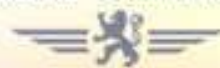




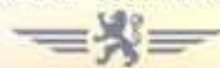
DIRECTION DE L'AVIATION CIVILE
GRAND-DUCHÉ DE LUXEMBOURG



Risk assessment using the ARMS Methodology

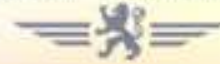
EASp Summit 10.6.2014

Jean-Claude PETESCH



Summary

1. Introduction – Aviation in Luxembourg
2. ARMS Methodology
3. Handling of occurrence reports
4. From occurrence report to Risk assessment
5. Software implementation
6. Obstacles cleared and obstacles ahead



1. Aviation in Luxembourg

1 Airport:

- 2,2 million passengers
- 673.500 t cargo

3 grass airfields

5 heliports (hospitals)

2 helidecks on ships

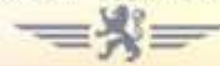
3 ANSPs



Picture:
Administration de la Navigation Aérienne



DIRECTION DE L'AVIATION CIVILE
GRAND-DUCHÉ DE LUXEMBOURG



1. Aviation in Luxembourg

8 AOCs

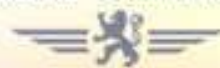
290 aircraft on register

Direction de l'Aviation Civile
personnel: 50

State Safety Programme:
Awaiting legal base –
draft *Règlement grand-ducal*
submitted for approval



Picture Viktor László



2. ARMS Methodology

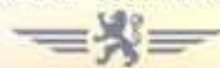
Aviation Risk Management Solutions

2 separate assessments:

1. Event Risk Classification ERC for occurrences
2. Safety Issue Risk Assessment SIRA for safety issues

Why 2 separate assessments?

- Risk = Frequency x Severity - *how to assess the « frequency » of 1 occurrence?*
- The « Barrier » model – *how to integrate it in risk assessment?*
- Development of a « Safety Issue » database



2. ARMS Methodology

1. ERC – Event Risk Classification

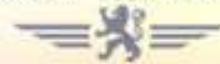
Question 2

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?	
Catastrophic Accident	Loss of aircraft or multiple fatalities (3 or more)
Major Accident	1 or 2 fatalities, multiple serious injuries, major damage to the aircraft
Minor Injuries or damage	Minor injuries, minor damage to aircraft
No accident outcome	No potential damage or injury could occur

Typical accident scenarios
Loss of control, mid air collision, uncontrollable fire on board, explosions, total structural failure of the aircraft, collision with terrain
High speed taxiway collision, major turbulence injuries
Pushback accident, minor weather damage
Any event which could not escalate into an accident, even if it may have operational consequences (e.g. diversion, delay, individual sickness)



2. ARMS Methodology

2. SIRA – Safety Issue Risk Assessment

1. Define:

Triggering event

Barriers to avoid UOS

UOS - Undesired operational state

Barriers to recover from UOS

Accident outcome

2. Estimate frequency...

...of event (every ... flights)

...how often the barriers fail

...of event

...how often the barriers fail

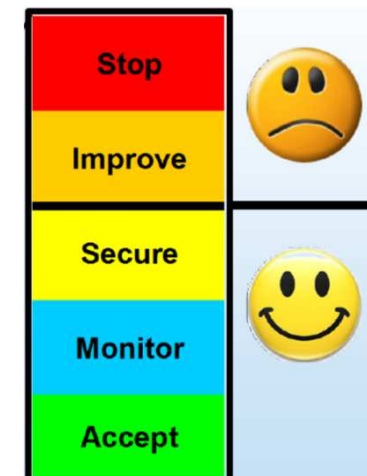
Result:
estimated accident frequency

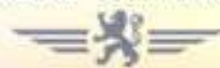
3. Assess:

Accident severity
(catastrophic / major / minor / no acc.)

