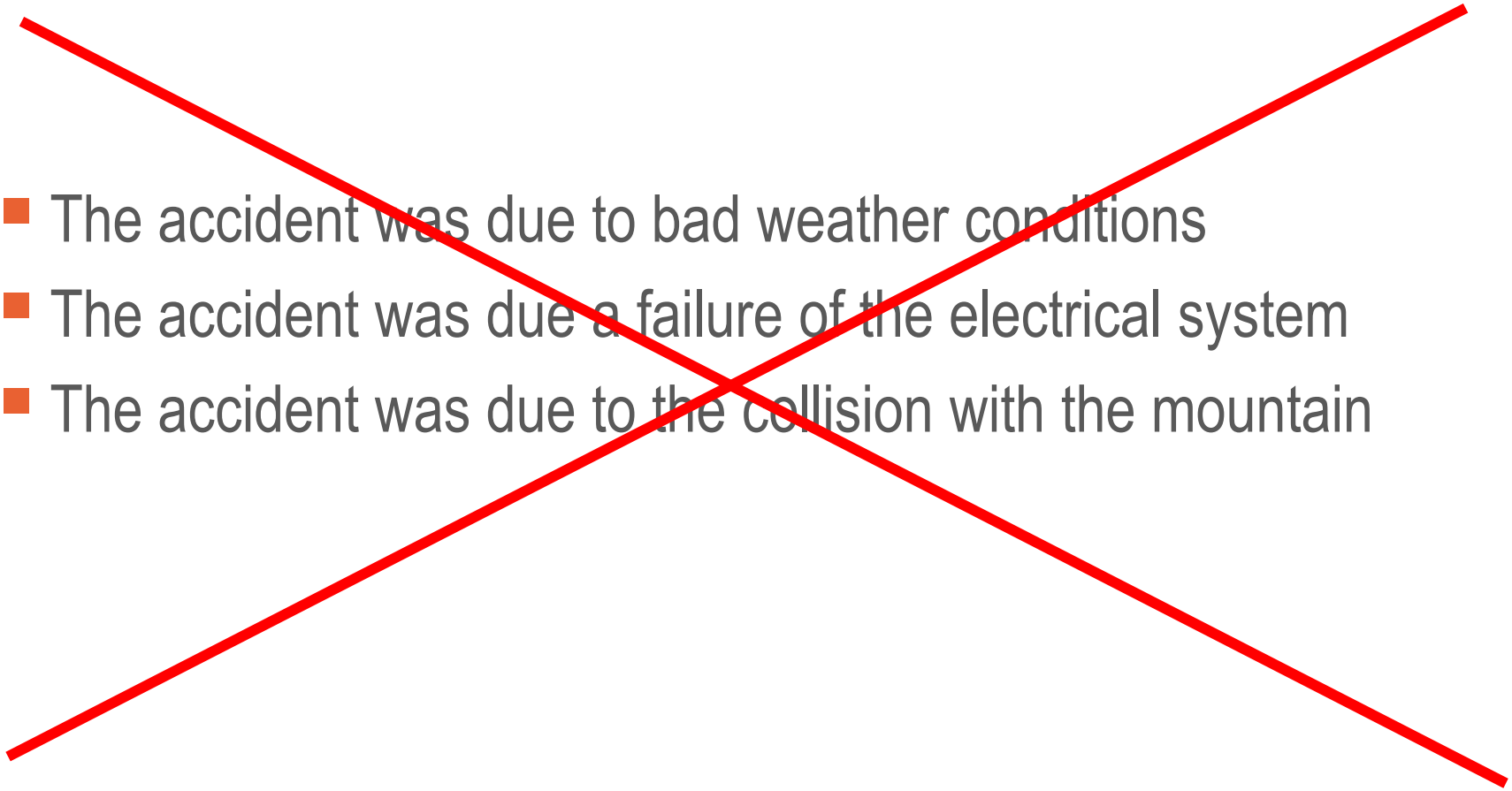
- Build a scenario, by identifying turning points (decision point by various actors, like pilots, technician, controller, designer…)



