INTERNATIONAL CIVIL AVIATION ORGANIZATION

AFI RVSM NATIONAL SAFETY PLAN (NSP) SEMINAR/WORKSHOP SUMMARY

(NAIROBI, 18 – 22 JULY 2005)

Prepared by the ICAO ESAF OFFICE, NAIROBI

This Summary constitutes what the Seminar/Workshop considered and decided on the next course of action on the Findings/Outcomes.

Table of Contents

Page

Note: ***The Appendices can be downloaded at the ICAO website: icao.int/regional offices/nairobi/RVSM programme***
A CD was provided to the participants containing all the documents on the seminar/workshop.

PART I - HISTORY OF THE NATIONAL SAFETY PLAN (NSP) SEMINAR/ WORKSHOP

1. Introduction

1.1 The RVSM Seminar/Workshop was convened pursuant to AFI/7 RAN Meeting Recommendations 5/7, 5/17 and APIRG/13 Decision 13/58 by the International Civil Aviation Organization in Nairobi from 18 to 22 July 2005.

1.2 The Seminar/Workshop was opened by Mr. Lot Mollel, ICAO ESAF Regional Director. He recalled that the Six meetings the Task Force has held so far, continued to update the AFI/RVSM Strategy/Action Plan and that the States continue to take their relevant remedial actions. The results of these consultations have been incorporated in the current Strategy/Action Plan. In order to foster early implementation of RVSM in the Region an AFI RVSM Programme Office was established in this Office. The RVSM activities are being carried out by the two Secretariats of Dakar and Nairobi and coordinated by the Task Force Secretary, RO/ATM at the ESAF Office. He noted that the AFI RVSM Regional Monitoring Agency was established in South Africa. Furthermore due to inadequate action by States the Stakeholders meeting (Dakar, 18 – 19 November 2004) agreed on the TF/5 (Dakar, 16 – 17 November 2004) (conclusions 5/5(b) to postpone by one year the RVSM implementation date to 19 January 2006.

1.3 He emphasized that the objective of the Seminar/Workshop was to assist AFI States in the development of their National Safety Plans taking into account the AFI RVSM Safety Policy. He stated that a Workshop similar to this one will take place in Dakar under the auspices of the ICAO Western and Central African (WACAF) Office. The National Safety Plans, when completed, will be subjected to a National Safety Plan Validation Panel (NSPVP) to be organized in mid-September 2005 in Johannesburg. The findings of the Panel will be presented to APIRG/15 meeting in late September 2005 in Nairobi. In order to enhance the implementation, Mr. Mollel remarked, the National Programme Managers whom he believed were the vital organs to the early implementation of RVSM were invited to work together in the workshop to ensure ways of meeting the target date of implementation. He recalled that as a pre-requisite to the implementation of RVSM, the ANC requested a Safety Assessment should be conducted. The main elements of the Safety Assessment are the Collision Risk Assessment (CRA) being done by the Netherlands Research Laboratories (NLR), the Functional Hazard Analysis (FHA), conducted by ALTRAN Technologies of France and the National Safety Plan (NSP) to be developed by States. He advised that these three deliverables will be required to develop the AFI RVSM Pre-implementation Safety Case (PISC).

1.4 The Director reminded the participants that the activities required by each State are clearly spelt out in the AFI RVSM Strategy/Action Plan of which each item shall be addressed and acted upon in order to determine the actual date for the implementation of RVSM. He wished the members fruitful deliberations with a view to further enhance the safety of air navigation in the Region.

2. Officers and Secretariat

2.1 Mr. Apolo KHARUGA, Regional Officer, Air Traffic Management/Secretary of APIRG RVSM Task Force, of the ICAO ESAF Office, acted as the Moderator of the Seminar/Workshop. He was assisted by Mr. BROU Konan, Regional Officer/ATM, ESAF Office and Mr. Kevin EWELS, Manager, AFI Regional Monitoring Agency (ARMA). Messrs. Julien LAPIE, CNS/ATM Safety Expert, ALTRAN Technologies, Harry ROBERTS, National Program Manager, South Africa, Gaoussou KONATE, Regional Manager, IATA SO & I Africa and Craig PARTRIDGE, Manager , SO & I, Africa facilitated and conducted the seminar/workshop.

3. Attendance

3.1 The meeting was attended by Seventy One (71) participants from Twenty One (21) States and Three (3) International Organizations namely AFRAA, KALPA and IFATCA. The list of participants is given at **Appendix A** (copy attached) to this summary.

4. Working Language

4.1 The meeting was conducted in the English language only.

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5. Programme

5.1 The following Programme was adopted by the Seminar/Workshop:

PROGRAMME

Monday, 18 July 2005		
0830-1000	Registration	
1000-1030	Opening Ceremony	
1030-1100	Overview of the AFI RVSM Implementation Programme: - APIRG Task Force - AFI RVSM Strategy/Action Plan - ANC and Council - RVSM Implementation Date	ICAO
1100-1130	Coffee/Tea Break	
1130-1230	RVSM Safety Assurance - AFI RVSM Safety Policy - RVSM Safety Policy Deliverables •Functional Hazard Analysis •Collision Risk Assessment •National Safety Plans - Pre-Implementation Safety Case (PISC) - Post-Implementation Safety Case (POSC)	ALTRAN TECHNOLOGIES
1230-1300	**Lunch**	
1300 - 1500	RVSM Safety Assurance (Cont.)	ARMA ALTRAN TECHNOLOGIES ICAO
1500 - 1530	**Coffee/Tea Break**	
1530 - 1615	RVSM Safety Assurance (Cont.)	ALTRAN TECHNOLOGIES

Tuesday, 19 July 2005		
0900 - 1100	Development of National Safety Plans	ALTRAN TECHNOLOGIES
1100-1130	Coffee/Tea Break	
1130-1230	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES
1230-1300	**Lunch**	
1300 - 1500	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES
1500 - 1530	**Coffee/Tea Break**	
1530 - 1615	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES

Wednesday, 20 July 2005		
0900 - 1100	Development of National Safety Plans	ALTRAN TECHNOLOGIES
1100-1130	Coffee/Tea Break	
1130-1230	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES
1230-1300	**Lunch**	
1300 - 1500	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES
1500 - 1530	**Coffee/Tea Break**	
1530 - 1615	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES

Thursday, 21 July 2005		
0900 - 1100	Development of National Safety Plans	ALTRAN TECHNOLOGIES
1100-1130	**Coffee/Tea Break**	
1130-1230	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES
1230-1300	**Lunch**	
1330 - 1500	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES
1500 - 1530	**Coffee/Tea Break**	
1530 - 1615	Development of National Safety Plans (Cont.)	ALTRAN TECHNOLOGIES

Friday, 22 July 2005		
0830 - 1100	Development of National Safety Plans	ALTRAN TECHNOLOGIES
1100 - 1230	Overview of Seminar and way forward.	ALTRAN TECHNOLOGIES ICAO
1230-1300	**CLOSING**	

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6. Outcomes

6.1 Outcomes of the NSP Seminar/Workshop

Number	Title
Outcome 1/1:	That States complete/update their National Safety Plan based on the revised NSP template at **Appendix B.**
Outcome 1/2:	That States submit to ICAO ARPO first draft of NSP by 31 July 2005.
Outcome 1/3:	That States submit to ICAO the final NSP by 31 August 2005 in order to be considered by NSP Validation Panel.
Outcome 1/4:	That the RVSM TF/7 be advised of the revised NSP template for application in the AFI Region.
Outcome 1/5:	That the revised NSP template be submitted to the ATS/SG/8 for their information.

PART II REPORT ON THE NSP SEMINAR/WORKSHOP

1. NSP Seminar/Workshop Process

a) The Seminar/Workshop was provided with a short overview of where the NSP fitted into the RVSM process. The importance of the NSP was emphasized. The Seminar/Workshop was then guided through the process of compiling the hazard Appendix table. Thereafter the draft NSP was worked through paragraph by paragraph.

b) The Seminar/Workshop delegates were afforded the opportunity during the process to ask questions while compiling the first draft which has to be submitted to the ARPO by 31 July 2005 and further advised that the final NSP be submitted to ARPO by 31 August 2005.

c) At the end of the Seminar/Workshop States were equipped with the required knowledge to complete the NSP in their respective countries. Those States that came equipped with computers were able to bring their NSPs up to a status of near completion.

d) **Presentation by RO/ATM Mr. A. Kharuga**

The Regional Officer ATM made a presentation on the overview of the AFI RVSM.

The scope of the presentation was:

(i) Historical background of the RVSM and status of implementation globally.
(ii) The APIRG RVSM Task Force and Terms of Reference.
(iii) The summary and conclusions of the Six meetings of the Task Force.
(iv) The contents of the AFI Strategy/Action Plan namely:

- Programme Management.
- Aircraft OPS and Airworthiness.
- Air Traffic Management.
- RVSM Safety Assurance.
- Monitoring Functions.
- Safety Assessment.
- Functional Hazard Analysis.
- Collision Risk Analysis.
- Pre-Implementation Case.

(v) The process of implementation from Task Force, the ATS/SG and APIRG was explained.
(vi) The ICAO presentation formed **Appendix C** (not attached) to this summary but can be downloaded at the ICAO website.

2. Presentations by Mr. Julien Lapie, ALTRAN Technologies Consultant

The ALTRAN Technologies Consultant Mr. Julien Lapie presented in details the following:

Module 1

a) The objective of Module 1 was to provide background information and to present how the NSP should be developed based on the NSP template developed by the AFI RVSM Task Force:

- The Risk Assessment principles
- The Risk Assessment and mitigation in ATM.
- AFI RVSM Safety Assessment process and deliverables.
- NSP: objectives, scope and structure.
- Working of Functional Hazard Analysis (FHA) results within NSP.

Module 2

b) The objective of module 2 was to:

- Develop State NSP based on the AFI RVSM NSP template.
- Develop State NSP based on the RVSM FHA on the information provided in Module 1.

c) The ALTRAN TECHNOLOGIES presentations formed **Appendices D – H** to this summary (not enclosed) but can be downloaded at the ICAO website.

Conclusion

The Seminar/Workshop proved to be successful in providing the guidance that States required to complete the NSP's for validation. Seminar/Workshop delegates were able to return home with definite guidelines and examples as well as an amended template from which to work with.

The Outcomes of this Seminar/Workshop are at Part I paragraph 6 of this summary. The States are requested to take their relevant appropriate action to these outcomes.

The following is a list of ICAO Documents which were provided to the participants at the Seminar/Workshop

RVSM DOCUMENTS

	Document
1.	Specimen ATC Operations Manual for Implementation of RVSM.
2.	AFI ATS RVSM Training Guidance Material.
3.	ICAO Doc.7030 amendment on RVSM.
4.	Guidance material for Airworthiness and Operational Approval (TGL 6).
5.	Specimen AIC on RVSM.
6.	Specimen NOTAM on RVSM.
7.	AFI RVSM Implementation Strategy/Action Plan.
8.	AFI RVSM Safety Policy.
9.	National Safety Plan.
10.	Sample letter of Agreement incorporating RVSM.
11.	ARMA Deviation Forms.
12.	PISC Schedule for RVSM Pre-Implementation Safety Case.
13.	RVSM Implementation Readiness Assessment Survey Forms.
14.	RVSM Readiness Survey Data.
15.	Functional Hazard Analysis Report.
16.	Presentations from ALTRAN Technologies and ICAO.
17.	CD containing NSP Workshop material.

Note: This summary of the Seminar/Workshop and Documentation and presentations can be downloaded at the ICAO website ie. *icao.int/regional offices/nairobi/RVSM programme*

INTERNATIONAL CIVIL AVIATION ORGANIZATION
EASTERN AND SOUTHERN AFRICAN OFFICE

AFI RVSM SEMINAR/WORKSHOP
(NAIROBI, 18 – 22 JULY 2005)

LIST OF PARTICIPANTS

	NAME	TITLE DESIGNATION	ADDRESS
	ANGOLA (ENANA)		
1.	Ms. Dulce da C. C. CACHIMBOMBO Manuel	National Programme Officer	Aeroporto Internaciona "4 de Fevereiro" DNAV CP 841 - **ANGOLA** Tel:244-222-351267/651013 Fax: 244-222-351267 **E-mail:dulcecachimbombo@yahoo.com**
2.	Ms. BERNARDA DE PAIVA Henrique	Air Traffic Controller	Aeroporto Internaciona "4 de Fevereiro" DNAV CP 841 - **ANGOLA** Tel:244-222-351267/651169 Fax:244-222-351267 **E-mail dinahenrique@hotmail.com**
	BOTSWANA		
3.	Mr. Oganne Maroba	Chief Air Traffic Control Officer	Department of Civil Aviation P.O. Box 250 – **GABORONE** - Botswana Tel:267-3655203/3655100/09267 **E-mail:dcahq@gov.bw or omaroba@gov.bw**
4.	Mr. Silas Silas	PATCO	Department of Civil Aviation Sir Seretse Khama Airport Private Bag SK 9–**GABORONE**-Botswana Tel:267-3643100 **E-mail:dcahq@gov.bw**
	BURUNDI		
5.	Mr. Pascal NTIMPIRANGEZA	Chief – Air Navigation Service	Régie des Services Aéronautiques B.P. 694 - **BUJUMBURA** - Burundi Tel:257-0986022/224239 Fax:257-223428 **E-mail: RSA@CBINF.com** **E-mail:ntipecos@yahoo.fr**
6.	Mr. KARIKURUBU CHRYSANTE	ATC	Régie des Services Aéronautiques B.P. 694 - **BUJUMBURA** - Burundi Tel:257-925028/223797 Fax:257-223428 **E-mail: RSA@CBINF.com** **E-mail:karikurubuchris@yahoo.fr**
	COMORES		
7.	Mr. IBRAHIM KASSIM	Operations Manager	Représentation auprès de l'union des Comores BP 2359 – **MORONI** Tel:269-731593/732135 Fax:269-732613 **E-mail:asnacom@snpt.km** **E-mail:kassim@snpt.km**

	NAME	TITLE DESIGNATION	ADDRESS
	ETHIOPIA		
8.	Mr. Girma Yami	Director, Air Operations and NAVAIDS Department	Ethiopian Civil Aviation Authority P.O. Box 978 - **ADDIS ABABA** - Ethiopia Tel:251-1-648265 Fax:251-1-648281 **E-mail :caa.airnav@ethionet.et**
9.	Mr. Gulilat Assefa	Head FIR and ATS Division	Ethiopian Civil Aviation Authority P.O. Box 978 - **ADDIS ABABA** – Ethiopia Tel:251-1-648271 Fax:251-1-648281 **E-mail :caa.airnav@ ethionet.et**
10.	Mr. Shimeles Kibreab	CATCO	Ethiopian Civil Aviation Authority P.O. Box 978 - **ADDIS ABABA** – Ethiopia Tel:251-1-648276 Fax:251-1-648281 **E-mail :caa.airnav@ ethionet.et**
11.	Mr. Fikremaryam Seyoum	SATCO	Ethiopian Civil Aviation Authority P.O. Box 978 - **ADDIS ABABA** – Ethiopia Tel:251-1-648276 Fax:251-1-612533 **E-mail :caa.airnav@ ethionet.et**
	ERITREA		
12.	Mr. GETACHEW Bekuretsion	Manager, National RVSM Program Office	National RVSM Program Office P.O. Box 252, **ASMARA**, Eritrea Tel:291-1-127222 **E-mail:gbekuretsion2003@yahoo.com**
13.	Mr. Girmay Teclemariam	Manager, National Safety Plan Sub-Group, National RVSM	National RVSM Program Office P.O. Box 252, **ASMARA**, Eritrea Tel:291-1-127222 **E-mail:TGHIRMAYTE@yahoo.com**
14.	Mr. Mesfun G.	Member of National RVSM Program Office	National RVSM Program Office P.O. Box 252, **ASMARA**, Eritrea Tel:291-1-127222
15.	Mr. Jonathan Kelleta	Member – National RVSM Program Office	National RVSM Program Office P.O. Box 222, **ASMARA**, Eritrea Tel:291-1-187851 **E-mail :JKELLETA@AOL.COM**
	GHANA		
16.	Mr. Martey Boye ATOKLO	ATC Watch Manager (RVSM Committee Member)	Ghana Civil Aviation Authority PMB – KIA – Accra - **GHANA** Tel:00233-21-773283/27-7780586 Fax:00233-21-769401 **E-mail:matoklo@hotmail.com** **E-mail:mbatoklo@gcaagh.com**
17.	Mr. Thomas Kodjoe DUOPAH	ATC Watch Manager	Ghana Civil Aviation Authority PMB – KIA – Accra - **GHANA** Tel:0023321-773283/00233277455790 Fax:00233-21-769401 **E-mail:tkduopah@gcaagh.com**
	KENYA		
18.	Ms. Truphosa Adiambo Chocho	Manager, ANS/MET/ Aerodromes Legislation	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827470 Fax:254-20-824716 **E-mail:kcaa@nbnet.co.ke**