Result: tolerable limit
(1 every ... flights)

4. Compare





3. Handling of occurrence reports

DAC safety management & occurrence handling department:

2 persons

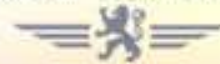
Safety Action Group:

safety department + 1 member from each safety oversight department:

- Airworthiness
- Operations
- NSA
- Aerodromes

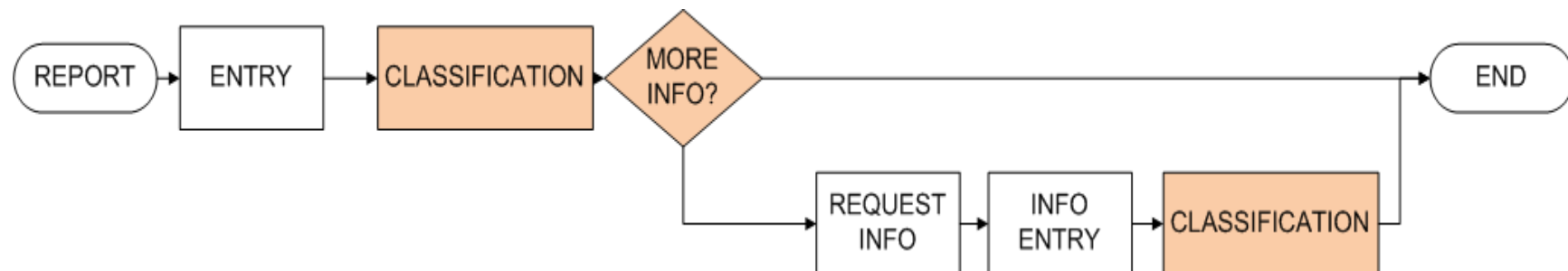
Members provide expertise and link to their department

Weekly meeting for occurrence classification and risk assessment

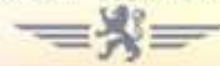


3. Handling of occurrence reports

Occurrence handling workflow:

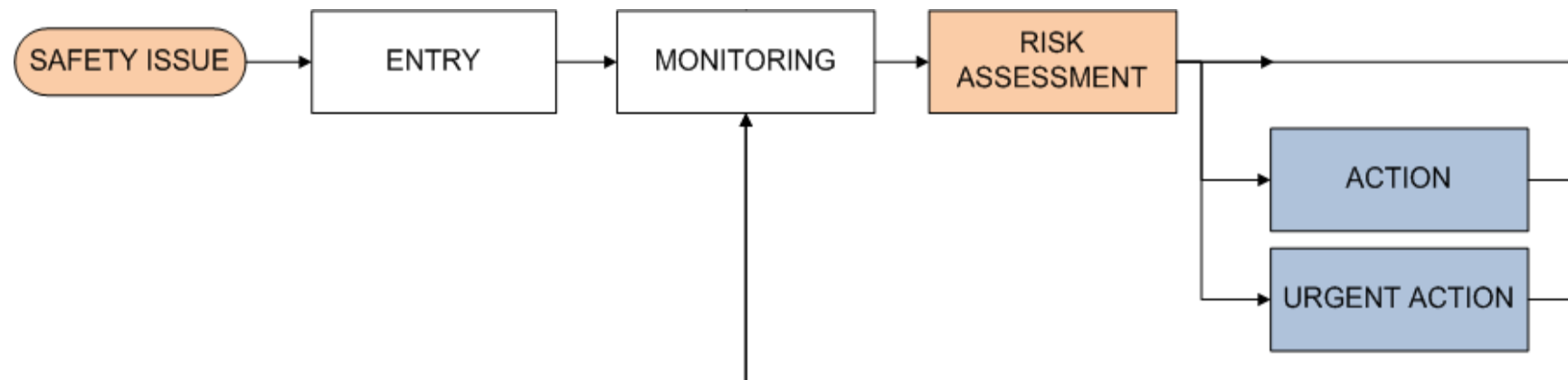


ERC classification implemented since July 1st 2013



4. Handling of safety issues

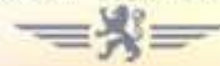
Safety Issue workflow:



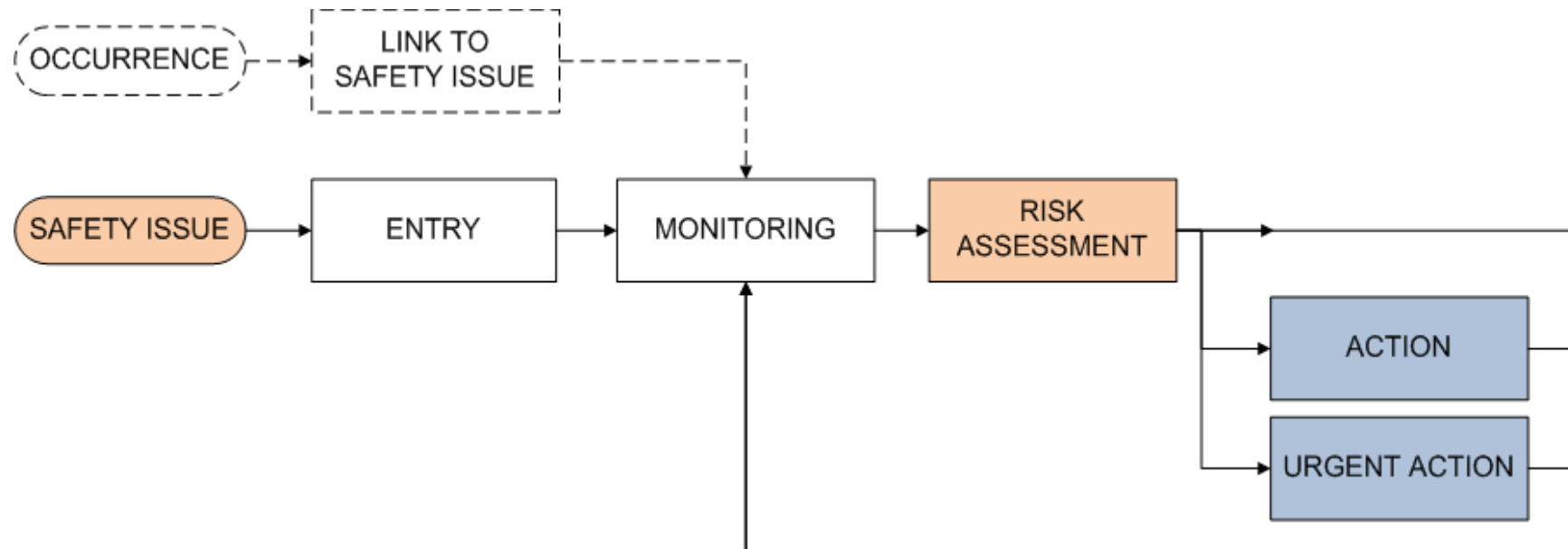
Identify safety issue: safety department / Safety Action Group

