

Changes in Aviation Organisations:

Perspective and retrospective assessment for a medium size Airline

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- 1. SMS & Risk Assessment**
- 2. Change Management Methodologies for Risk Assessment**
- 3. Standard techniques utilised and modern methods**
- 4. Three Case studies**

ICAO, FAA, EASA and EC included the implementation of SMS in their strategic plans



All CAA and national organisations “have” to implement it in their everyday life

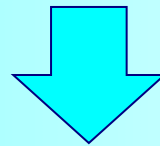
SMS requires:

- 1. move from the concept of deterministic safety assessment*
- 2. face risks of credible events in a probabilistic perspective.*

Key issue in addition to standard risk analysis

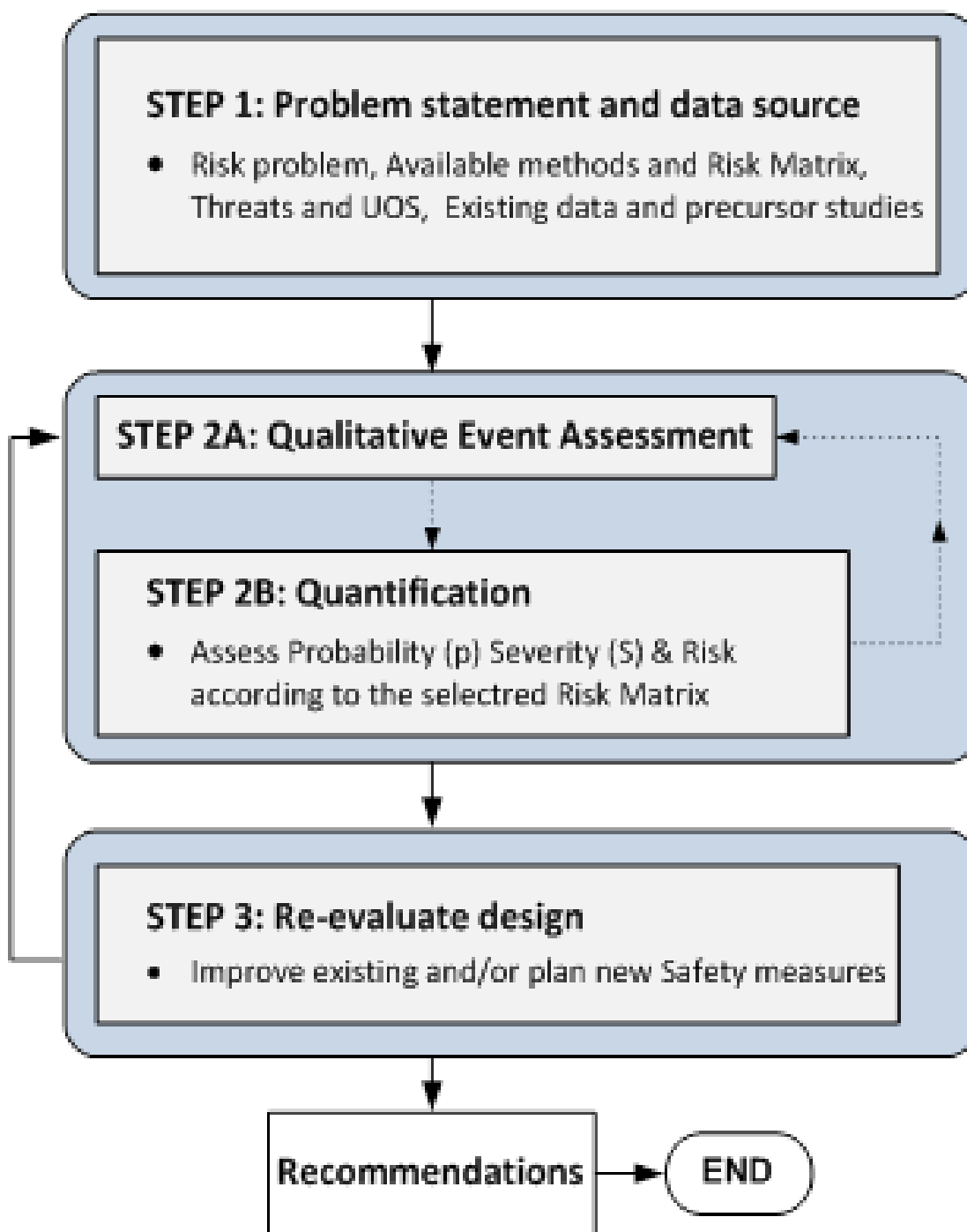
- **Management of Change: Ability to tackle new situations in a risk based perspective**