	NAME	TITLE DESIGNATION	ADDRESS
19.	Mr. Patrick Mwangi Kinuthia	CATCO	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827470 Fax:254-20-824716 **E-mail:kcaa@nbnet.co.ke**
20.	Mr. Jackson Ooko Kiriga	Chief ATCO	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827470 Fax:254-020-824716 **E-mail:kcaa@nbnet.co.ke**
21.	Mr. Joseph Kariuki Maina	Senior AIS Officer	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827557 Ext.195 Fax:254-020-824716 **E-mail:kcaa@nbnet.co.ke** **E-mail:jmaina@yahoo.ca**
22.	Mr. Erastus M. Njogu	Manager – ICAO Liaison	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827470/1 Fax:254-20-824716 **E-mail:kcaa@nbnet.co.ke**
23.	Mr. Hitler Adikiny Olwenge	Chief Air Traffic Control Officer	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827100 Fax:254-20-827101 Cell:0733898048/0723838108 **E-mail:kcaa@nbnet.co.ke** **E-mail:hitadikiny@yahoo.com**
24.	Mr. Kennedy Omenda	Senior Aeronautical Officer	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:0720922725/254-20-824557 **E-mail:kcaa@nbnet.co.ke**
25.	Mr. Lucas Opondo	Airworthiness Inspector	P. O. Box 586 – 00517 – Nairobi Tel:254-20-827741 Fax:254020-824716 **E-mail:ojowi@yahoo.com**
26.	Mr. Mathew Mwendwa	Flight Operations Inspector	Kenya Civil Aviation Authority (KCAA) P.O. Box 4635 – Nyayo Stadium 00506 - NAIROBI - **KENYA** Tel:254-20-827470/1/2/3 Ext.144 Fax:254-020-824716 **E-mail:mwendwa@wananchi.com**
27.	Mr. Henry Daniel Ochieng	Manager ANS - JKIA	Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – 00100 NAIROBI, **KENYA** Tel:254-20-827102 Fax:254-20-827102 **E-mail:kcaa@nbnet.co.ke**
28.	Mr. Joseph Mureithi Gichu	Chief Instructor ATS	East African School of Aviation P. O. Box 30689 – 00100 - Nairobi Tel:0720382568 **E-mail:jmgichu@yahoo.com**
29.	Mr. Daniel Akech Oloo	Chief Air Traffic Control Officer	East African School of Aviation P. O. Box 30689 - Nairobi Tel:254-20-823602/7 Cell:0722948356 **E-mail:olooda2000@yahoo.com**

	NAME	TITLE DESIGNATION	ADDRESS
30.	Mr. Forbian Ndiwa Wachina	Operations Planning Officer	Kenya Airways P. O. Box 11124 – 00100 – Nairobi Tel:254-20-6422089/0724748529 Fax:254-20-822269 **E-mail:forbian.ndiwa@kenya-airways.com**
31.	Major C. M. Kinyotta	SO2 FLIGHT SAFETY	Kenya Air Force Headquarters P. O. Box 41584 – Nairobi Cell Phone:0721427403 **E-mail:KINYOTTAC@HOTMAIL.COM**
32.	Mr. Angus Hamisi Swedi	Chief - ANS	Air Navigation Services P. O. Box 93939 – 80115 – Mombasa Tel:254-041-3433416 Cell:0722626644 **E-mail:angusswedi@yahoo.com**
33.	Mr. Tirrus Mutunga	Senior Air Traffic Controller	P. O. Box 93939 – 80115 - Mombasa Cell Phone:0721883971 **E-mail:tirrusmutunga@yahoo.com**
	MAURITIUS		
34.	Mr. Rajanah K. GURUVADOO	Air Traffic Control Supervisor	Department of Civil Aviation SSR International Airport **PLAINE MAGNIEN** - Mauritius Tel:230-6032000 Fax:230-6374164 **E-mail:civil-aviation@mail.gov.mu**
	MADAGASCAR		
35.	Mr. ROBINSON ANDRIANAIVONIAINA EUGÈNE		Aviation Civile de Madagascar (ACM) 101 - ANTANANARIVO BP 4414 **MADAGASCAR** Fax:261-2022-22438 Fax :261-2022-24726 **E-mail :acm@acm.mg**
	MOZAMBIQUE		
36.	Mr. F. Saraiva		Mozambique Civil Aviation P.O. Box 227, **MAPUTO**, Mozambique Tel:258-1-465025 Fax:258-1-465415 **E-mail:iacm@teledata.mz**
37.	Mr. Ernesto dos S. M. Júnior	SATCO	Aeroportos de Moçambique, E.P. Caixa Postal, 2631 **MAPUTO** – Moçambique Tel:258-1-465375/6 Fax:258-1-465783 **E-mail:admdtel@tropical.co.mz**
	RÉUNION (FRANCE)		
38.	Mr. Patrick Poujol	Chef de la subdivision Circulation Aérienne Service de la Navigation aérienne Océan Indien	Service de la Navigation aérienne de l'Océan Indien BP 52 - F-97408 Saint-Denis Cédex 9 ILE DE LA RÉUNION Tel:0262-2-62728830 Fax:0262-2-62728713 **E-mail:patrick.poujol@aviation-civile.gouv.fr**
	RWANDA		
39.	Mr. MAKUZA Alphonse	RVSM National Program Manager	Régie des Aéroports du Rwanda B.P. 1122 – **KIGALI** - Rwanda Tel:250-585499/8470186 Fax:250-583462 **E-mail:caa@rwanda1.com** **E-mail:alphonsemakuza@yahoo.com**

	NAME	TITLE DESIGNATION	ADDRESS
	SEYCHELLES		
40.	Mr. David Paul Labrosse	Chief Air Traffic Services	Seychelles Civil Aviation Authority (SCAA) P.O. Box 181 - Victoria - **SEYCHELLES** Tel:248-384042/384036 Fax:248-384009/384032 **E-mail:dcaadmin@seychelles.net**
41.	Ms. Esmee Martine Samson	SATCO (Training and Standards Development)	Seychelles Civil Aviation Authority (SCAA) P. O. Box 181, Victoria–**MAHE** - Seychelles Tel:248-384036/384039 Fax:248-384032 **E-mail:dcaadmin@seychelles.net** **E-mail:ems101166@yahoo.com**
	SOMALIA (CACAS)		
42.	Mr. Athanas B. Wanyama	Air Traffic Services Expert (Operations)/ RVSM National Programme Manager	ICAO SOM/PROJECT – Nairobi -Civil Aviation Caretaker Authority for **SOMALIA** (CACAS) P. O. Box 46294-00100 - Nairobi Tel:254-20-622785/6/9 Fax:254-20-7122340 **E-mail: icaosom@africaonline.co.ke**
43.	Mr. Humphrey Kilei Mwachoki	Mogadishu FIC Supervisor	ICAO SOM/PROJECT – Nairobi -Civil Aviation Caretaker Authority for **SOMALIA** (CACAS) P. O. Box 46294-00100 - Nairobi Tel :254-20-622785 Fax:254-20-7122340 **E-mail: icaosom@africaonline.co.ke**
44.	Mr. Ali Jama Abdi	RVSM Committee Member	ICAO SOM/PROJECT – Nairobi -Civil Aviation Caretaker Authority for **SOMALIA** (CACAS) P. O. Box 46294-00100 - Nairobi Tel :254-20-622785 Fax:254-20-522340 **E-mail: icaosom@africaonline.co.ke**
45.	Mr. Ahmed Bahur Hagi	RVSM Committee Member	ICAO SOM/PROJECT – Nairobi -Civil Aviation Caretaker Authority for **SOMALIA** (CACAS) P. O. Box 46294-00100 - Nairobi Tel :254-20-622785 Fax:254-20-7122340 **E-mail: icaosom@africaonline.co.ke**
	SOUTH AFRICA		
46.	Mr. Ronnie Thato Mothusi	Air Traffic Services Inspector	Civil Aviation Authority - Private Bag X73 Halfway House - **SOUTH AFRICA** Tel:27-11-545-1065 Fax:27-11-5451459 E**-mail:mothusir@caa.co.za**
47.	Mr. Seboseso Machobane	General Manager Air Safety Infrastructure	P. O. Box 14834 – LYTTELTON - 0140 South Africa Tel:27-11-545-1405 Fax:27-11-5451463 **E-mail:machobanes@caa.co.za**
	SUDAN		
48.	Mr. Ibrahim Musa Mohamed	Director Air Navigation	**Civil Aviation Authority** P. O. Box 430 – Khartoum D. A. T. C. S. **E-mail:ibrahim_caa@yahoo.com**
49.	Mr. Mohamed Elamin Rustom	Director ATC Services	Civil Aviation Authority P. O. Box 430 – Khartoum D. A. T. C. S. **Tel :00249912278164 Fax :00249183784964**

	NAME	TITLE DESIGNATION	ADDRESS
	TANZANIA		
50.	Mr. Godwin Makoroma	Chief Air Traffic Management	Tanzania Civil Aviation Authority P.O. Box 2819 DAR ES SALAAM- **TANZANIA** Tel:0744335633 Fax:255-22-2124914 **E-mail :tcaa@tcaa.go.tz** **E-mail:gmakoroma@tcaa.go.tz**
51.	Mr. Iqbal Sajan	Chief Air Navigation/ Aerodrome Regulation	Tanzania Civil Aviation Authority P.O. Box 2819 DAR ES SALAAM- **TANZANIA** Tel:255-22-2115079/80 Fax:255-22-2118905 **E-mail :tcaa@tcaa.go.tz** **E-mail:isajan@tcaa.go.tz**
52.	Mr. Michael Joseph Munyune	Chief of Flight Operations	Tanzania Civil Aviation Authority P.O. Box 2819 DAR ES SALAAM- **TANZANIA** Tel:255-22-2115079/80 Fax:255-22-2118905 **E-mail :tcaa@tcaa.go.tz** **E-mail:mmnyune@tcaa.go.tz**
53.	Mr Makhiid Hassan Towillo	Senior Airworthiness Surveyor	Tanzania Civil Aviation Authority P.O. Box 2819 DAR ES SALAAM- **TANZANIA** Tel:255-22-2115079/80 Fax:255-22-2118905 **E-mail :tcaa@tcaa.go.tz** **E-mail:mtowillo@tcaa.go.tz** **E-mail:maktow@yahoo.com**
54.	Mr. Joseph Mbuluko	Senior Air Traffic Control Officer (ACC)	Tanzania Civil Aviation Authority P.O. Box 18001 DAR ES SALAAM- **TANZANIA** Tel:255-22-2110254 Cell:255744314166 Fax:255-22-2110290 **E-mail :tcaa@tcaa.go.tz** **E-mail:mbuluko@yahoo.com** **E-mail:jmbuluko@tcaa.go.tz**
	UGANDA		
55.	Mr. Andrew F. K. Musoke	Civil Aviation Technical Advisor	Uganda Civil Aviation Authority P.O. Box 5536 – KAMPALA - **UGANDA** Tel:006-41-320486 Fax:006-41-320964 **aviation@caa.co.ug or amusoke@caa.co.ug**
56.	Mr. Sezibwa Moses Joel K.	Senior Air Traffic Control Officer	Uganda Civil Aviation Authority P.O. Box 5536 – KAMPALA - **UGANDA** Tel:256-41-320368 Fax:256-41-320964 **E-mail:aviation@caa.co.ug** **E-mail:msezibwa@caa.co.ug**

	NAME	TITLE DESIGNATION	ADDRESS
57.	Mr. Ochan Alex Albinus	Manager Air Traffic Management	Uganda Civil Aviation Authority P.O. Box 5536 Kampala - **UGANDA** Tel:256-41-320368 Fax:256-41-320964 **E-mail:aviation@caa.co.ug or** **E-mail:aochan@caa.co.ug**
	ZAMBIA		
58.	Ms. Mary Peggy Harah	Chief Air Traffic Control Officer	National Airports Corporation Limited P. O. Box 30175 – Lusaka – Zambia Tel:260-1-271018 Fax:260-1-271469 Mobile:097786803/095764201 **E-mail:nacl@zamnet.zm (office)** **E-mail:maryharah2005@yahoo.com**
59.	Mr. Alex Mutaka Sinyangwe	Senior Air Traffic Control Officer/RVSM Manager	Department of Civil Aviation P.O. Box 50137 - 15101 Ridgeway **LUSAKA** - Zambia Tel: 260-1-251861/253250 Fax:260-1-251841 Cell :260-95755777 **E-mail :aviation@coppernet.zm**
60.	Mr. Justin Katandika	Air Traffic Control Officer	Air Traffic Liaison Lusaka International Airport P. O. Box 31291 – **LUSAKA** Tel:260-1-271169 Fax:260-1-271169 **Cell:097-323378**
	ZIMBABWE		
61.	Mr. Richard Munyenyiwa	Principal Air Traffic Control Officer/National RVSM Programme Manager	Civil Aviation Authority of Zimbabwe Air Traffic Control – Private Bag 6002 Harare International Airport - **ZIMBABWE** Tel:263-4-575187/3 Fax:263-4-575163/585100 **E-mail:ais@caaz.co.zw** **E-mail:rmunyenyiwa@yahoo.co.uk**
62.	Jabulani Mabhena	Flight Operations Inspector	Civil Aviation Authority of Zimbabwe Air Traffic Control – Private Bag 6002 Harare International Airport - **ZIMBABWE** Tel:263-4-575187/3 Fax:263-4-575163/585100 **E-mail:ais@caaz.co.zw**
	INTERNATIONAL ORGANIZATIONS		
	AFRAA		
63.	Mr. Elijah Chingosho	Technical and Training Director	African Airlines Association P. O. Box 20116 – 00200 - Nairobi – Kenya Tel :254-20-604832 Fax :254-20-601173 **E-mail : chingoshoe@hotmail.com**
	KALPA		
64.	Captain Mark Kipruto Koross	Executive Council Member	KALPA P. O. Box 60091 – 00200 Tel:0722-776638 **E-mail:mkoross73@yahoo.co.uk**

	NAME	TITLE DESIGNATION	ADDRESS
	IFATCA		
65.	Arthur Kitao	IFATCA Representative	IFATCA P. O. Box 30689 – Nairobi Tel:254-20-823607 **E-mail:Arthur_kitao@yahoo.com**
	ROBERTS FIR		
66.	MR. ALIMAMY DIXON CONTEH	Senior Air Traffic Control Officer/RVSM Program Manager	Roberts FIR - 020 B.P. 507 (MATAM) Conakry GUINEA Tel:224-404-391 Fax:224-404-987/431970 **E-mail:adconteh@robertsfir.org.gn** **or E-mail:alimamydixon@yahoo.co.uk**
	FACILITATORS		
	ALTRAN TECHNOLOGIES		
67.	Julien Lapie	CNS/ATM Safety Expert	ALTRAN Technologies – 17 av. Daurat 31700 Blagnac - **FRANCE** Tel :33632653562 Fax :33534561357 **E-mail :jlapie@altran-tech.net**
	SOUTH AFRICA		
68.	Mr. Harry Roberts	National Program Manager	ATNS - Private Bag X15 – Kempton Park – 1620 - **SOUTH AFRICA** Tel:27-11-961-0303 Fax:27-11-392-3946 **E-mail:harryr@atns.co.za**
	AFI Regional Monitoring Agency (ARMA)		
69.	Mr. Kevin V. Ewels	Manager: ARMA	ARMA - Private Bag X1 Bonaero Park – 1622 - **SOUTH AFRICA** Tel: 27-11-928643 Fax: 27-11-928-6420 **Email:afirma@atns.co.za**
	IATA		
70.	Mr.Craig Partridge	Manager SO & I	IATA Postnet Suite 167 – Private Bag X9916 Sandton 2146 South - Africa Tel :27-11-523-2700 Fax :27-11-523-2702 **E-mail:partridgec@iata.org**
71.	Mr. Gaoussou KONATE	Regional Manager SO & I	88 Stella Street – Sandown Mews Private Bag X9916 Sandton – **SOUTH AFRICA** Tel :27-11-523-2724 Fax :27-11-523-2702 **e.mail : konateg@iata.org**
	SECRETARIAT		
	Mr. Lot Mollel	Regional Director	ICAO - Eastern and Southern African Office (ESAF) - P. O. Box 46294 00100 – Nairobi – Kenya Tel :254-20-622394/622395/622396 Fax :254-20-621092/623028 **E-mail :icao@icao.unon.org** **E-mail :Lot.Mollel@icao.unon.org**

	NAME	**TITLE DESIGNATION**	**ADDRESS**
	Mr. Samuel Githaiga	Deputy Regional Director	ICAO - Eastern and Southern African Office (ESAF) - P. O. Box 46294 00100 – Nairobi – Kenya Tel :254-20-622397/622395/622396 Fax :254-20-621092/623028 **E-mail :icao@icao.unon.org** **E-mail.Samuel.Githaiga@icao.unon.org**
	Mr. Apolo Kharuga	Regional Officer, ATM	ICAO - Eastern and Southern African Office (ESAF) - P. O. Box 46294 - 00100 – Nairobi – Kenya – Tel :254-20-622372/622374 Fax :254-20-621092/623028 **E-mail. icao@icao.unon.org** **E-mail :Apolo.Kharuga@icao.unon.org**
	Mr. BROU Konan	Regional Officer, ATM	ICAO - Eastern and Southern African Office (ESAF) - P. O. Box 46294 00100 – Nairobi – Kenya Tel :254-20-622373/622374 Fax :254-20-621092/623028 **E-mail. icao@icao.unon.org** **E-mail :Konan.Brou@icao.unon.org**

[*Insert Name of State*] Safety Plan For the Implementation of RVSM

DOCUMENT APPROVAL

The following table identifies all Authorities that have successively approved the present issue of this document.