- The immediate cause is the last turning point before the accident
- Contributing factors are the preceding ones: even if going towards the accident, there was still a way out

Examples to avoid

- The accident was due to bad weather conditions
- The accident was due a failure of the electrical system
- The accident was due to the collision with the mountain



Consultation

- The State conducting the investigation sends a copy of the "draft final report" to any State that participated in the investigation
  - Acc. Reps consult Technical Adviser
  - Acc. Reps compile comments
- 60 days
- For large scale investigation:
  - Plan meeting to merge comments
  - Give feedback on what you take into account or not
- Amend report or append comments (for Acc. Reps comments)

Publication & Safety Recommendations

- Interim Report ~30 days
  - May include Safety Rec.
- Final Report within 12 months
  - If not possible, issue an interim statement publicly available on each anniversary

Language Issue

- The report shall be submitted to appropriate States and to ICAO in one of its working languages
- As often as possible, provide an English version of the report
  - Reports in their English version are more accessible and, as such, more downloaded
- Make the report publicly available
  - Internet site
  - ICAO's e-Library of Final Reports

Releasing the report

- Especially, for large scale investigation
  - Plan a victims' families meeting to present the report before it is released
  - Prepare a media release
  - Expect reactions from the families, the airline, the manufacturer

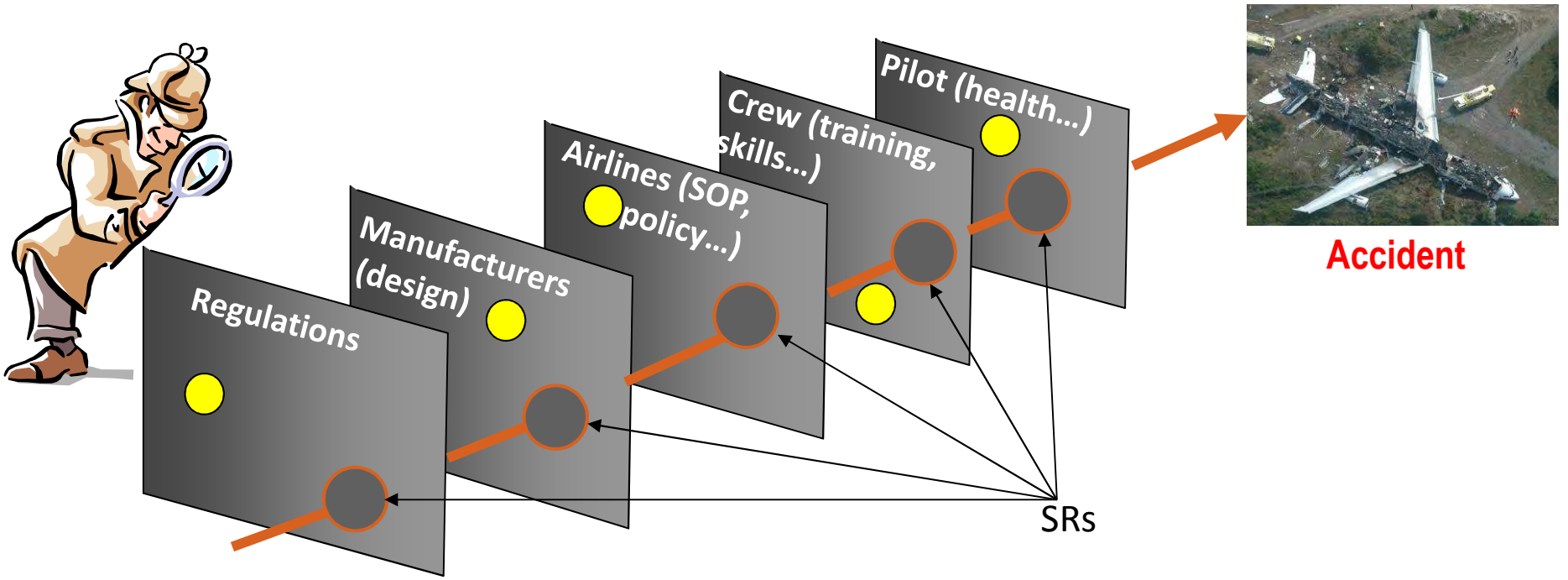
It may be appropriate to make a presentation of the report to the executives of the airline if the latter is involved in the conclusions of the investigation