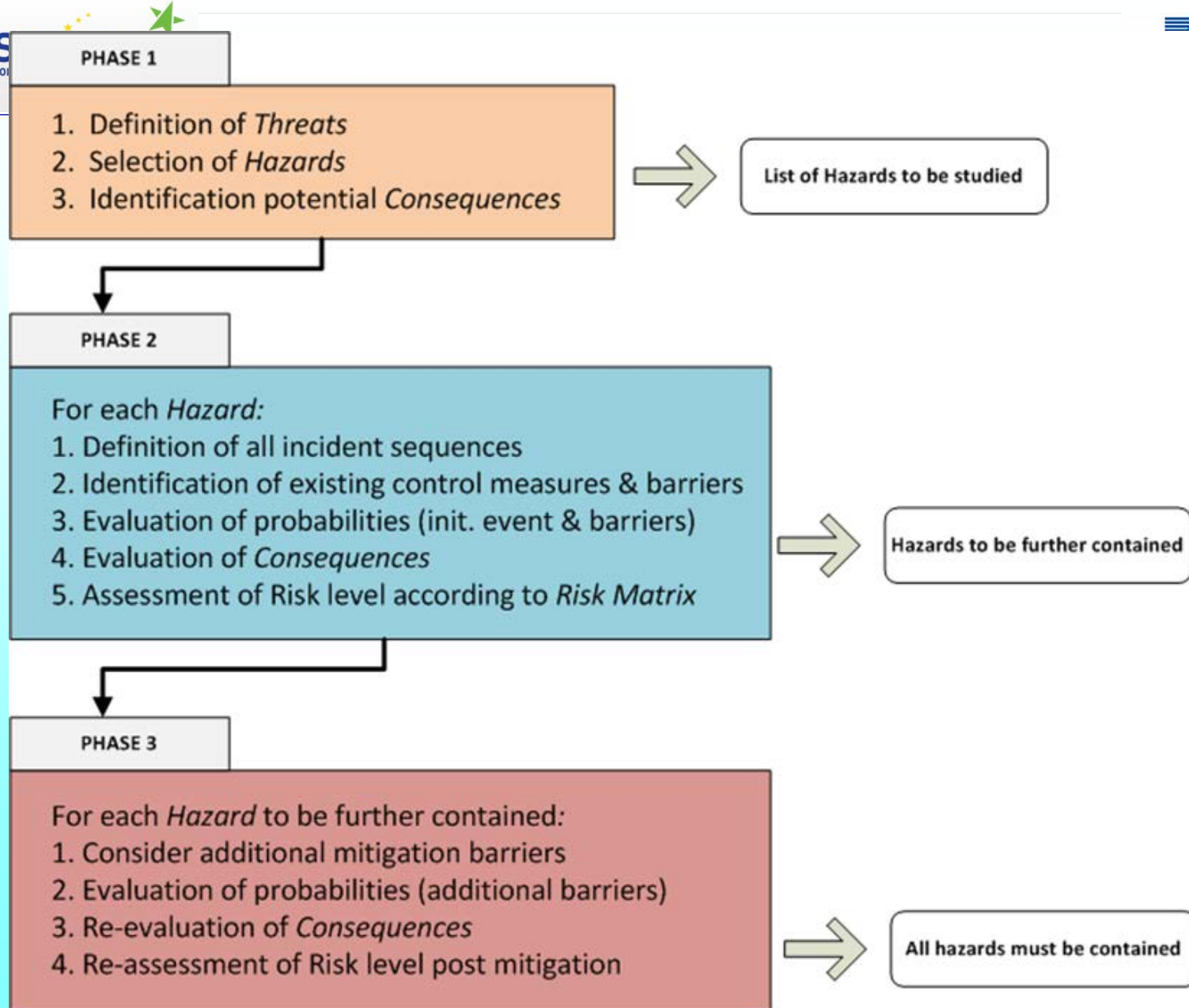
MASCA (MANaging System Change in Aviation) EU Funded Project during the 7th Framework Programme