Risk Assessment: Safety Action Group

Action or urgent action: any department concerned or operators' SMS



4. Handling of safety issues

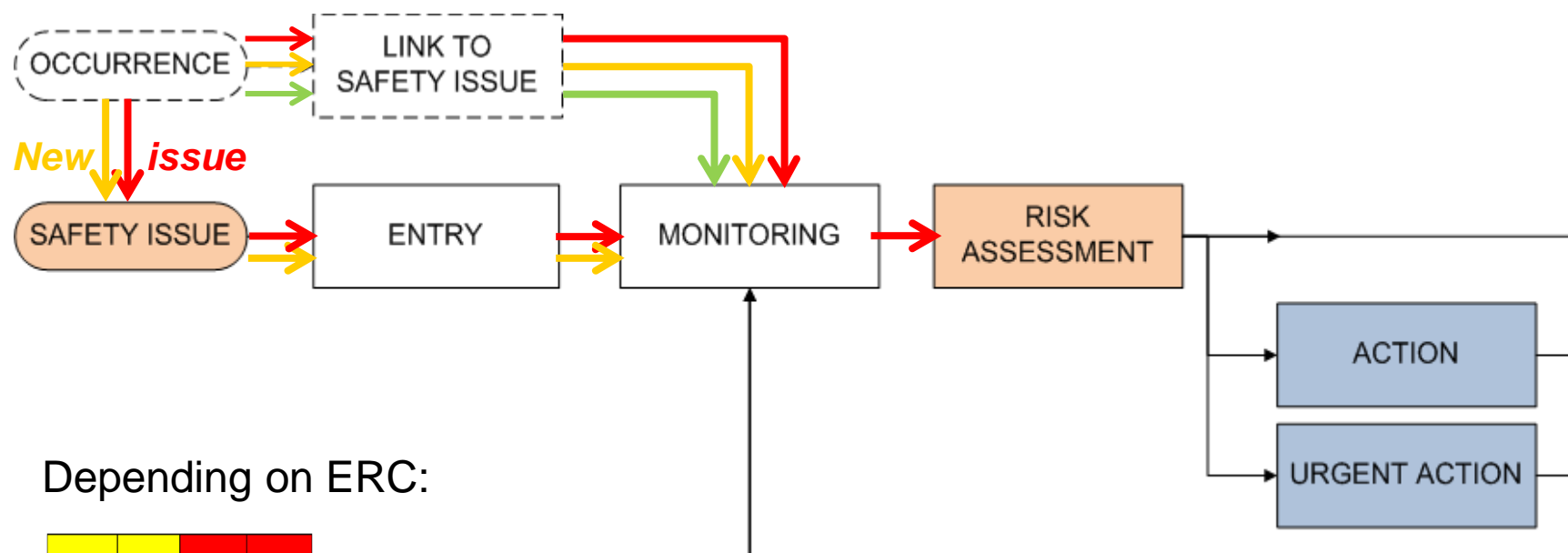


Occurrences linked to Safety Issue

Safety Issue Risk Assessment implemented since October 1st 2013



4. Handling of safety issues



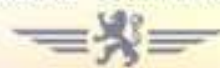
Depending on ERC:

50	102	502	2500
10	21	101	500
2	4	20	100
1			

Green: link to Safety Issue (if S.I. exists)



Yellow: link to Safety Issue (create S.I. if necessary)

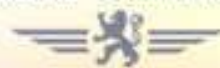
Red: link to Safety Issue (create S.I. if necessary) + RA



4. Handling of safety issues

Actions:

<div>Stop</div> <div>Improve</div>		Urgent action: <ul style="list-style-type: none">• Inform director• Verification of action (closed loop)	Monitoring: schedule next risk assessment in 6 or 12 month (closed loop)
		Action: <ul style="list-style-type: none">• DAC or operator's SMS	
	<div>Secure</div> <div>Monitor</div> <div>Accept</div>		



4. Handling of safety issues

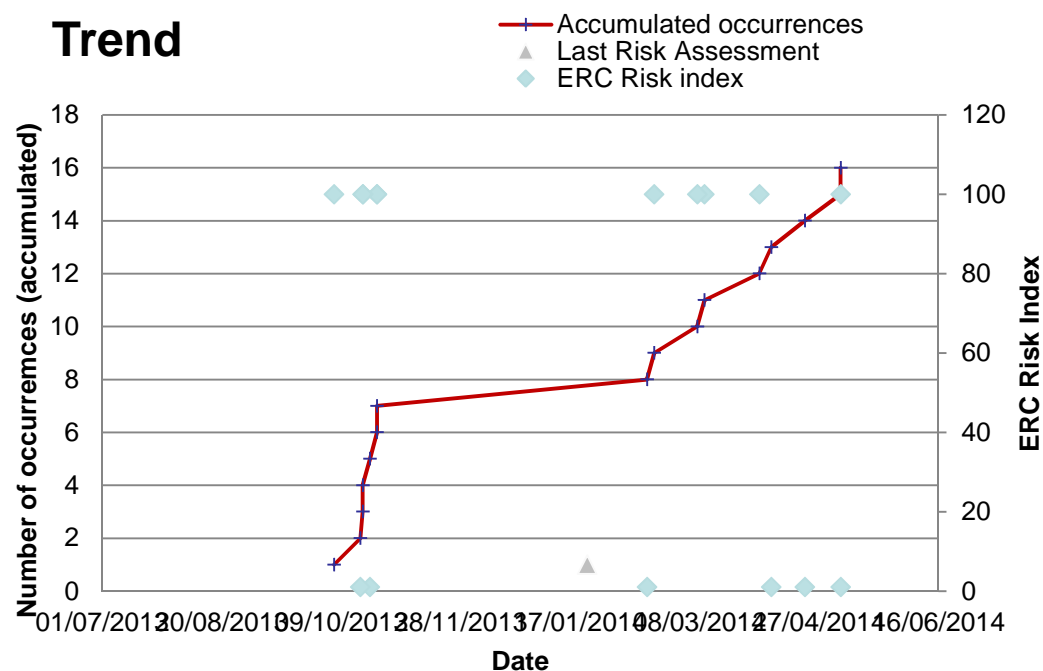
Data available per
Safety issue:

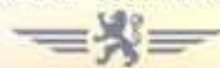
- Number of related occurrences
- Sum of ERC Risk indexes
- Average of ERC Risk indexes

Example:
Birdstrikes at ELLX

Start date (1st. Occ)	06/10/2013	Number of occurrences	16
		Average ERC Risk index	62,9
Date of last RA	20/01/2014	Number of occurrences	9
		Average ERC Risk index	56,0