Safety Recommendations

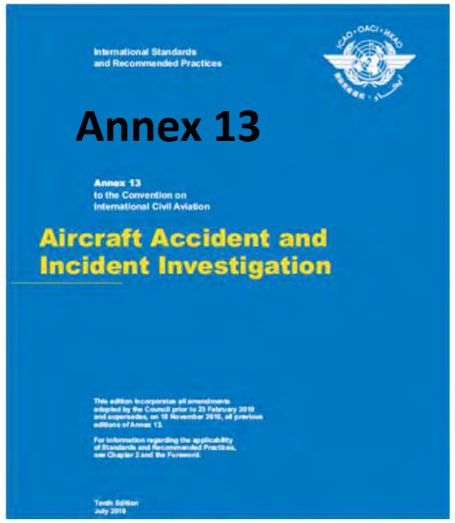
- Annex 13 definition : "*A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.*"
- Golden rules:
  - Be backed by strong evidence and clear cause-and-effect relationships
  - Focus the attention on the problem rather than the suggested solution
  - Include a specific addressee
  - Leave enough scope for the addressee to determine how the problem could be resolved

Basis of a Safety Recommendation

- Holes in the “safety barriers” have been identified by the investigation or the safety study
- SRs should point out the areas where to apply a “patch” in order to cover the holes



Follow-up



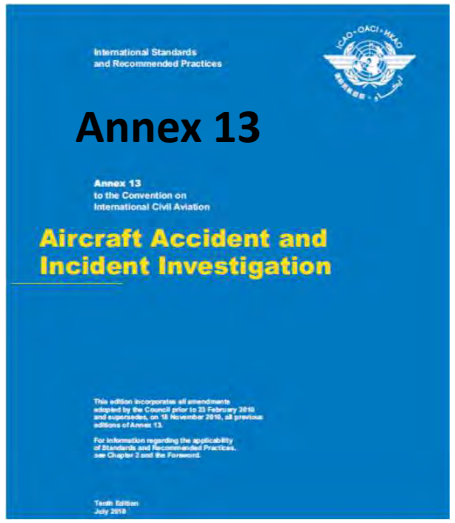
- § 6.10 *A State that receives safety recommendations shall inform the proposing State, within ninety days of the date of the transmittal correspondence, of the preventive action taken or under consideration, or the reasons why no action will be taken.*

- EU 996/2010

  ↪ Same as Annex 13 +

> 2. Within 60 days of the receipt of the reply, the safety investigation authority shall inform the addressee whether or not it considers the reply adequate and give justification when it disagrees with the decision to take no action.

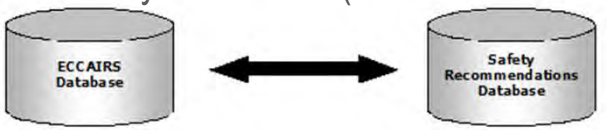
Follow-up



- § 6.11 *A State conducting an investigation or any other State issuing a safety recommendation should implement procedures to record the responses to the safety recommendation issued*
- § 6.12 *A State that receives a safety recommendation should implement procedures to monitor the progress of the action taken in response to that safety recommendation*