AUTHORITY	NAME	SIGNATURE	DATE
National RVSM Safety Manager			
National RVSM Program Manager			
Head of Operations in National ATS Provider			
Approval Authority			

NOTES

- This draft plan is written to provide a template for use by individual States
- Where possible the text is written to be suitable for direct inclusion in State's Safety Plans.
- Where additional text is required to be inserted by the State, this is indicated in the text in Italics within brackets, for example [*insert Name of responsible authority here*].
- Some of the text is illustrative. In such circumstances a State may need to develop text appropriate to its circumstances, which reflects its local environment and activities etc. The illustrative text does, however, broadly represent best practice and may be used by States for their planning. States should note that there may be more than one way to achieve best practice and the text in this draft plan only reflects one of these possibilities.
- This draft plan does not try to take into account all the specifics of safety planning in use in the States. Each State needs to identify those aspects of their safety planning that are not included in this draft plan. States should include, as appropriate, such aspects within their State Safety Plan

DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION	DATE	REASON FOR CHANGE	SECTIONS PAGES AFFECTED

TABLE OF CONTENTS

CONTENTS ..... Page

1 INTRODUCTION

1.1 Safety Plan Objective

The objective of this Safety Plan for [*Name of State*] is to set out those National activities that are required to support the RVSM Safety Case. The plan also addresses safety requirements identified by the State's Regulator [*Insert Name of regulatory authority*]. Each of the National activities required for the implementation of RVSM by [*Name of State*] is described in some detail. The descriptions address:

- The role of the activity in support of the safe implementation and operation of RVSM in [*Name of State*],
- The standards to be applied to the conduct of the activity,
- The additional supporting activities that will provide confidence that the identified National activities will lead to the successful implementation of RVSM within [*Name of State*]. These supporting activities include:
  - Those that help achieve quality,
  - Those that help manage identified risks.

The purpose in showing this level of information is to provide early assurance that *[Name of State]* takes its safety responsibilities seriously and has developed a plan to achieve the safe implementation of RVSM.

This safety plan has also been produced to help those within *[Name of State]* who have responsibility for the provision and regulation of the State's Air Traffic Service [*insert Name of ATS Provider*]. It helps them understand the safety aspects of the State's RVSM activities and shows how the National Program Manager is managing these aspects.

1.2 Approach

This National safety plan is divided into sections that consider the National activities for RVSM as follows:

- Section 2: Aircraft and Operator Approvals for RVSM
- Section 3: ATS Training,
- Section 4: ATS Equipment,
- Section 5: ATS Procedures,
- Section 6: Airspace Design,
- Section 7: RVSM Switchover,
- Section 8: Operational Monitoring of RVSM.

Within each section the plan:

(a) Describes those activities that are necessary to provide an appropriate ATS following the implementation of RVSM in the AFI region;

(b) Identifies the appropriate responsible Authorities, together with a description as to how these Authorities discharge their responsibility;

(c) Describes the detailed activities and checks that underpin the achievement of quality of the activities described in item (a) above;

(d) Shows how the hazard and risk information that will be produced by AFI's RVSM Program will be addressed as appropriate by the State.

1.3 Organisation

The Organisation for the RVSM safety plan and associated activities is as follows**.**

(a) [*Insert Name*] has been appointed as the Safety Manager for RVSM and is responsible for the production of this plan;

(b) The National Program Manager [*insert Name*] has responsibility for the National RVSM program. He approves the safety plan and is responsible for obtaining the further approvals that are described below. In approving the plan the National Program Manager is confirming that in his view the plan is acceptable, and accurately describes the activities that are required to show that the stated safety requirements will be achieved;

(c) The Head of ATS Operations [*insert Name*] has overall responsibility for the ATS operations. In approving the plan the Head of Operations is confirming that from a safety perspective all necessary actions have been or will be undertaken by the ATS provider to ensure that RVSM can be safely implemented and operated within *[Name of State]*;

(d) The CAA/ATS provider company [*insert Name*] is the designated Authority and is responsible for the provision of an appropriate Air Traffic Service within the State. In approving the plan the DG is confirming that he is satisfied that responsibility for the safe implementation of RVSM has been properly delegated; that the staff delegated have been duly authorised to act on his behalf; and that they are competent to act on his behalf.

In addition to the above, specific approvals for individual activities are also required (see sections 2.4, 3.4 through to 8.4).

The above organisation applies during the pre-implementation phase of RVSM. There are activities (in particular safety monitoring activities) that take place post-implementation. The responsibility for post-implementation safety activities rests with responsible staff in the State and the ATS provider [*insert Names, otherwise state that the post-implementation safety organisation and responsibilities are not yet determined*].

2 AIRCRAFT AND OPERATOR APPROVALS

2.1 Introduction

This section deals with Aircraft/operator approval requirements for aircraft to operate within the AFI RVSM region and describes the approval program within the State.

2.2 Safety Requirement

The safety requirement is to show that all Operators based in *[Name of State]* are aware of the RVSM implementation and have obtained RVSM approval for themselves and their aircraft as appropriate. Both the aircraft and the Operator require approval if they are to operate in RVSM airspace. It is the responsibility of the State's CAA to describe their regulatory activities that will lead to documentary proof of the State's CAA diligence with respect to these approvals.

2.3 Standards Applied

[Name of State] will use TGL6 revision 1 to conduct the approval for civil aircraft and operators for RVSM operations.

2.4 Planned Aircraft/Operator Activities

An approval program has been developed to support the implementation of RVSM. The details of the program are found in [*Name of State*] National RVSM Plan. The program subdivides into two main activities:

(a) Awareness Activities
Operators and State aircraft authorities have already been informed about RVSM approval and monitoring requirements through:

- AICs [*supply details of AICs issued and planned for issue*].
- RVSM Seminars/workshops [*Supply details of seminars/workshops already run and planned to be run*]
- A working group has been set up with the Operators and State aircraft Authorities to discuss RVSM implementation. [*supply details of working group*]

(b) Approval Activities
These are described in 2.5 below.

2.5 Approval Activities

There are two areas for which *[Name of State]* has an established approval/regulatory process:

(a) Operator Approval

Those Operators that are based in *[Name of State]*, and wish to operate within the AFI RVSM Airspace, will apply to the State CAA to obtain operational approval (in line with TGL 6). The responsible officer for giving such approvals is [*insert title and name of current jobholder*]. His approval is based on [*insert approval criteria – this should be based on establishing compliance with the relevant aspects of TGL 6*].

(b) Aircraft Certification and Approval

Operators (or owners) of aircraft registered within *[Name of State]* will apply to the State CAA for certification and approval (in line with TGL 6). The responsible officer for giving such approvals is [*insert title and name of current jobholder*]. His approval is based on [*insert approval criteria – this should be based on establishing compliance with the relevant aspects of TGL 6*].

In addition military Authorities have elected to submit identified military transport aircraft for RVSM certification and approval. The responsibility for this rests with *[Name of State]* Ministry of Defence. It has elected to implement the principles embodied in TGL 6 Issue 1. The responsible officer for giving such approvals is [*insert title and name of current jobholder*]. His approval is based on [*insert approval criteria*].

As of [date], [number] civil aircraft and [number] operators have been approved for RVSM operations . This leaves an anticipated [number] aircraft and [number] operators that will require RVSM approval. [State] anticipates that these approvals will be in place by [date]. In addition, as of [date], State Authorities have approved [number] State aircraft for RVSM operations. This leaves an anticipated [number] aircraft that will require RVSM approval. [State] anticipates that these approvals will be in place by [date].

2.6 Quality Assurance of Activities

It is important to ensure that the approval activities are effective and lead to RVSM approved aircraft that are capable of meeting the more stringent height keeping requirements within the AFI RVSM airspace and air crew that are familiar with RVSM rules and procedures. There are several elements that provide confidence in this capability.

2.6.1 Aircraft Technical Height Keeping Performance Monitoring

The ARMA has established a Height Monitoring Infrastructure that will provide ongoing monitoring of a substantial proportion of the aircraft fleet operating within the AFI RVSM region.

Aircraft that are not within the specified standards will be reported to the appropriate State Authorities that approved the aircraft for RVSM operations. The Operator of the non-compliant aircraft will also be contacted. [*Insert Name of State Authority*] will follow up all such reports with the Operators concerned. This review will take place within the normal framework of aircraft certification and operator licensing.

2.6.2 Operational Error Monitoring

The AFI Regional Monitoring Agency (ARMA) has an established and ongoing program of operational error data collection and assessment. Information is obtained from ACCs and States on operational altitude deviations of 300 ft or greater. ARMA will use the data as part of the RVSM Safety Case. At present mechanisms have not been developed to inform the appropriate States of clusters of events associated with a specific operator or region of airspace. These will be established prior to the implementation of RVSM.

In addition to the above, [*insert Name of State Authority*] monitors and reviews aircraft airworthiness and Operator Licenses both on a regular basis and in response to identified concerns or trends.

2.7 Aircraft and Operator Risk Management

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference] and has made the adaptation provided in Appendix XX.

[State] has reviewed the FHA-proposed mitigation strategy related to the aircraft and operator element of its RVSM System, as follows:

Mitigation	Actions / Activities	Hazard ID

All of these mitigations will be in place by [date].

3 ATS TRAINING

3.1 Introduction

This section focuses on [*Name of State*] ATS training activities that are needed to ensure that operational staff is familiar with RVSM procedures. Additionally further details are provided to show how this training program supports and underpins the safe implementation of RVSM.

3.2 Safety Requirement

The safety requirement associated with the ATS training is to show that all relevant staff have been appropriately trained in RVSM procedures and are competent to operate within an RVSM environment.

3.3 Standards Applied

The AFI RVSM training guidance material, approved by the AFI RVSM Task Force for application within the AFI Region, is used for the development of *[Name of State]*'s training material.

3.4 Planned ATS Training Activities

An ATS training program has been developed to support the implementation of RVSM. The details of the program are found in [*insert reference to appropriate documents*]. The detailed program subdivides into four main activities and shows that it is the intent to train all controllers licensed in RVSM airspace sectors prior to RVSM Implementation on 19 January 2006.

3.4.1 Training Roles and Responsibilities

Staff has been identified to lead, prepare and deliver RVSM training to ACC Staff. [Include *Names, staff positions and RVSM training roles*].

3.4.2 Training Material

The AFI RVSM training guidance material supplied by ARPO will be used as the basis for the State training material. This will be supplemented by locally developed material. All the designated instructors will become familiar with the material.

3.4.3 Training Program

A program of courses will be established at each ACC [*Names of the ACCs and summary of each training program to be included*]. The program will be developed in close co-operation with managers at each ACC. All controllers who will have operational responsibility in the AFI RVSM region (ie above FL 290) will receive this training. Other controllers and staff within the Air Traffic Provider will as a minimum be familiarise with RVSM operations and how it affects them in their duties. As far as is practical all controllers at an ACC will receive the full RVSM training.

As of [date], the following ATS training sessions have been run:

Date	Training module	ACC	Number of staff attending

The following ATS training sessions are planned:

Date	Training module	ACC	Number of staff attending

3.4.4 ACC Training Program

Courses will be run at each ACC as required. Follow-up and refresher training will be provided as needed.

3.5 RVSM Training Program Approval

There are two aspects of these training activities for which *[Name of State]* has established an approval process. These two aspects are:

3.5.1 Training Material Approval

All ATS training material is subject to strict control and changes must be approved prior to first use. The RVSM training material is subject to this process. The responsible officer for the approval of the training material is [*insert title and name of current jobholder*]. His approval is based on [*insert approval criteria*].

The training material will be approved for use by the above named responsible officer by [date]. Evidence for this approval will be found in [provide reference to the document that gives this approval].

3.5.2 Controller Competence in RVSM Operations

The change to RVSM does not require changes to the controller's ATC license (or certificate of competence). However the ATS provider does accept the responsibility to ensure that controllers are capable of RVSM operations. To discharge this responsibility the manager of that ACC approves the RVSM training program for each ACC. Approval of the program represents a commitment from each ACC to ensure that all appropriate staff receives RVSM training and that this training makes full use of the approved training material.

3.6 RVSM Training Quality Assurance

It is important to ensure that the ATS training in RVSM operations is effective and understood by controllers. There are several elements that provide confidence in this effectiveness.

3.6.1 Use of the AFI RVSM training guidance material

The AFI material has been developed by the AFI RVSM Task Force and has been subject to extensive review within the RVSM Program. This material forms the core of the training material developed for the State RVSM training program.

3.6.2 ATC Instructors

The responsibility for the delivery of the training programme rests with [*insert Name(s) and roles*]. They are experienced training instructors and are licensed as On-the-Job Training (OJT) Instructors. [*Further evidence of their experience may be usefully provided here*]. They are familiar with RVSM procedures. [*Insert Name(s)*] has attended the AFI Training Course on the RVSM Training material [*insert dates*]. They in turn will ensure that all the other designated instructors become familiar with, and understand, the material.

3.6.3 Training Material Review

Operational and management staff at each ACC will review the material prior to first use. The review comments will be documented and the material will be amended as appropriate.

Or

Operational and management staff at each ACC have reviewed the training material. Their review comments and response to those comments are documented in [provide reference].

3.6.4 Timely Training Program

The ATS provider recognizes its responsibility for the competence of controllers in operating within the AFI RVSM region. It will therefore ensure that:

- The training program allows controllers sufficient time from their operational duties to attend one of the courses,
- That accurate course attendance records are kept (including time spent on training simulators), and
- Controllers are encouraged to seek clarification, and further training if necessary, on those aspects they did not fully understand.

3.6.5 Interactive Training Program

Specific interaction will be encouraged through a course feedback questionnaire. The questionnaire will seek attendee views on the quality and ease of understanding of the course. This will be fed back to the instructors and course developers and used to further refine the course. Secondly the material will be presented in an interactive manner and interaction with attendees will be encouraged. Areas of difficulty in assimilating/understanding the material will be sought from attendees and will be addressed on an individual or group basis through further explanation and training if necessary.

Or

A course feedback form has been given to all those that have attended the course offered to date. Thus far the comments made have been mainly positive and have not resulted in any changes to the course material.

3.6.6 Refresher Training

RVSM training may, through operational and staffing constraints, be provided to a controller more than 6 months in advance of RVSM. In such circumstances in the weeks prior to implementation, refresher training will be provided, so that what was learnt on the course is refreshed in the mind. [Provide d*etails of the provisions at each ACC for such refresher and follow-up training*].