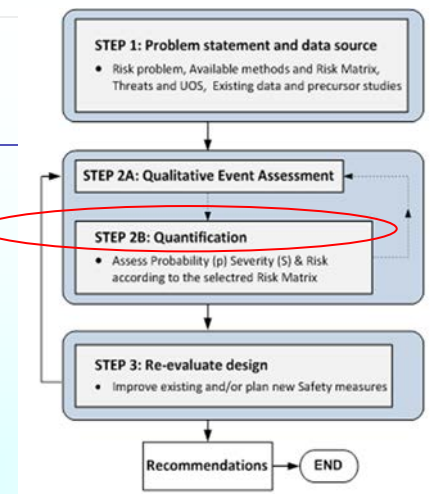
Risk Assessment Methodology for Company Operational Processes (RAMCOP)

Risk Assessment for Managing Changes in Operational Processes (RAMCOP).

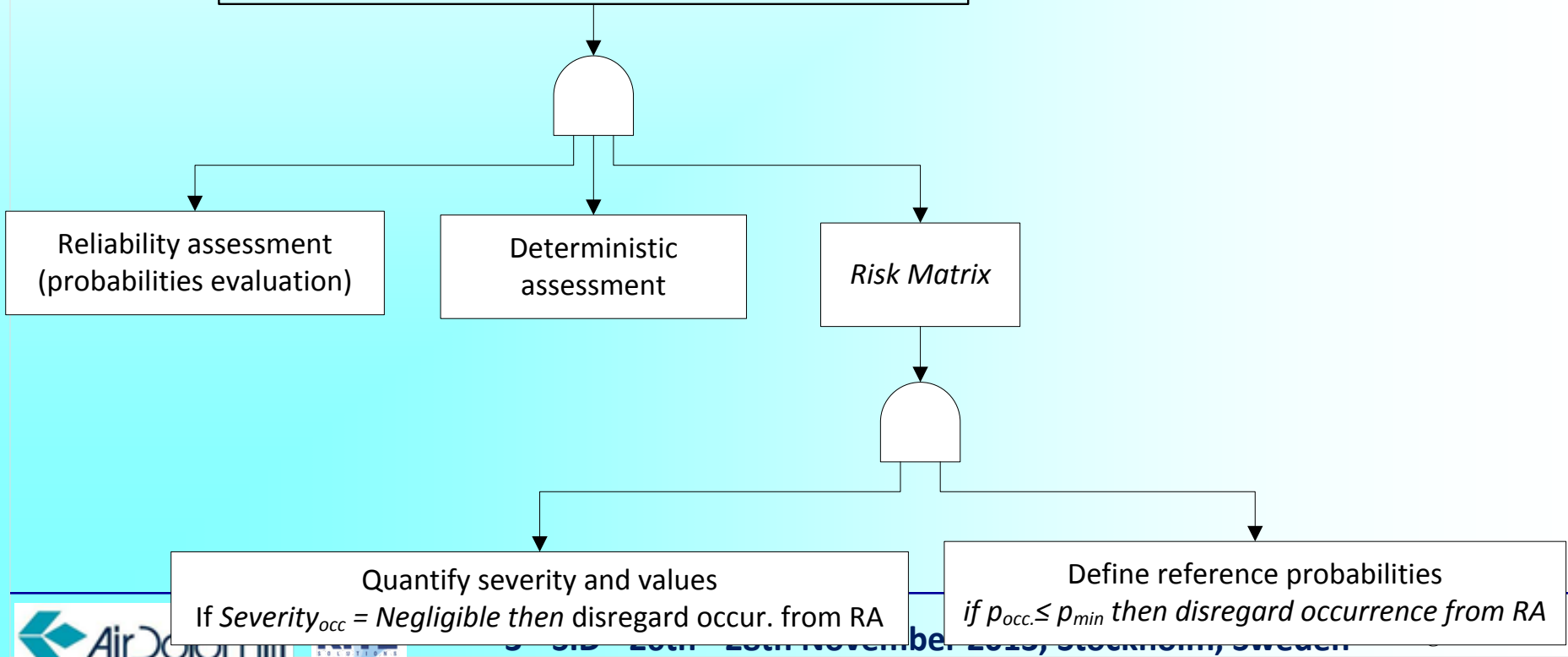




To perform standard risk analysis is complex and time demanding

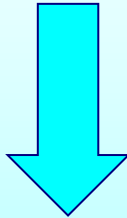


2. Available methods and reference Risk Matrix



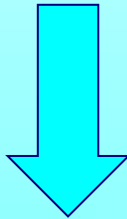
Problem

To perform standard risk analysis is complex and time demanding (e.g., dynamic nature of CM)