Trend

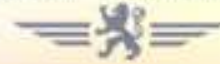




4. Handling of safety issues

Risk assessment

- Scheduled (due dates)
- Performed by the Safety Action Group
- Quick assessment (ca. 20 min.)
- To be repeated every 6 or 12 month



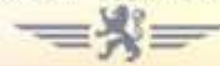
5. Software implementation

Software to manage workflows:

- Occurrence reporting workflow
initial report(s) as attachment
- SIRA (Safety Issue and Risk Assessment) Workflow
Link between 1 Safety issue and many occurrences

Features:

- Easy to use (Safety Action Group)
- User-defined screen layout
- Search/Filter the list of occurrences and list of safety issues
- Export to MS Excel (data from the list of occurrences or safety issues)
- Creation of forms (data from 1 Occurrence / 1 Safety Issue)



5. Software implementation

Occurrence report

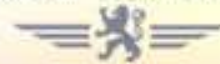
Title, date, location

Information:
Aircraft, flight
Narrative

Classification / Categorisation

The screenshot shows a web-based form for reporting an occurrence. The title bar indicates 'Enregistrement - < nouveau > [Entry]'. The interface is divided into several sections:

- Général:** Includes fields for 'Id' (set to '< nouveau >'), 'Date' (03/06/2014), 'Type' (1_Occurrences), 'Clôturé le' (ap. J.-C.), 'Reporting operator', 'Location', 'UTC Date' (ap. J.-C.), 'Oper. Ref.', 'State', and 'UTC Time' (ap. J.-C.).
- Information:** Includes fields for 'Registration', 'Departure', 'Operator', 'Flight Nb.', 'Type (ICAO 4-letter)', 'Destination', 'Flight phase', and a 'Narrative' text area. The 'Narrative language' is set to 'English'.
- Review:** Includes a 'DAC Follow-up action' section with radio buttons for 'Logged - no follow-up', 'Information', 'Info (monthly report)', and 'Investigation'. It also has a 'Watchlist' dropdown and 'Departments' checkboxes for ADRM, ATM, NAV, and OPS.
- Occurrence Categories:** A grid of checkboxes for various categories including ADRM, AMAN, ARC, ATM, BIRD, CABIN, CFIT, EVAC, F-POST, FUEL, GCOL, ICE, LALT, LOC-G, LOC-I, MAC, OTHR, RAMP, RE, RI-A, RI-VAP, SCF-NP, SCF-PP, SEC, TURB, UNK, USOS, and WSTRW.
- Injury Level:** Includes dropdowns for 'Injury Level' (None), 'Damage Aircraft' (None), 'Damage Aerodrome' (None), '3rd Party Damage' (No), and 'ATM contribution'.



5. Software implementation

Occurrence report

Enregistrement - < nouveau > [Entry]

Sauvegarder et clôturer l'étape

Etape actuelle: Entry

Général

Id < nouveau > Date 03/06/2014

Type 1_Occurrences

☐ Clôturé le

ap. J.-C.

State Reporting Luxembourg Luxembourg (CAA)

Occurrence Follow-up ERC Attachments and history

Title

Reporting operator Location UTC Date ap. J.-C.

Oper. Ref. State UTC Time ap. J.-C.

ERC Risk Index

Most credible accident outcome?	Effectiveness of remaining barriers?			
	Effective ERC Risk index	Limited	Minimal	Not effective
Catastrophic accident	<input type="radio"/> 50	<input type="radio"/> 102	<input type="radio"/> 502	<input type="radio"/> 2500
Major accident	<input type="radio"/> 10	<input type="radio"/> 21	<input type="radio"/> 101	<input type="radio"/> 500
Minor injuries or damage	<input type="radio"/> 2	<input type="radio"/> 4	<input type="radio"/> 20	<input type="radio"/> 100
No accident outcome	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1

ERC Result

☐ RED Immediate investigation and action (500-2500)

☐ YELLOW Investigation or further risk assessment (20-102)

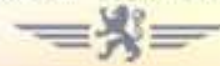
☐ GREEN No further action (1-10)

SIRA

Link to Safety Issue

Accident scenario(s) considered

Remaining barriers



5. Software implementation

Safety Issue

Title

Date of next RA

Information:
Scenario
Categories:
CICCTT,
departments

Limitations:
Specific...
...aircraft?
...operator?
...location?