3.7 ATS Training Risk Management

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference] and has made the adaptation provided in Appendix XX.

[State] has reviewed the FHA-proposed mitigation strategy related to the ATS Training element of its RVSM System, as follows:

Mitigation	Actions / Activities	Hazard ID

All of these mitigations will be in place by [date].

4 ATS EQUIPMENT

4.1 Introduction

This section addresses those to ATS equipment required for RVSM Operations and describes the program of activities that has been established to make the required changes to ATS equipment. Additionally further details are provided to show that these equipment will be completed successfully and will underpin the safe implementation of RVSM.

4.2 Safety Requirement

The safety requirement is to show that the the ATS equipment have been made successfully and approved for operational use.

4.3 Standards Applied

ICAO Technical Document 7030/4 (*Include as Appendix E*) provides the standards for procedures. ARPO has developed an AFI ATC manual that is consistent with ICAO Document 7030/4 and provides further information. This latter document provides the basis for the changes to ATS equipment that are required for the AFI RVSM Region.

4.4 Planned ATS Equipment Changes

[*Name of State*] has developed a program for changes to ATS equipment to support the implementation of RVSM. The details of the program are found in [*insert reference to the National RVSM Plan*]. This detailed program shows that it is the intent to complete the ATS equipment changes well before the implementation of RVSM on 19 January 2006. [*Dates to be inserted and tight timescales requires each the State to summarize the contingency plans that have been developed to mitigate the risk of slippage in the dates*].

In [*Name of State*] changes are required to the Flight Data Processing (FDP), Radar Data Processing (RDP), Display, flightstrip, Short Term Conflict Alert (STCA), Medium Term Conflict Detection (MTCD) and On-Line Data Interchange (OLDI) systems. Software Modifications are required to all these systems to ensure that they are compatible with the ATC Manual for RVSM.

The State ATS Provider [*insert Name of ATS Provider*] is in contract with an external supplier who will make the necessary changes to the above systems. The contractor will make the changes to the systems, and test them. Following on from the successful conclusion of these tests, the ATS provider will accept the changed software and apply to the [*State CAA*] for approval to operate with the changed software.

4.5 Approval of Activities

There are two aspects of these ATS equipment changes for which *[Name of State]* has established an approval process.

4.5.1 Modified ATS Equipment

With the exception of minor updates to software, all changes require approval from the [*State CAA*] prior to their installation at ACCs. The responsible officer is [*insert title and name – ATS engineering function*]. He will approve the changes to ATS equipment prior to installation. His approval is based on [*insert approval criteria*].

The ATS equipment will be approved by the above named responsible officer by [date]. Evidence of this approval will be found in [provide reference to the document that gives that approval.

4.5.2 Modified ATS Equipment for Operational Use at ACCs.

The ATS equipment need to be installed satisfactorily at each ACC. The acceptance of the installed changes is required at each ACC by the [*State CAA*]. The responsible officer is [*insert title and name – ATS operational function*]. He will approve the equipment at each ACC prior to operational use. His approval is based on [*insert approval criteria or responsible officer's terms of reference, where available and appropriate*].

The to ATS equipment will be approved by the above named responsible officer by [date]. Evidence of this approval will be found in [provide reference to the document that gives that approval.

4.6 Quality assurance of ATS Equipment Changes

It is important to ensure that the changes are successful, in that they fully implement the agreed requirements; and are fully compatible with the systems and practises at each ACC. There are several elements that provide confidence in the successful change to the ATS equipment:

4.6.1 Functional Requirements

Functional Requirements for the change have been established [*reference to be supplied by State*] and the delivered changes will be judged against these requirements. These functional requirements were an integral part of the specification agreed with the contractor.

4.6.2 Software Development

Contractors have development processes for software modifications needed for RVSM operations. These are internal contractor procedures and have been established for some time [*supply ref to these procedures*].

4.6.3 Developed Software

Developed software will go through a series of tests and user trials prior to acceptance. Each of the identified functional requirements will be formally tested against agreed acceptance criteria [*ref on acceptance criteria to be supplied here*].

4.6.4 The Human Machine Interface

Controllers, as part of the RVSM training, will evaluate the Human-Machine Interface (HMI). Feedback will be sought from those attending courses on the usability and clarity of the HMI.

Or

HMI has been evaluated by controllers as part of the RVSM training. Feedback has been sought on all the courses run to date. Thus far no significant HMI issue has arisen.

4.7 Risk Management of ATS Equipment Changes

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference] and has made the adaptation provided in appendix XX.

[State] has reviewed the FHA-proposed mitigation strategy related to the ATS Equipment element of its RVSM System, as follows:

Mitigation	Actions / Activities	Hazard ID

All of these mitigations will be in place by [date].

5 ATS PROCEDURES

5.1 Introduction

This section identifies changes required to ATS Procedures for implementation of RVSM in the AFI region and to implement new ATS procedures within each ACC. Additionally further details are provided to show how these activities underpin the safe implementation of RVSM.

5.2 Safety Requirement

The safety requirement is to show that the changes to the ATS procedures have been approved for use. Assurance is required to show that the new procedures are appropriate; do not cause excessive controller and aircrew workloads; and have been co-ordinated with other organisations.

5.3 Standards Applied

ICAO Document 7030/4 provides the standards. AFI has developed an ATC manual that is consistent with ICAO Document 7030/4 and provides further amplification of its implementation in the AFI region.

5.4 ATS RVSM Procedures

A program of activities has been established to develop and co-ordinate the changes to the ATS procedures. The details of the program are found in [*Name of State*] National RVSM Plan. The program subdivides into the following main activities:

5.4.1 State Aircraft Authorities Co-ordination

State aircraft in [*Name of State*] have no restriction on operating between flight levels FL290 and FL410 and do not require special procedures or co-

ordination. State aircraft will operate within a policy of the flexible use of airspace and in co-operation with the Civil Authorities. The implementation of RVSM potentially imposes additional requirements on both State and Civil Authorities. A co-ordinating committee [*insert Name*] has been formed with these State-aircraft Authorities to ensure that satisfactory procedures are developed and that the high standards of co-operation and co-ordination continue following the Implementation of RVSM.

5.4.2 Adjacent ACC Co-ordination

The changes to procedures required for RVSM at an ACC will need to be co-ordinated with adjacent ACCs. New (or amended) letters of agreement/procedures (LoA/Ps) are required. The Head of the ATS Provider is responsible for making the necessary agreements.

5.4.3 ATSU Operations Manual Changes

Each ACC will need to change its ATSU Operations Manual to include the changes as a result of RVSM. This is the responsibility of ACC management. The changes will include these appropriate changes due to the new LoAs, and any new agreements with the State Authorities concerning the use of RVSM airspace by State aircraft.

National Program activities recognise the links between the changes to airspace, which must precede the changes to procedures, and the development of RVSM ATC training which can only be fully completed when the new procedures are available.

5.5 Approval of ATS Procedures Changes

There are two aspects of these changes to procedure activities for which *[Name of State]* has established an approval process.

5.5.1 ATSU Operations Manual Approval

Any change to an ACC Operations Manual is subject to strict control. All changes must be approved prior to use. The responsible officer is [*insert title and name of current jobholder*]. He will approve the changes to the manual for use. His approval is based on [*insert approval criteria*].

5.5.2 Acceptance of ACC Amended Agreements (LoA/Ps)

Changes to LoA/Ps are approved (signed) by ACC managers of both centers. For ACCs within [*Name of State*] approval is based on [*insert approval criteria*].

In addition within [*Name of State*] it is policy for to require additional, more senior signatures where the Adjacent or subjacent ACC is in another State. In

[*Name of State*] the [*insert title and name of the officer responsible for LoA/Ps signature*] of the CAA signs. His approval is based on [*insert approval criteria or responsible officer's terms of reference, where appropriate*].

5.6 ATS Procedures Changes Quality assurance

It is important to ensure that the changes to ATS procedures are appropriate and have been conducted in a professional manner. There are several elements that provide confidence in this.

5.6.1 ICAO and AFI Material

ICAO Documents 7030/4, 9574 and the AFI ATC Manual for RVSM have been subject to extensive review and development and provide a definitive basis for these changes.

5.6.2 Operational Staff Review

Operational staff at each ATSU will review the ATSU Operations Manuals. The review comments will be documented and where appropriate the manual will be modified.

Or

The changes to the Unit Operations Manual have been reviewed by [list names and staff positions]. Their review comments have been discussed and changes to the manual have been agreed as appropriate. These have been documented in [either reference a report, letter or memo giving comments and response to those comments, or reference the review meeting minutes that provide the agreed response to the comments made].

5.6.3 LoA/P Control Process

All LoA/Ps within *[Name of State]* are subject to extensive review. Within [*Name of State*] this includes the Airspace policy staff, and ACC operational staff.

Or

The proposed LoA/P with [name of ACC] has been reviewed by [list names and staff positions]. Their review comments have been discussed and changes to the LoA/P have been agreed where appropriate. These have been documented in [provide reference].

5.6.4 Procedure and Airspace Design Change Simulation

[Name of State] has a computer based simulation capability. The changes to airspace design and use of RVSM procedures will be subject to simulation. The simulation validates the use of the new RVSM procedures and changes to airspace policy. [Insert s*imulation dates, constraints and objectives*].

[or refer to desktop exercises run to explore throughout the likely effects of RVSM operations]

5.7 ATS Procedure Risk Management

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference] and has made the adaptation provided in appendix X.

[State] has reviewed the FHA-proposed mitigation strategy related to the ATS Procedures element of its RVSM System, as follows:

Mitigation	Actions / Activities	Hazard ID

All of these mitigations will be in place by [date].

6 AIRSPACE DESIGN

6.1 Introduction

This section addresses airspace design activities needed to ensure safe and effective RVSM operations. Additionally further details are provided to show how these airspace changes underpin the safe implementation of RVSM.

6.2 Safety Requirement

The safety requirement associated with the changes to airspace design is to show that the changes are appropriate and are consistent with the safe operation of RVSM in the AFI region.

6.3 Standards Applied

Whilst it is best practice to simulate such changes to show both the impact on traffic flows and controller workload, there are no applicable standards for evaluating proposed changes.

6.4 Planned Airspace Design Changes

A program for airspace design changes has been developed to support the implementation of RVSM. The details of the program are found in [*Name of State*] National RVSM Plan. There are several changes to the design of airspace that have been proposed to support the effective implementation of RVSM. These include:

(a) Changes to entry, reporting and exit points to minimise possible congestion at these points;
(b) A new flight level allocation scheme;
(c) Re-sectorisation of the upper airspace to allow the capacity in the upper airspace to increase to take advantage of the new RVSM levels;
(d) Some modifications to allow more direct routings.

Some of these changes need to be agreed with ACCs in adjoining states and are reflected in the LoA/P change process described in section 5.3 above.

6.5 Approval of Airspace Design Changes

There are two aspects of these airspace design activities for which *[Name of State]* accepts responsibility and has established an approval process.

6.5.1 Approval of the Changes

All airspace design issues are subject to strict change control and must be approved prior to first use. The responsible officer [*insert title and name of current jobholder*] will approve the changes. His approval is based on [*insert approval criteria*].

6.5.2 Acceptance of Changes Included in the LoAs as Necessary

This approval process is described above in section 5.5.

6.6 Airspace Design Quality Assurance

It is important to ensure that the changes to airspace design are effective. There are several elements that provide confidence in this effectiveness.

6.6.1 Use of Simulations

Simulations have been performed [*insert ref here*]. The studies show that the airspace design changes are effective within simulations of RVSM Operations. The simulation shows that controllers can safely handle RVSM operations.

6.6.2 Review Airspace Changes

The proposed airspace design changes receive extensive review by management staff within each of the ACCs. The review comments will be documented and where appropriate the manual will be modified.

Or

The changes to the Airspace Design have been reviewed by [list names and staff positions]. Their review comments have been discussed and changes to the manual have been agreed as appropriate. These have been documented in [either reference a report, letter or memo giving comments and response to those comments, or reference the review meeting minutes that provide the agreed response to the comments made].

6.7 Airspace Design Change Risk Management

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference] and has made the adaptation provided in Appendix XX.

[State] has reviewed the FHA-proposed mitigation strategy related to the Airspace Design element of its RVSM System, as follows:

Mitigation	Actions / Activities	Hazard ID

All of these mitigations will be in place by [date].

7 RVSM SWITCHOVER

7.1 Introduction

Switchover is the operational process of managing the actual conversion of ATS from a 2000-ft separation (CVSM) environment to a 1000-ft (RVSM) environment. It covers the changes in the few hours before switchover on 19 January 2006 and the first few hours after the switchover. This switchover is the key operational aspect of the countdown to the implementation of RVSM. This section confirms that the operational impact of switchover to RVSM has been addressed and contingency plans exist. Details are provided to show how this changeover activity supports and underpins the safe implementation of RVSM.

7.2 Safety Requirement

The safety requirement is to show that the special procedures for the switchover to RVSM have been approved for use. Assurance should be provided to show that procedures and reversionary modes of operation are in place.

7.3 Applied Standards

[Name of State] will use the AFI RVSM countdown plan as the basis for its own countdown plan. (*Include as Appendix G*).

7.4 Planned Switchover Activities

The AFI RVSM Task Force will issue the AFI RVSM switch-over plan incorporating the results of the AFI RVSM Functional Hazard Assessment (FHA) [provide reference]. It includes appropriate consideration of the mitigation required by the FHA report.

[State] NPM has agreed to develop a national version of this plan, that will be provided in Appendix XX. This should be completed by [date].

7.5 Approval of Switchover Plans

There is one aspect of this switchover for which *[Name of State]* accepts responsibility and has established an approval process.

7.5.1 Approval of Special Procedures Developed for each ACC

These special ATS procedures (to cover switchover) will require approval prior to use just like any other ATS procedure. The responsible officer is [*insert title and name of current jobholder*]. He will approve the material for use and the approval is based on [*insert approval criteria*].

7.6 Switchover Quality Assurance

It is important to ensure that the planning for switchover is effective. There are several elements that provide confidence in this effectiveness.

7.6.1 AFI Countdown Material

The AFI material on the countdown process is being developed and the switchover aspects are an identified key part of the countdown process. This AFI material has been subject to extensive review.

7.6.2 Review of Switchover Procedures

Operational and management staff at each ACC will review the material. The review comments will be documented and the material will be amended as appropriate.

7.7 Switchover Risk Management

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference] and has made the adaptation provided in Appendix XX.

[State] has reviewed the FHA-proposed mitigation strategy related to the Switch-over period, as follows:

Mitigation	Actions / Activities	Hazard ID

All of these mitigations will be in place by [date].

8 RVSM OPERATIONAL SAFETY MONITORING AND REVIEW

8.1 Introduction

This section identifies activities required for post-implementation monitoring of the safety performance of RVSM operations by *[Name of State]*.

8.2 Safety Requirement

The safety requirement is to provide appropriate monitoring of the operational safety performance of the ATS in the application of RVSM.

8.3 Applied Standards

ICAO Annex 11 provides the standards.

8.4 Monitoring Activities

The post-implementation monitoring arrangements will continue as per current traffic data capturing procedures and will also consider the normal monitoring of safety performance by the State.

There are two key activities:

(a) ATS Performance Safety Monitoring

These arrangements will be a specific aspect of the normal monitoring of safety performance by the State.

(b) Operational Error Reporting

[Name of State] commits to providing operational error data reported by controllers in its ACCs. The State already supplies this information as part of its contribution to the Collision Risk Assessment (CRA) and the AFI Pre-Implementation Safety Case. The data supplied will be used, together with data from the other RVSM states, to assess the likely risk of collision in AFI RVSM region and to contribute to the AFI RVSM Post-Implementation Safety Case.

In addition *[Name of State]* will assess this data provided by its own ACCs and act on the evidence as appropriate.

8.5 Approvals

The approval process for establishment of such monitoring arrangements is not yet determined and will be part of the national SMS activities.

8.6 Quality Assurance

It is important to ensure that the monitoring arrangements are appropriate and will be conducted efficiently and in a professionl manner.

There are several elements that provide evidence in this. They are:

[insert the elements]

8.7 Risk Management

Monitoring arrangements will help manage operational risks identified in the [State] national hazard log. These arrangements do not introduce additional risks.

APPENDIX : [State] RVSM hazard log

[State] has reviewed the AFI RVSM hazard log of the AFI RVSM Functional Hazard Assessment [provide reference].