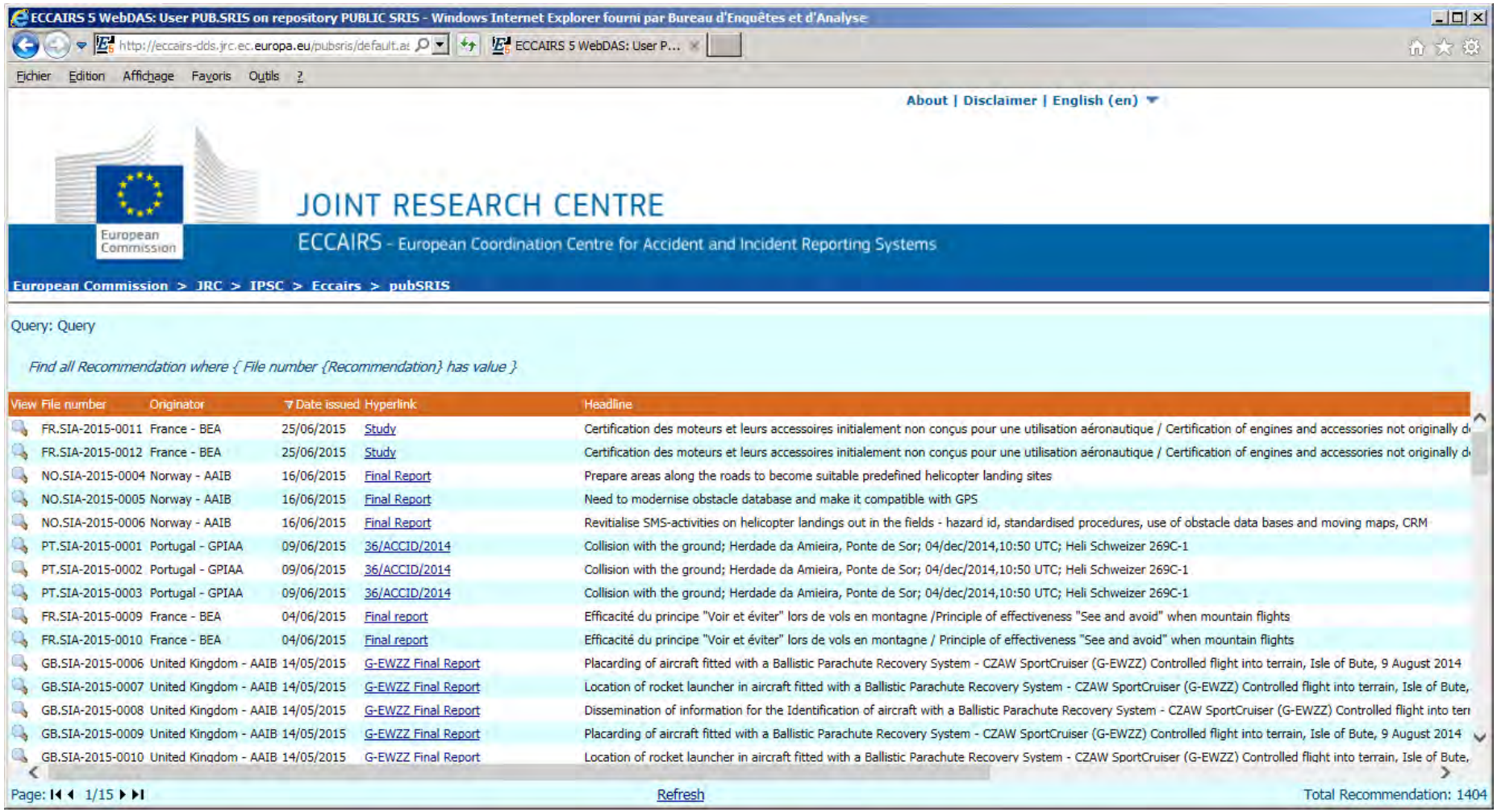
SRIS in EU States

- Sharing recommendations and experience on their effectiveness is helpful when considering issuing new recommendations
- Enable queries on common safety concerns or themes
- Track the timeliness of responses, as well as the assessments on these responses
- Make the final reports or safety studies containing the recommendations easily accessible (via hyperlinks)



SRIS

- http://eccairs-dds.jrc.ec.europa.eu/pubsris/default.asp



Conclusion

- Always try to consult the addressee of your safety recommendations before issuing them
- A series of serious incidents may really support your recommendations
- Sharing safety recommendations adds weight to our impact on safety

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Thank you for your attention

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