Enregistrement - < nouveau > [Entry]

Sauvegarder et clôturer l'étape

Etape actuelle: Entry

Général

Id: < nouveau > Date: 03/06/2014

Type: 2_Monitor&RA_V0

Clôturé le: ap. J.-C.

Safety Issue Title

Description of hazard

Next Risk Assessment due date: ap. J.-C.

Info Occurrences Risk Assessment Follow-up Urgent action Attachments and history

Description of scenario

Departments

☐ ADM ☐ ATM ☐ NAV ☐ OPS

Categories

☐ ADM ☐ AMAN ☐ ARC ☐ ATM ☐ BIRD ☐ CABIN ☐ CFIT ☐ EVAC ☐ F-NI ☐ F-POST

☐ FUEL ☐ GCOL ☐ ICE ☐ LALT ☐ LOC-G ☐ LOC-I ☐ MAC ☐ OTHR ☐ RAMP ☐ RE

☐ RI-A ☐ RI-VAP ☐ SCF-NP ☐ SCF-PP ☐ SEC ☐ TURB ☐ UNK ☐ USOS ☐ WSTRW

Occurrences - Total

Nb of occ. (all): 0

Avg. RI (all): 0

Occ. - last RA period

Occ. - last RA: 0

Avg. RI (last R): 0

Specific to ...?

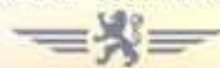
Registration

Type (ICAO 4-letter)

Operator

Location

Additional occurrences (+ ERC RI)



5. Software implementation

Safety Issue

Title

Date of next RA

Risk assessment:

Triggering event

Barriers to avoid

UOS

Barriers to recover

Accident outcome

Accident severity

RA Outcome

Enregistrement - < nouveau > [Entry]

Sauvegarder et clôturer l'étape

Etape actuelle: Entry

Général

Id: < nouveau > Date: 03/06/2014

Type: 2_Monitor&RA_V0

☐ Clôturé le

ap. J.-C.

Safety Issue Title

Description of hazard

Next Risk Assessment due date: ap. J.-C.

Info Occurrences Risk Assessment Follow-up Urgent action Attachments and history

Risk assessment iteration No. 0 completed on ap. J.-C.

Triggering event

Frequency of trigg. event

Barriers to avoid

Frequency of failure

UOS

UOS Frequency 1

Barriers to recover

Frequency of failure

Accident outcome

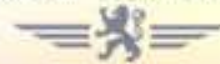
Acc. Frequency 0

Accident severity

SIRA -2

Result

Comments



6. Obstacles

Lessons learned - ERC:

1. « Calibration » is required

Example: bird strike –
no damage to aircraft

Most credible accident
outcome?

Minor injuries or damage

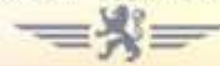


Effectiveness of
remaining barriers?
Not effective ↓

50	102	502	2500
10	21	101	500
2	4	20	100
1			

ERC Risk Index = 100

Final outcome: Birdstrike as highest risk?



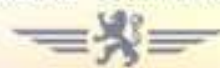
6. Obstacles

Lessons learned - SIRA:

1. « Scope » of a safety issue: not too narrow but not too wide
 - too narrow: no « repeat » occurrences, too many Safety Issues
 - too wide: impossible to do a risk assessment (too many triggering events,...)

Examples:

- ~~Aircraft flying wrong SID~~
 - => Aircraft deviation from ATC clearance
- ~~Runway incursion~~
 - => Runway incursion by a person
 - => Runway incursion by a vehicle
 - => Runway incursion by an aircraft



6. Obstacles

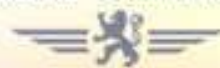
Lessons learned - SIRA:

2. « Classification » of safety issues needed:

- Structured « database » of safety issues
- linking each occurrence to a safety issue:
do we already have a safety issue like that?

CICTT categories applied to safety issues

...work in progress



6. Obstacles

Remaining limitations:

ARMS Methodology:

Good information available for ERC and SIRA but not for...

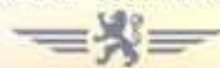
- Managing a Safety Issue Database

Software:

- Linking an occurrence to safety issues: link to only 1 safety issue
- Data input – manual (with drop-down lists and tables)



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Thank you for your attention!

Questions?