With regards to its national RVSM core airspace, [State] has made the following adaptation:

Hazard ID	Hazard Description	Mitigations

With regards the Switch-Over period, [State] has made the following adaptation:

Hazard ID	Hazard Description	Mitigations

AFI RVSM Seminar/Workshop (Nairobi 18 – 22 July 2005)

ICAO Presentation on Overview of Reduced Vertical Separation (RVSM) Implementation

INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO).

Presented by APOLO KHARUGA Regional Officer,

Air Traffic Management and Search and Rescue

(Nairobi.18-22 July,2005)

Overview of Reduced Vertical Separation (RVSM)implementation

- 1970 ICAO initiates studies on RVSM FL 290 to FL 410 inclusive
- 1980 Studies conducted in Canada,Europe,Japan and USA
- Studies confirm Cost- beneficial
- NAT MNPS airspace – planning commenced in 1990

Introduction of RVSM

- March 1997 First stage FL 330 to FL370 inclusive
- October 1998 Second stage FL 310 to FL390 inclusive
- NAT/ EUR airspace
- ASIA/PAC
- EUR/SAM corridor
- ASIA/PAC
- November 2003 MID Region
- January 2005 CAR/SAM
- January 2006 AFI Region (tentative)

AFI RVSM

- Establishment of RVSM/RNAV/RNP/ Task Force (APIRG/13 Decision 13/58)
- Under the framework of the ATS/SG

Terms of Reference of the TF

- Develop implementation Plan for RVSM in AFI Region
- Identify the airspaces for the implementation of RVSM
- Determine cost-benefit analysis
- Harmonize Plan with adjacent Regions
- Develop guidance material for RVSM

APIRG/14

- Mandated AFI RVSM TF
  - Objectives
    - ➪Develop an AFI RVSM strategy/action Plan
    - ➪Develop an AFI RVSM implementation Plan
  - AFI RVSM SIP 2003
    - ➪Assist in the development of RVSM Plan
    - ➪Conduct RVSM Seminar

RVSM TF meetings

- RVSM/TF/1 meeting (Dakar17-18 June 2002)
  - Develop draft guidance material for RVSM
  - Develop draft RVSM Plan
- RVSM/TF/2 meeting (Dakar 19-21 November 2003)
  - Approved the AFI RVSM strategy/action Plan
  - The strategy/action Plan circulated to States (December 2003)

RVSM/TF meetings

- RVSM/TF/2
  - Guidance on RVSM implementation Plan developed
- February 2004 AFI RVSM programme established
- RVSM/TF/3 (Nairobi 19-21 April 2004) Approve the RVSM finalized RVSM Documentation for circulation to States
- RVSM/TF/4 met Nigeria June 2004
- RVSM/TF/5 met October2004.
  - Go/no Go Decision –DELAYED implementation by one year
- AFI RVSM implementation Date 19 January 2006

RVSM TF/meetings

- TF/6 Nairobi,25-27 May 2005
  - Approval of the Functional hazard assessment
  - Updated the RVSM strategy/action plan
  - Updated the State readiness data
  - Updated the AFI SUPPS amendment proposal

AFI RVSM Implementation Strategy/action Plan

- Programme Management
  - Circulate the strategy/action Plan
  - Develop guidance material for ATC
  - Harmonize RVSM plan with adjacent Regions
  - Develop documents to be published by States.
  - Go /NO GO decision

AFI RVSM strategy/action Plan

- Aircraft Ops and Airworthiness
  - Develop Guidance material
  - Pilot Training guidance material
  - Operations approval processes-
  - Monitor operator approval process

AFI RVSM strategy/action Plan

- Air Traffic Management
  - RVSM National Safety Plan
  - Regional ATC operational manual
  - RVSM airspace definition
  - Regional ATC training guidelines
  - Letters of Procedures
  - Collect RVSM aircraft data AFI RMA
  - Civil/military coordination issues.

AFI RVSM strategy/action Plan

- RVSM safety assurance
  - Data collection and readiness assessment
  - Complete RVSM safety assessment
  - Develop AFI RVSM safety policy

AFI RVSM strategy/action Plan

- Monitoring agency
  - Establish AFI RVSM RMA-March 2004 in Joburg
  - Validate readiness assessment.

Safety Assessment

- Functional Hazard Analysis (FHA)-ALTRAN of France.
- Collision Risk Analysis (CRA) –NLR AMS June 2005
- Pre-Implementation Safety Case (PISC) July 2005
  - RVSVM T/6 approval of FHA-May 2005
- RVSM workshops
- ATS/SG/8 approval TF reports

Safety Assessment

- National Safety Plan Validation Panel(HQ ATM,ARMA ASECNA,ATNS,IATA,RO/ATMs /Dakar and Nairobi (Jo' burg, 12-23 Sept.2005)
- APIRG 15 (Nairobi 26-30 Sept. 2005)
- Consideration OF RVSM issues
  - RVSM Task Force reports
  - FHA,CRA, NSPs and PISC
  - Amendments to DOC 7030 relating RVSM
- approval of PISC by APIRG 15
- ANC approval

Task and Stakeholders meetings

- Go/delay meeting October 2005.
- Target date for the Implementation of RVSM 19 January 2006

THANKS, MERCIE, MUITO OBLIGADO, ASANTE

AFI RVSM Seminar/Workshop (Nairobi 18 – 22 July 2005)

ALTRAN Technologies Presentation on Risk Assessment Principles

INTERNATIONAL CIVIL AVIATION ORGANIZATION

EASTERN AND SOUTHERN AFRICAN OFFICE (ESAF)

RVSM NSP Workshop
(Nairobi, 18 - 22 July 2005)

Risk assessment principles

Presented by

Julien LAPIE

ALTRAN Technologies, CNS/ATM Division, Toulouse (France)

ALTRAN TECHNOLOGIES

Introduction

Objectives

- to present the concept of risk
- to present the risk assessment principles

Program

- What is a risk ?
- Risk assessment
- Risk management
- Risk acceptability/tolerability
- Risk mitigation

Introduction

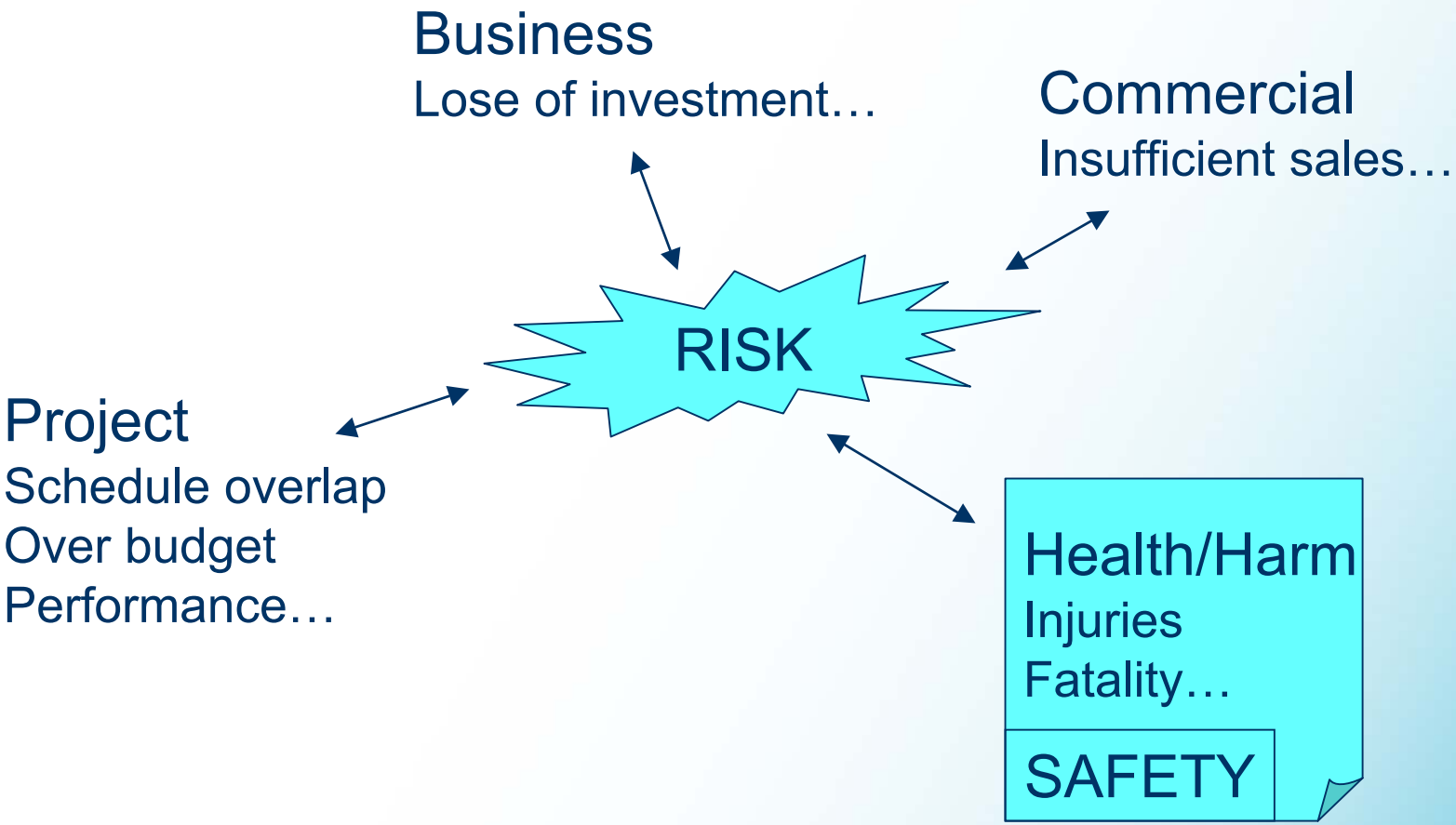
US Air Force MX981 project (1949)

« If anything can go wrong, it will » - Edward Murphy

Murphy's principles

- « If there is a possibility of several things going wrong, the one that will most damage will be the one to go wrong, and at the most inopportune time »
- « Every solution breeds new problems »

What kind of risk?



Definition

Safety = freedom from unacceptable risks of harm [ESARR 4]

What is a risk ?

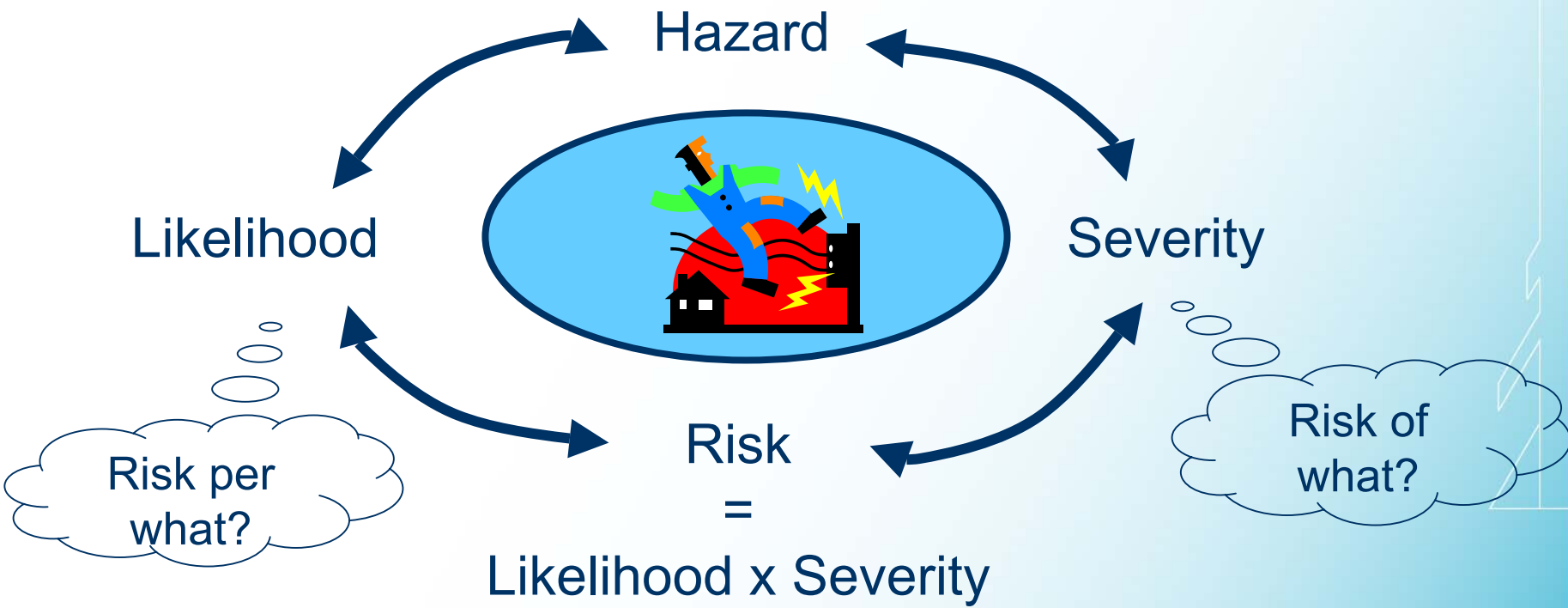
« The chance of suffering some specified undesirable consequence in some specified time period or circumstance »

- In safety, risks arise from hazards

Definitions

- Hazard = a potential source of threat to safety, a situation which has the potential to lead to harm. [SAM]
- Risk = the combination of the frequency of occurrence (likelihood) of a defined hazard and the magnitude of the effects of that occurrence. [SAM]

What is a risk ?



Definitions

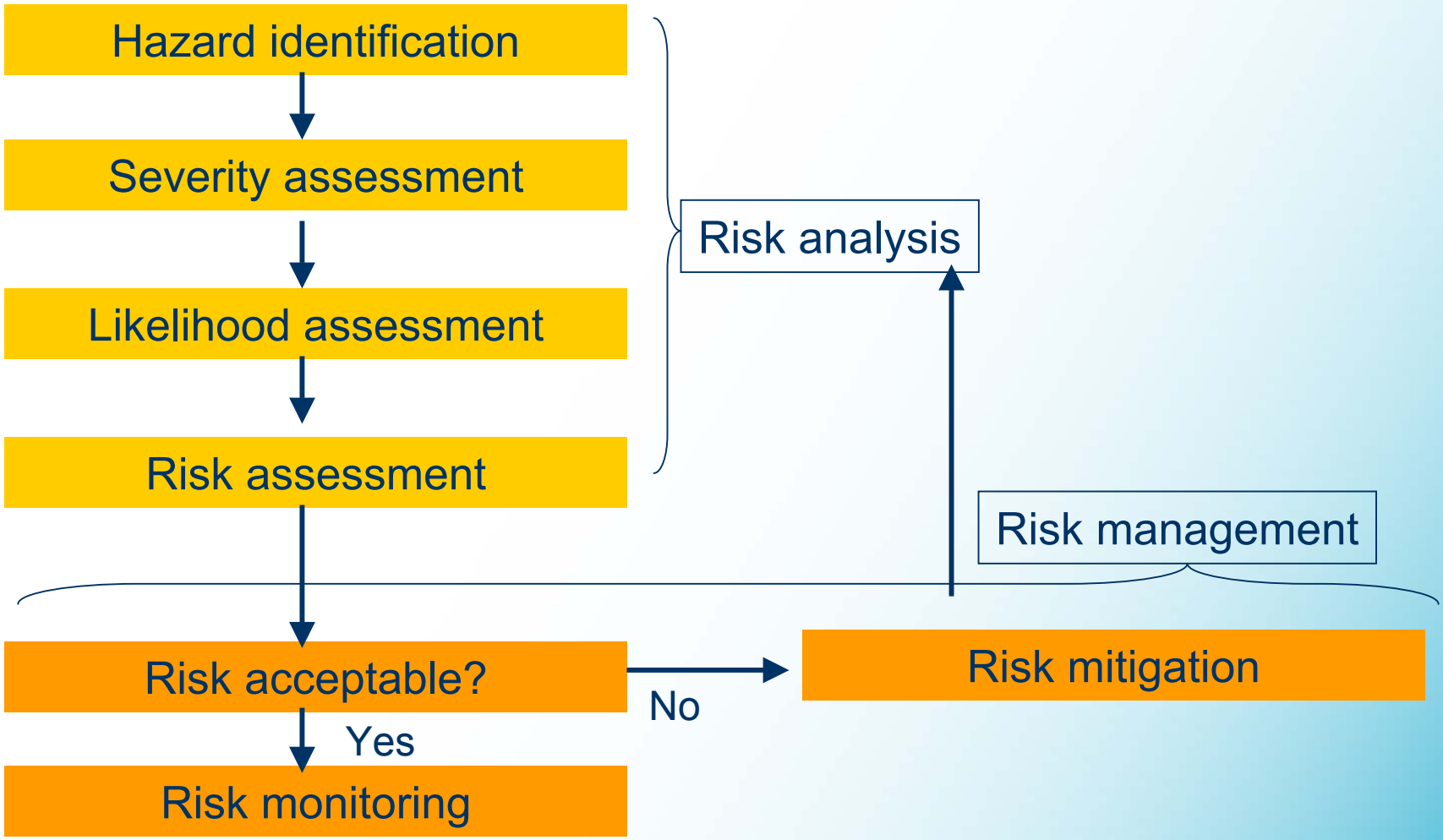
- Likelihood = frequency of occurrence of hazard
- Severity = level/magnitude of effects/consequences of hazard