Solution

Recent methodologies, e.g., ARMS, too focused on Expert Judgement



Risk

Adapting p values or power of barriers to needed result

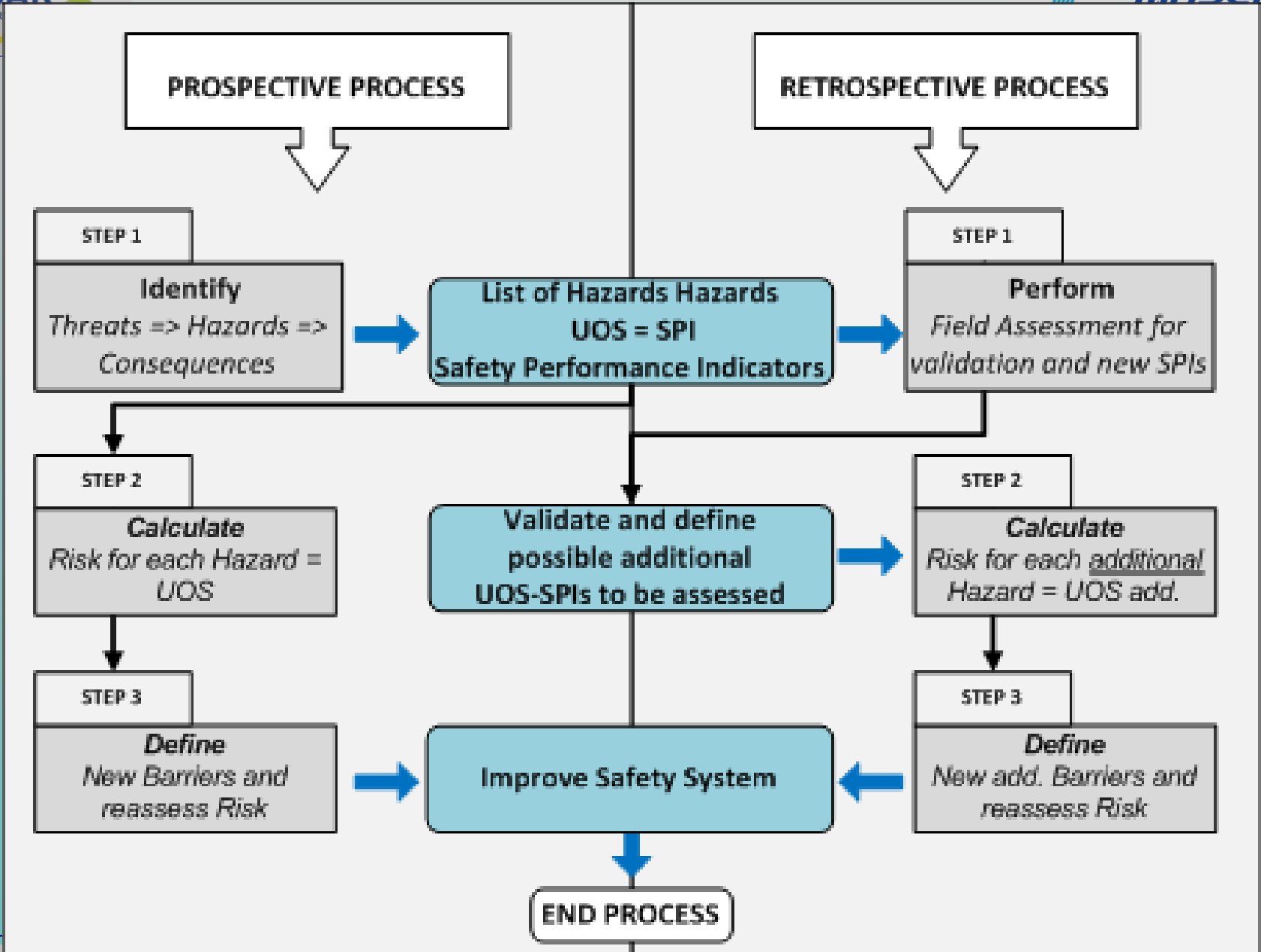
Measures

Variable use of different methods (EJ, FT, ET HRA etc.) in relation to:

- **Availability of data sources**
- **Relevance of issue being tackled**
- **Available expert information**
- **Availability of structured/computerised tool**
- **Requested accuracy in hazard and risk evaluation**

Major issue:

**Combination of Prospective and Retrospective analysis
=> validation of assessed hazards**



Phase 1				Phase 2					
Threats		Hazard UOS	Incident sequence description		Existing control		Outcome (Pre-Mitigation)		
Description	Prob.	Description and probability	Consequences	Prob. without control	Barriers	Prob. reduction	Severity	Probab.	Risk
threat ₁	p_{th1}	Description of UOS and calculation of p_{UOS} as a function of p_{thr} . $p_{UOS} = f(p_i)$	Cons. ₁	$p_{cons.1}/p_{UOS}$	Barrier ₁	$\alpha_{barr.1}$	$S_{cons.1}$	$P_{cons.1} = f(\alpha, p_{cons.1})$	$R_{cons.1}$
threat ₂	p_{th2}		Cons. ₂	$p_{cons.2}/p_{UOS}$	Barrier ₂	$\alpha_{barr.2}$	$S_{cons.2}$	$P_{cons.2} = f(\alpha, p_{cons.2})$	$R_{cons.2}$
threat ₃	p_{th3}		Cons. ₃	$p_{cons.3}/p_{UOS}$	Barrier ₃	$\alpha_{barr.3}$	$S_{cons.3}$	$P_{cons.3} = f(\alpha, p_{cons.3})$	$R_{cons.3}$
threat _i	p_{thi}		Cons. _i	$p_{cons.i}/p_{UOS}$	Barrier _i	$\alpha_{barr.i}$	$S_{cons.i}$	$P_{cons.i} = f(\alpha, p_{cons.i})$	$R_{cons.i}$
.....

		Phase 3						
e tion)		Add. Mitigation required		Outcome (Post-Mitigation)			Actions & owners	Monitoring & Review req.
	Risk	Type of Barriers	Type of barr. Reduction	Severity	Probab.	Risk		
s.1)	$R_{cons.1}$	Add. Barrier ₁	$\beta_{add.barr.1}$	$S_{cons.1}$	$p_{cons.1}$	$R_{cons.1}$	Describe actions that are planned for mitigating risk and identify teh actors involved ("who should do what")	Describe monitoring and auditing activity and means of complience with assigned actions ("how and what to monitor")
s.2)	$R_{cons.2}$	Add. Barrier ₂	$\beta_{add.barr.2}$	$S_{cons.2}$	$p_{cons.2}$	$R_{cons.2}$		
s.3)	$R_{cons.3}$	Add. Barrier ₃	$\beta_{add.barr.3}$	$S_{cons.3}$	$p_{cons.3}$	$R_{cons.3}$		
s.i)	$R_{cons.i}$	Add. Barrier _i	$\beta_{add.barr.i}$	$S_{cons.i}$	$p_{cons.i}$	$R_{cons.i}$		
.....		

	Severity Level					
Probability Level	S5 Extreme	S4 High	S3 Medium	S2 Low	S1 Minor	S0 None
P5 Frequent	A	A	B	C	D	E
P4 Likely	A	A	B	C	D	E
P3 Possible	A	B	C	D	E	E
P2 Low	A	B	C	D	E	E
P1 Unlikely	B	C	D	E	E	E
P0 Remote		C	D	E	E	E
Pe Extr. Remote	C	D	E	E	E	E

Risk Level	Risk	Risk Mitigation
A	Extreme	Immediate mitigation required
B	High	Short term improvement required
C	Acceptable with mitigation	Long term improvement desired
D	Low	Monitor
E	Negligible	Collect data