Risk assessment

Definition

- Risk assessment = process of hazard identification and the estimation, analysis and evaluation of the associated risks [SAM]

Risk management



- Mitigation : steps taken to control or prevent a hazard from causing harm and reduce risk to a tolerable or acceptable level [ESARR 4]

Risk analysis

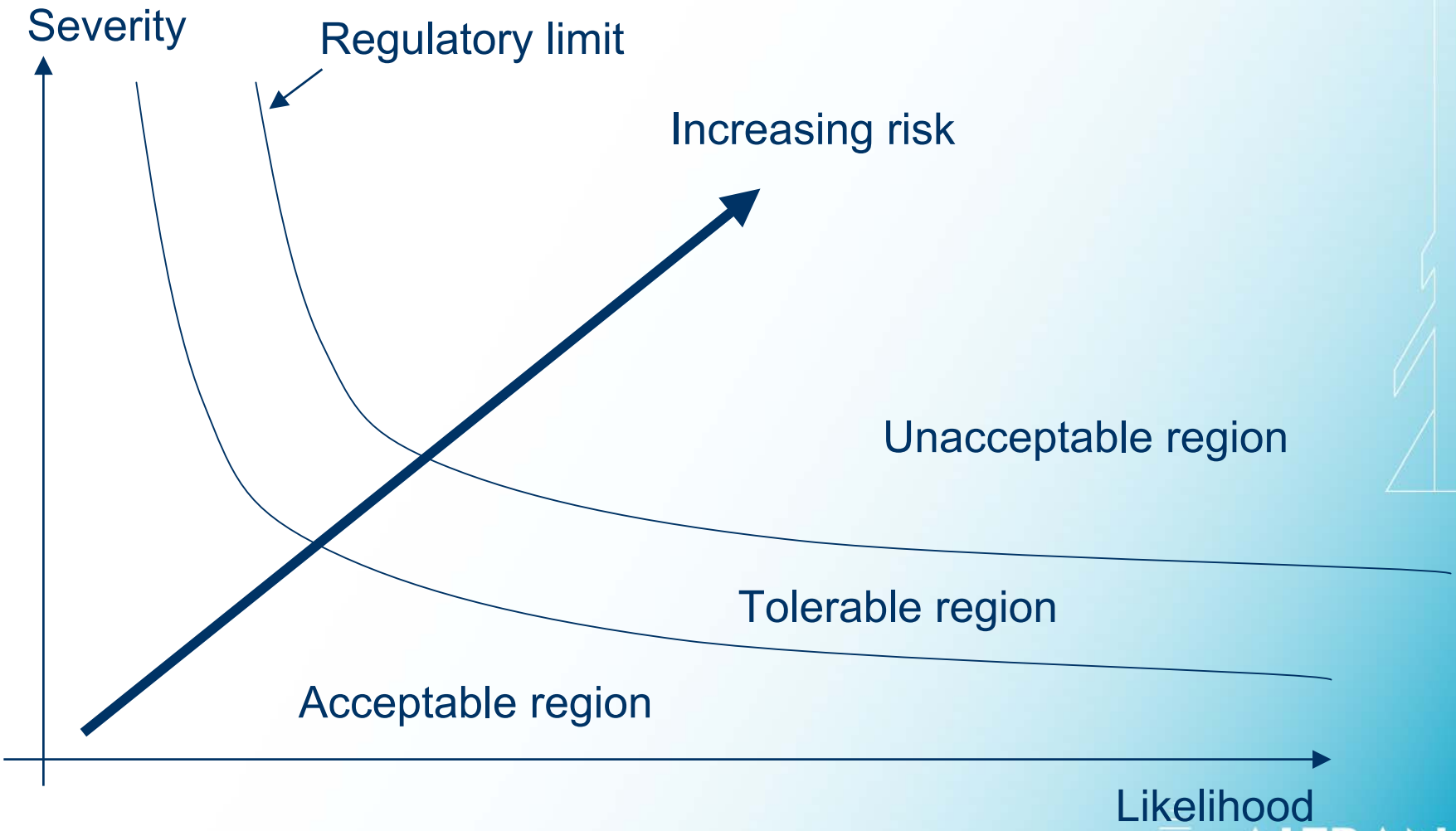
Assessment approaches

STEP	HISTORICAL	PREDICTIVE
Hazard ID	Experience	Methods
Severity	Experience	Modelling/Simulation
Likelihood	Statistics	Systems analysis/ Simulation

- Both approaches provide qualitative and quantitative evidence

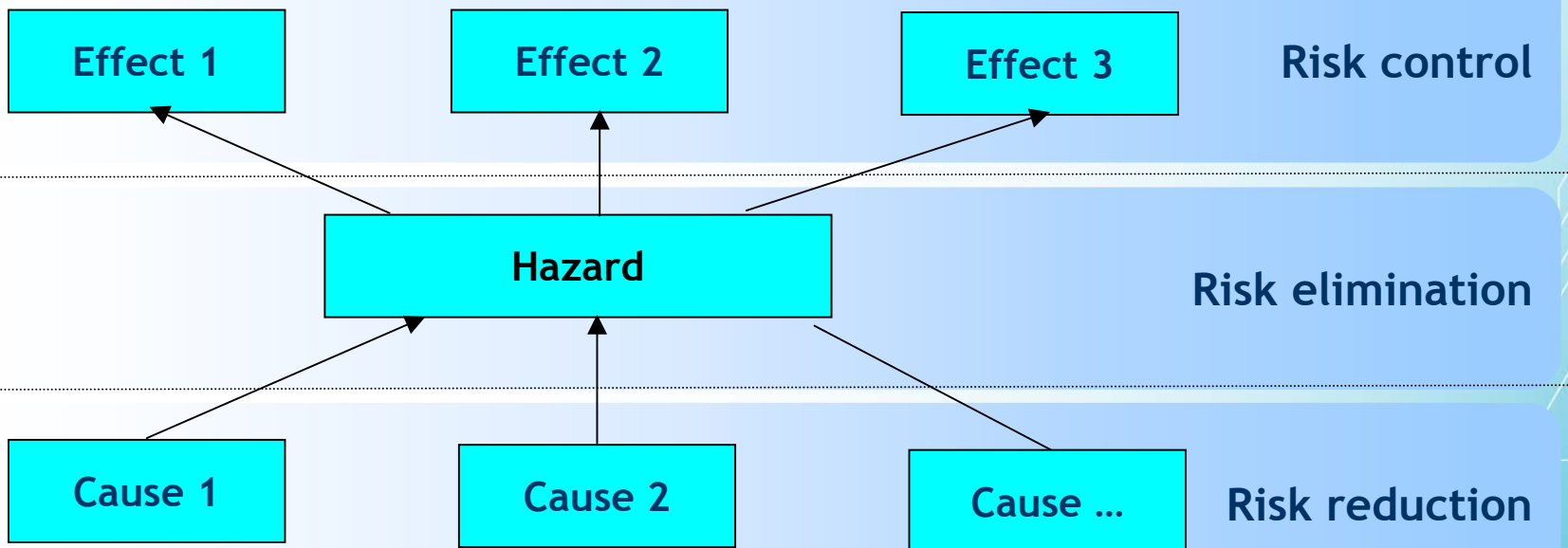
Risk acceptance criteria

General approach



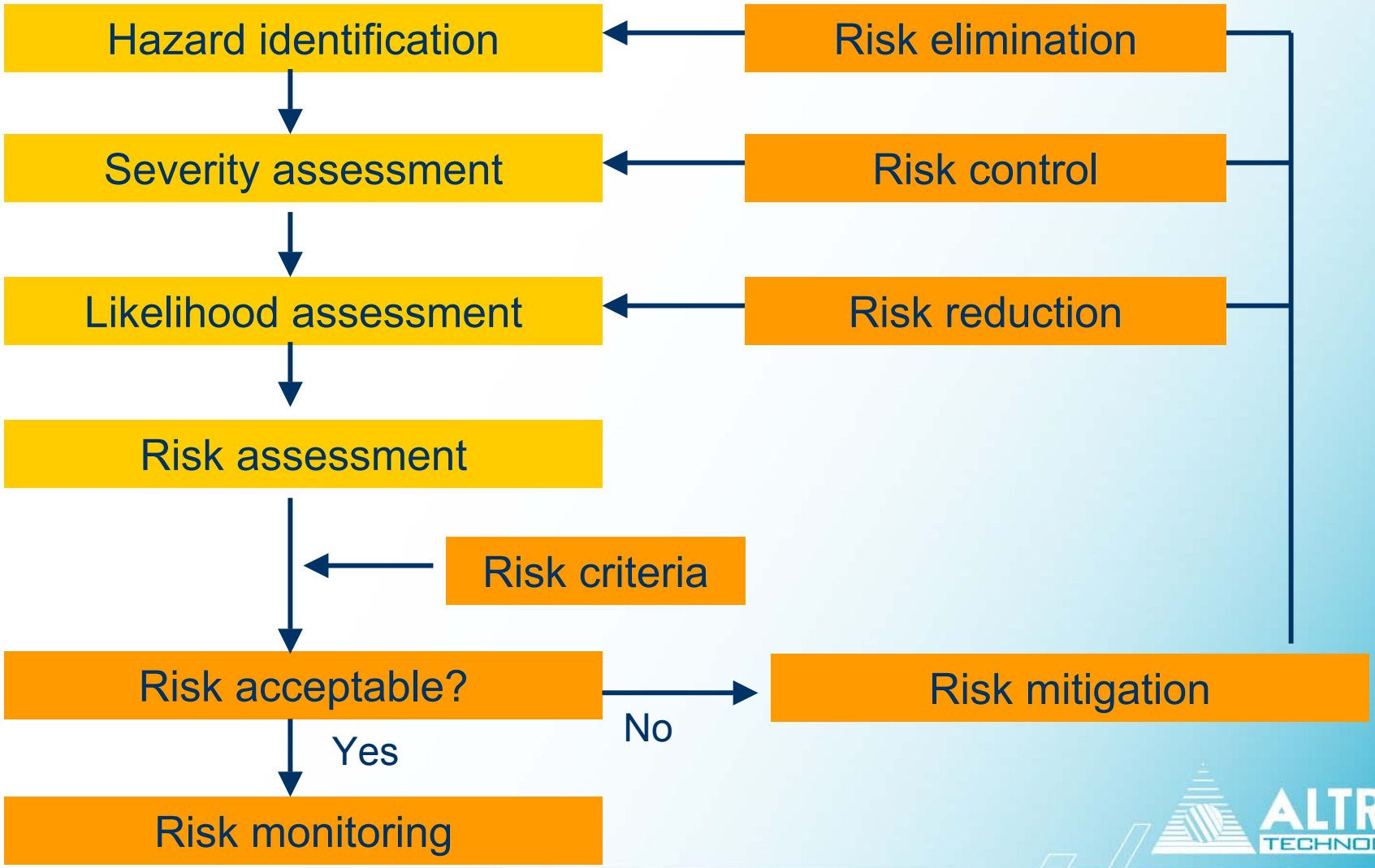
Risk mitigation

Three mitigation approaches…



… for a global and shared strategy

Overall risk management



Conclusion

- **Any questions ?**

AFI RVSM Seminar/Workshop (Nairobi 18 – 22 July 2005)

ALTRAN Technologies Presentation on Risk Assessment and Mitigation in ATM

INTERNATIONAL CIVIL AVIATION ORGANIZATION

EASTERN AND SOUTHERN AFRICAN OFFICE (ESAF)

RVSM NSP workshop
(Nairobi, 18 - 22 July 2005)

Risk assessment and mitigation in ATM

Presented by

Julien LAPIE

ALTRAN Technologies, CNS/ATM Division, Toulouse (France)

ALTRAN TECHNOLOGIES

Risk assessment in ATM

Objectives

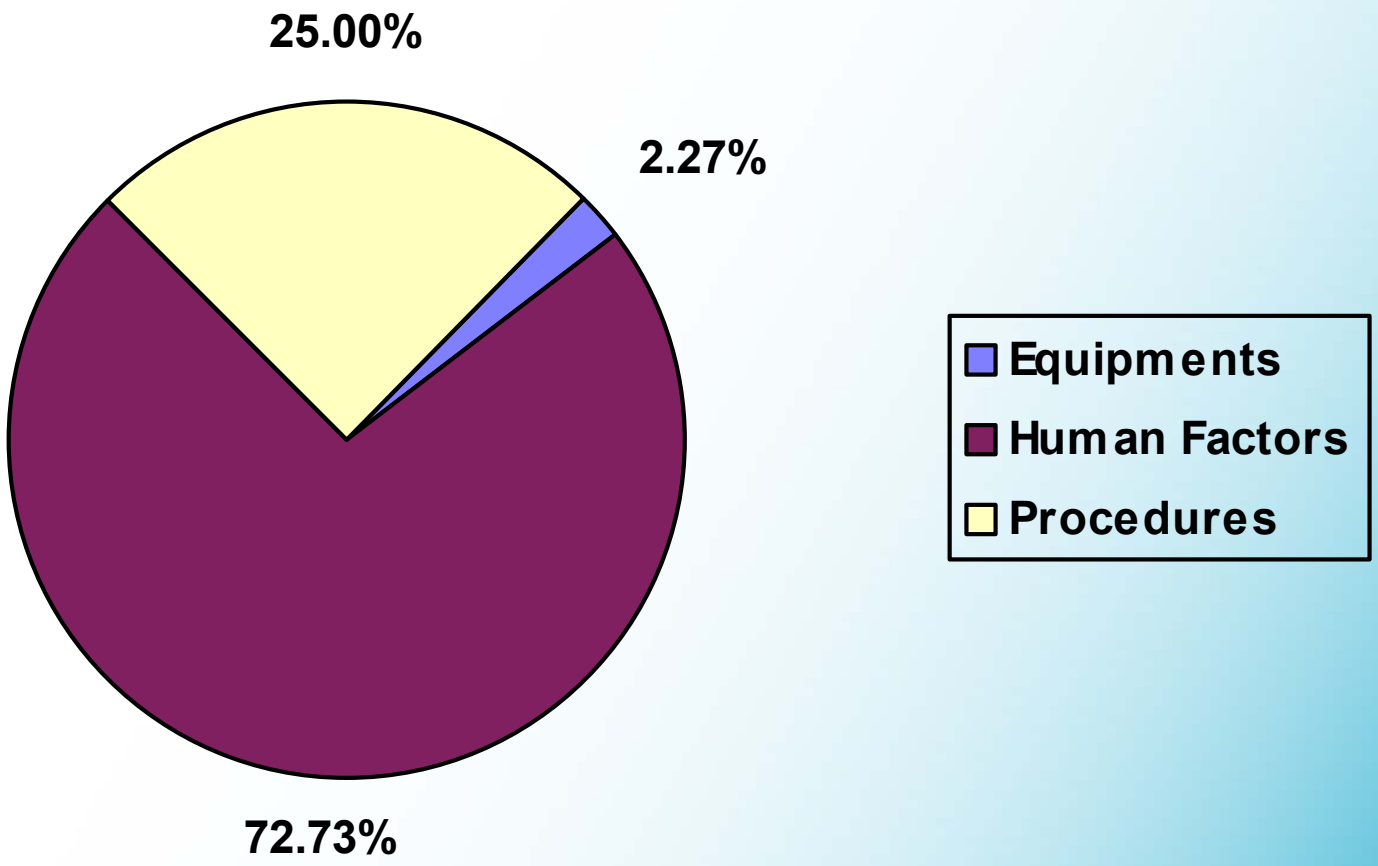
- to present the risk assessment principles in ATM
- to describe the risk and severity classification schemes

Program

- What is a risk ?
- Risk assessment
- Risk management
- Risk acceptability/tolerability
- Risk mitigation

Introduction

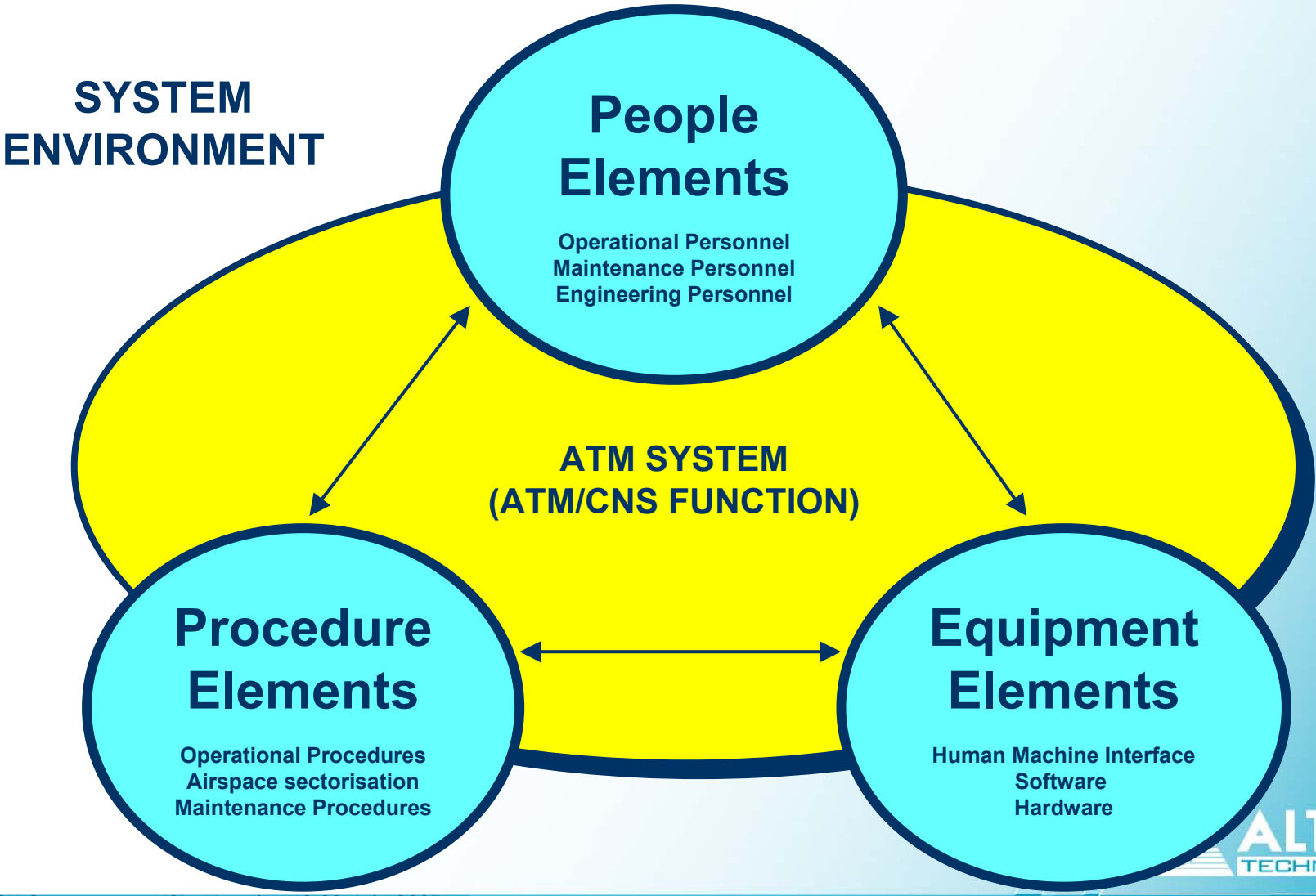
Primary causes of Airprox



Source : French CAA (DO)

Introduction

ATM System



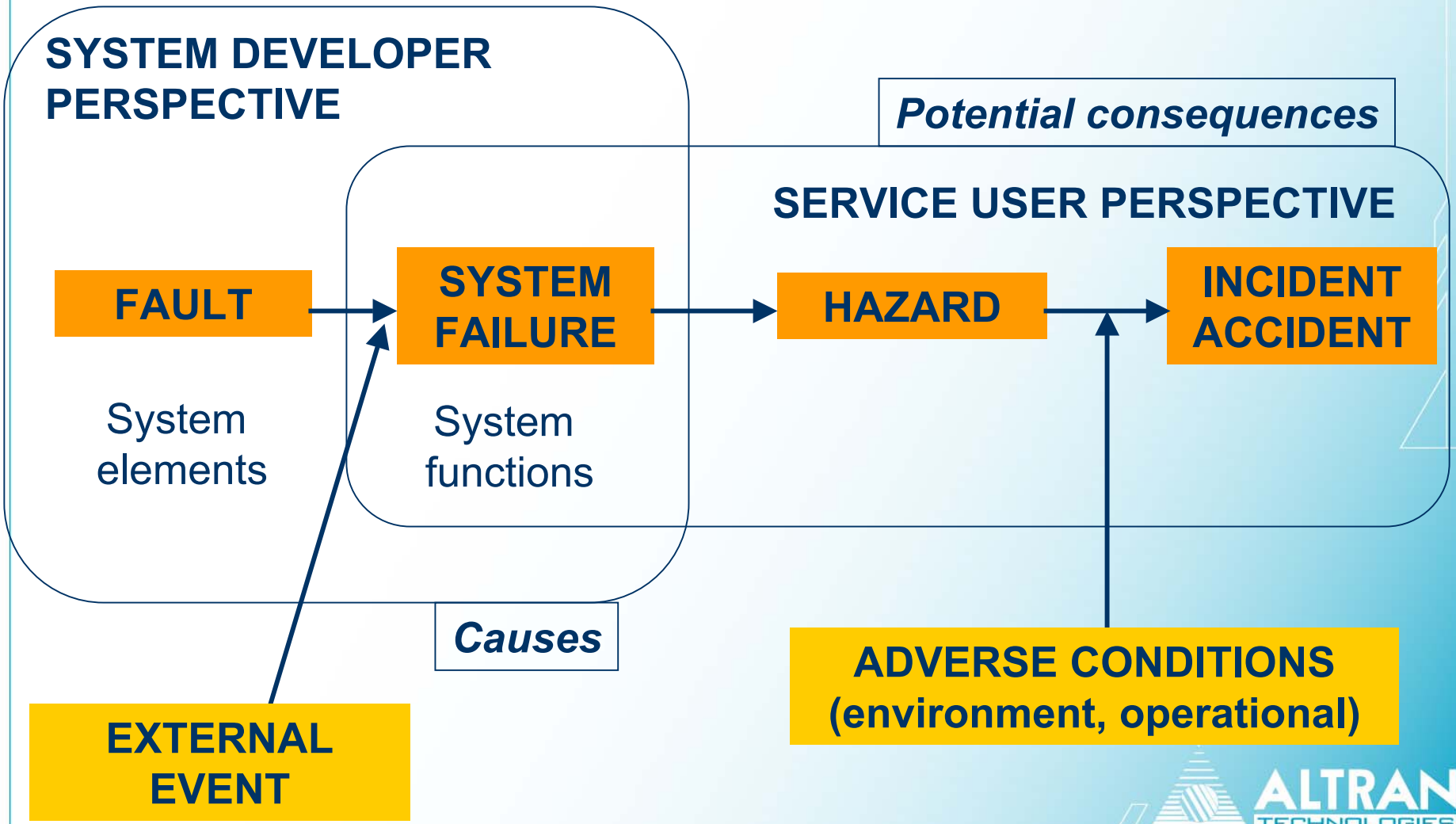
Hazard in ATM

Definitions (in the context of ATM)

- Hazard : a potential source of threat to safety, resulting in a reduction of the safety margins
- Examples :
  - Incorrect information issued by the controller
  - Radar failure
  - Height keeping system failure…
- A hazard is not an incident or accident, but a potential source (pre-requisite to the occurrence)
- A hazard could lead to an incident or accident when combined with certain adverse environmental/operational conditions
- Hazards are generated by ATM system failures (loss or degradation of an ATM/CNS function)

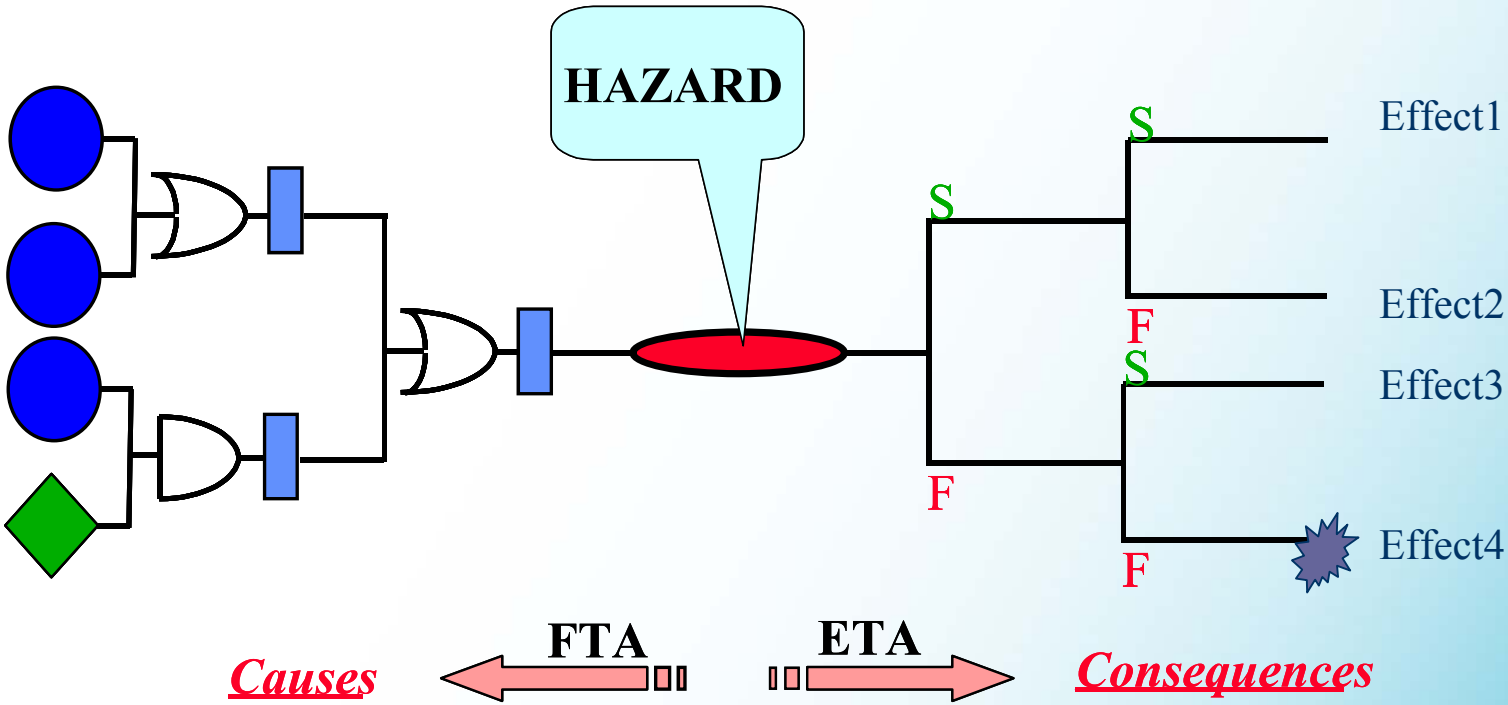
Hazard in ATM

Hazard, failure and incident…



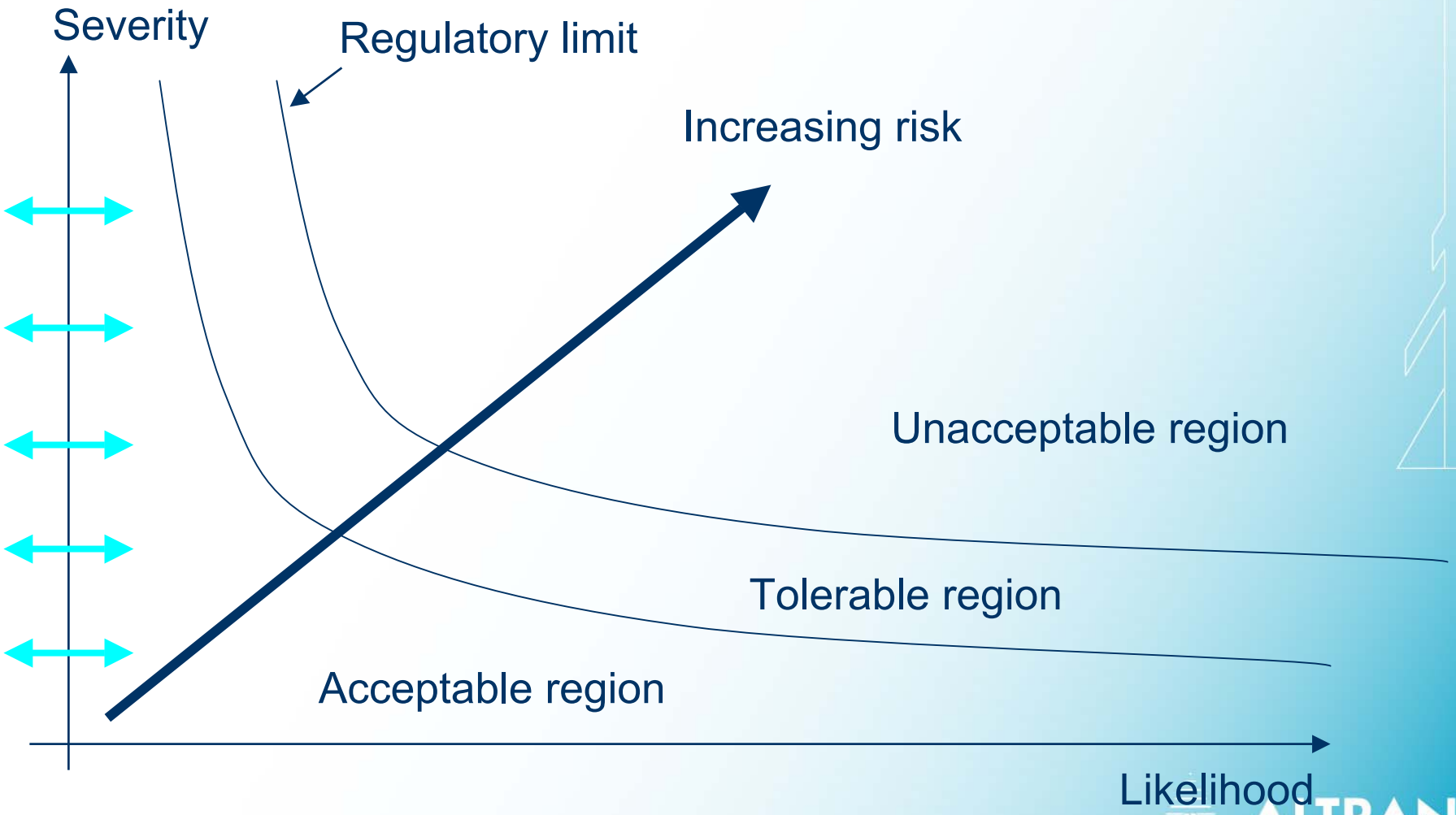
Hazard in ATM

Hazard, causes and consequences: bow-tie model



Severity in ATM

How the severity could be expressed?