The Risk Matrix

The problem of flights in airspace contaminated by volcanic ash

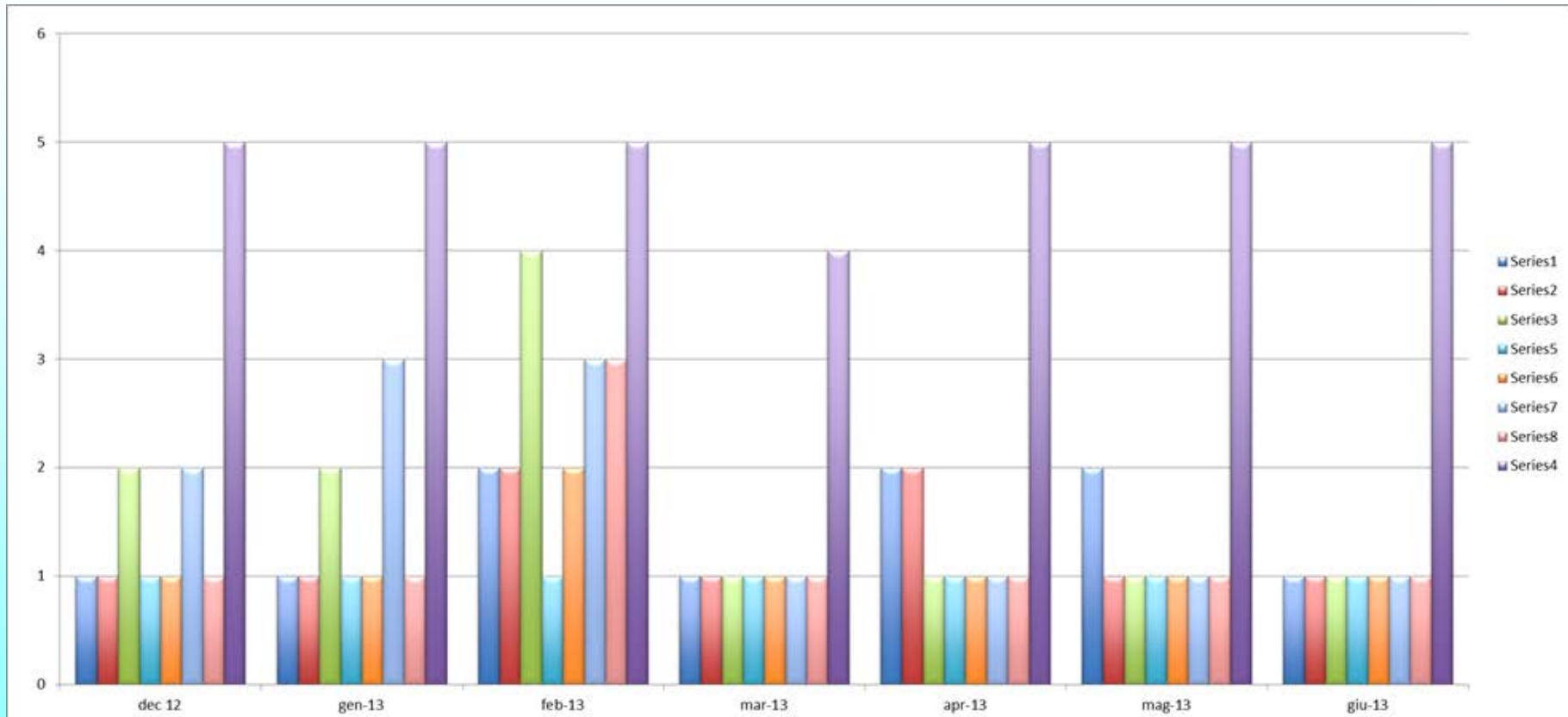
Implementation in the Embraer 195 family of the EFB: Assessing HF risks associated to the change

Change in a company fleet with reduction of crews and redundancies



Phase 1		Phase 2					Phase 3			
Hazard/ UOS No.		Incident sequence description	Existing control	Outcome (Pre-Mitigation)			Add. Mitig. required	Outcome (Post-Mitigation)		
		Consequences	Barriers	Severity	Probab.	Risk	Type of Barriers	Severity	Probab.	Risk
1	Software initialization not completed	Flight div. or canc.	M-Q; TCAS; EGPWS	Low	Likely	Acc. with mitig.	Paper maps	Low	Possible	Low Monitor
2	Maps not available	Loss of separation	M-Q; TCAS; EGPWS	High	Remote	Acc. with mitig.	Paper maps	High	Ext. Remote	Low Monitor
3	Improper selection of portrait	Flight cancellation or delay	Training; SOP; EOP; TCAS; EGPWS	Low	Likely	Acc. with mitig.	Paper maps	Low	Possible	Low Monitor
4	Improper storage of PC	Damage to cables/ PC and flight delay/cancel	M-Q; SOP	High	Unlikely	Acc. with mitig.	Paper maps; Training	High	Ext. Remote	Low Monitor
5	Pilots unable to locate maps	Loss of separation	Training; SOP; EOP; TCAS; EGPWS	High	Unlikely	Acc. with mitig.	Paper maps; Training	High	Ext. Remote	Low Monitor
6	Loss of SA	Loss of separation	Training; SOP; EOP; TCAS; EGPWS	High	Low	High	Paper maps; Training	High	Remote	Acc. with mitig. Long term
7	No charts on show	CFIT	M-Q; TCAS; EGPWS	Extreme	Ext. Remote	Acc. with mitig.	Paper maps	Extreme	Ext. Remote	Acc. with mitig. Long term
8	Flying with wrong maps or without maps	Loss of separation	Training; SOP; EOP; TCAS; EGPWS	High	Unlikely	Acc. with mitig.	Paper maps; Training	High	Ext. Remote	Low Monitor
9	No coordination for X-check with FMS	Ground collision with aircraft, vehicles or infrastr.	A TC; SOP; EOP; Training	Extreme	Ext. Remote	Acc. with mitig.	Training	Extreme	Ext. Remote	Acc. with mitig. Long term
10	Getting lost on airfield	Runway excursion	A TC; SOP; Training	Medium	Unlikely	Low Monitor	-	Medium	Unlikely	Low Monitor
11	Missing performance	Mid Air Collision (MAC)	EOP; Training; EGPWS	High	Remote	Acc. with mitig.	Training	High	Ext. Remote	Low Monitor
12	Missing info. in the case of emergency	Loss of control in flight	A TC; EOP; Training; EGPWS	High	Unlikely	Acc. with mitig.	Paper maps; Training	High	Remote	Acc. with mitig. Long term
13	No information on obstacles	CFIT	A TC; EOP; EGPWS	Extreme	Ext. Remote	Acc. with mitig.	Training	Extreme	Ext. Remote	Acc. with mitig. Long term
14	Flying wrong departure	CFIT	A TC; EOP; TCAS; EGPWS	Extreme	Ext. Remote	Acc. with mitig.	Paper maps; Training	Extreme	Ext. Remote	Acc. with mitig. Long term
15	Inadequate speed for take-off	Tail strike	SOP; Training	Medium	Possible	Acc. with mitig.	Training	Medium	Low	Acc. with mitig. Long term
16	Inadequate speed for aborted take-off	Runway excursion	SOP; Training	High	Unlikely	Acc. with mitig.	Training	High	Unlikely	Acc. with mitig. Long term

	Severity Level					
Probability Level	S5 Extreme	S4 High	S3 Medium	S2 Low	S1 Minor	S0 None
P5 Frequent						
P4 Likely						
P3 Possible				1, 3		
P2 Low			15			
P1 Unlikely		16	10			
P0 Remote		6, 12				
Pe Extr. Remote	7, 9, 13, 14	2, 4, 5, 8, 11				



Field observations:

- 1 & 2 are related to behaviour vs crew and passengers;
- 3, 4 & 5 behaviours towards flights such as the sterile cockpit;
- 6 & 7 concern the attitude toward the company and
- 8 is indicate the program to fuel saving recently introduced

- 1. The basic Methodologies for Risk Assessment able to deal with Change Management exist and can be found in the variety mature and established tools**
- 2. New methods are always possible aimed at improving results and knowledge (e.g. simulation based methods, advanced approaches combining models and hazard assessment)**
- 3. The implementation of the practical approaches utilised can be expanded to handle the analysis and assessment required by the formal National Safety Plan of all European Authorities**

Thank you for your attention