Severity in ATM

Five severity classes

- Severity class : gradation of the hazard, ranking from 1 to 5

SEVERITY 1	**ACCIDENTS** Collision between aircraft or with obstacles
SEVERITY 2	**SERIOUS INCIDENTS** Critical near collision between a/c or with obstacles
SEVERITY 3	**MAJOR INCIDENTS** Near collision between a/c or with obstacles
SEVERITY 4	**SIGNIFICANT INCIDENTS** No actual risk of collision / Workload
SEVERITY 5	**NO IMMEDIATE EFFECT ON SAFETY**

INCREASING SEVERITY

Severity in ATM

Severity assessment

- The severity assessment should include the effects of the hazards on the various elements of the ATM system
  - Effect on air crew
  - Effect on the Air Traffic Controllers
  - Effect on the aircraft functional capabilities
  - Effect on the capabilities of the ground part of the ATM system
  - Effect on the provision of ATM services

High level severity criteria

- Reduction in separation
- Ability for the air crew or controllers to control/recover from an hazardous situation
- Increase of the air crew and/or controller workload

Severity in ATM

Severity classification scheme

- A qualitative ranking scheme for the severity (magnitude of the effects)
- Examples :
  - ESARR 4
  - ED-78A (datalink services safety assessment)

Practical use principles

- Severity should be assessed:
  - in the worst credible conditions : high traffic density…
  - individually (independently from the others hazards that are reasonably not expected to occur at the same time)
  - by taking account of existing mitigation factors (especially existing contingencies)

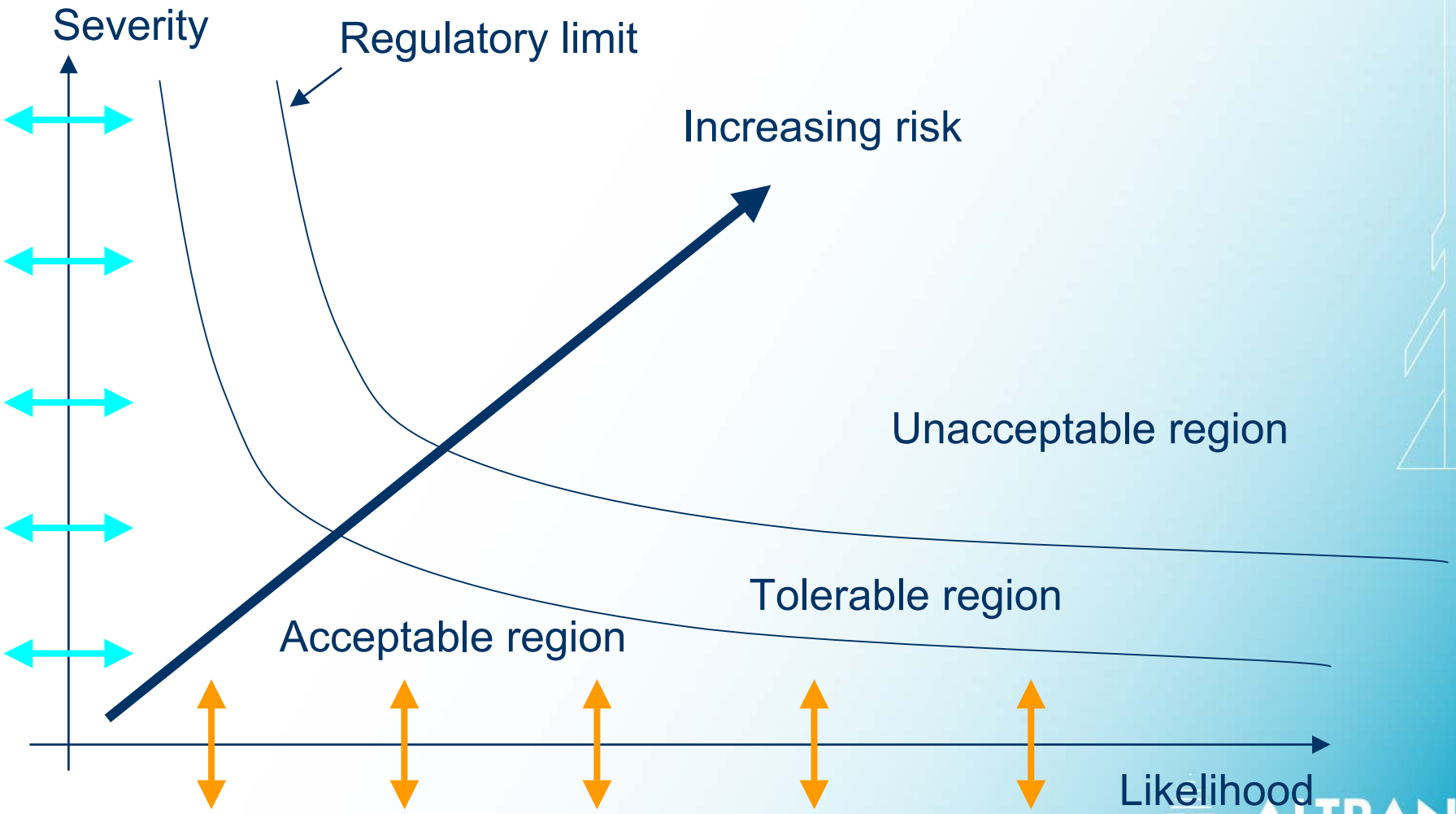
Severity in ATM

Severity classification scheme for the AFI RVSM FHA

Severity Class	1 [Most Severe]	2	3	4	5 No safety effect [Least Severe]
Effect on Operations*)	Accidents	Serious incidents	Major incidents	Significant incidents	No immediate effect on safety
Examples of effects on operations Include*):	❑ one or more catastrophic accidents, ❑ one or more mid-air collisions ❑ one or more collisions on the ground between two aircraft ❑ one or more Controlled Flight Into Terrain ❑ total loss of flight control. No independent source of recovery mechanism, such as surveillance or ATC and/or flight crew procedures can reasonably be expected to prevent the accident(s).	❑ large reduction in separation (e.g., a separation of less than half the separation minima), without crew or ATC fully controlling the situation or able to recover from the situation. ❑ one or more aircraft deviating from their intended clearance, so that abrupt manoeuvre is required to avoid collision with another aircraft or with terrain (or when an avoidance action would be appropriate).	❑ large reduction (e.g., a separation of less than half the separation minima) in separation with crew or ATC controlling the situation and able to recover from the situation. ❑ **minor** reduction (e.g., a separation of more than half the separation minima) in separation without crew or ATC fully controlling the situation, hence jeopardising the ability to recover from the situation (without the use of collision or terrain avoidance manoeuvres).	❑ increasing workload of the air traffic controller or aircraft flight crew, or slightly degrading the functional capability of the enabling CNS system. ❑ **minor** reduction (e.g., a separation of more than half the separation minima) in separation with crew or ATC controlling the situation and fully able to recover from the situation.	No hazardous condition i.e. no immediate direct or indirect impact on the operations.

Likelihood in ATM

How the likelihood could be expressed?

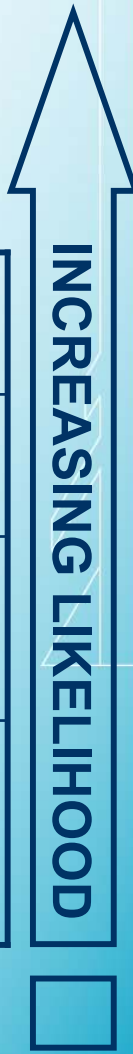


Likelihood in ATM

Four probability classes

- Probability class : gradation of the likelihood of a given hazard

PROBABLE	**LIKELY TO OCCUR SEVERAL TIMES**
REMOTE	**LIKELY TO OCCUR SOMETIMES**
EXTREMELY REMOTE	**UNLIKELY, BUT MAY OCCUR EXCEPTIONALLY**
EXTREMELY IMPROBABLE	**UNLIKELY TO OCCUR**



Likelihood in ATM

Likelihood classification for the AFI RVSM FHA

Probability Class	Per flight hour / per aircraft	AFI RVSM Airspace
Extremely improbable	$P \leq 10^{-9}$	P≤1/100 years
Extremely remote	$10^{-9} < P \leq 10^{-7}$	1/100 years < P ≤ 1/year
Remote	$10^{-7} < P \leq 10^{-5}$	1/year < P ≤ 1/day
Probable	$10^{-5} \leq P$	1/day ≤ P

Risk in ATM

What is a safe system ?

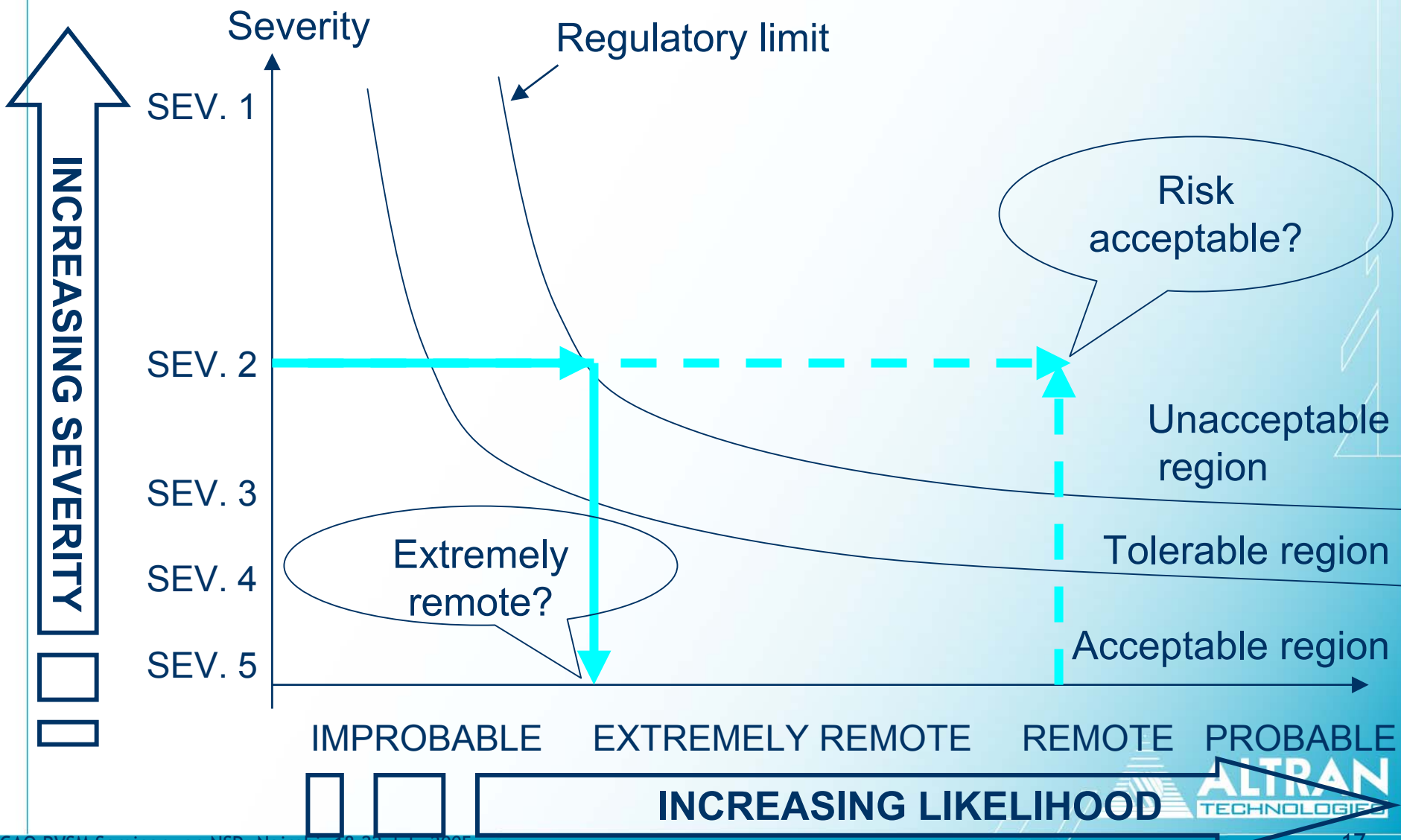
- A system is considered to be safe if :
  - All the risks have been identified and classified
  - Unacceptable risks have been mitigated to ensure tolerable risk level achievement

What is safety assessment ?

- Assessment of the risks associated with the system in order to provide evidence that the system is, or is capable of being, tolerably safe

Risk in ATM

Risk tolerability



Risk in ATM

Risk classification scheme…

- A framework providing:
  - Risk acceptance/tolerance criteria
  - Correspondence between severity and probability classes

… supporting safety objective derivation

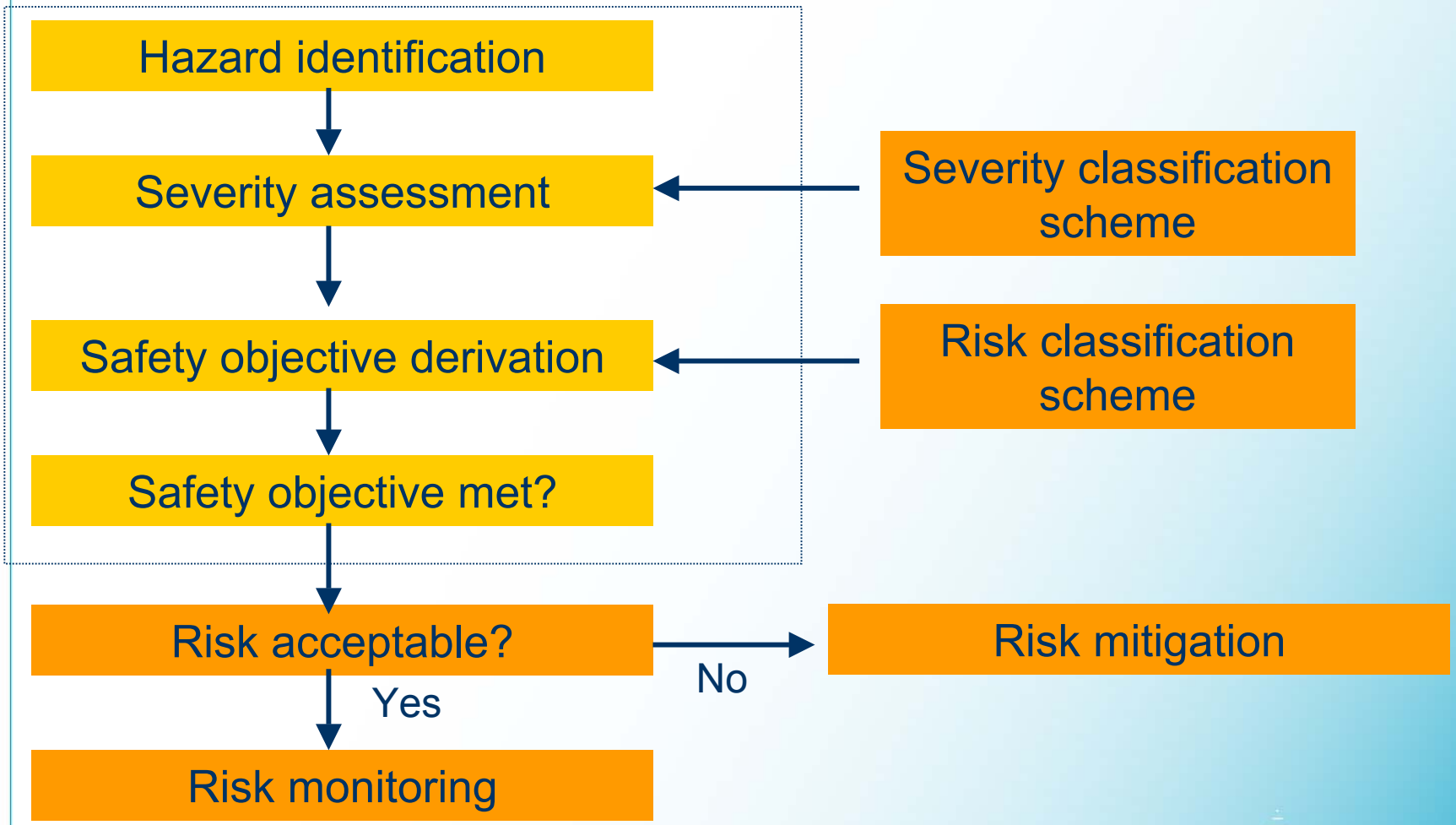
- Safety objective : a planned safety goal, a qualitative or quantitative statement that defines the maximum frequency at which a hazard can be expected to occur [ESARR 4]

Risk in ATM

Severity classification					
	1				
	2				
	3				
	4				
	5				
		Extremely improbable	Extremely remote	Remote	Probable
		Probability classification			
			Acceptable	Tolerable	Not tolerable

Conclusion

Risk assessment process in ATM



Conclusion

- **Any questions ?**

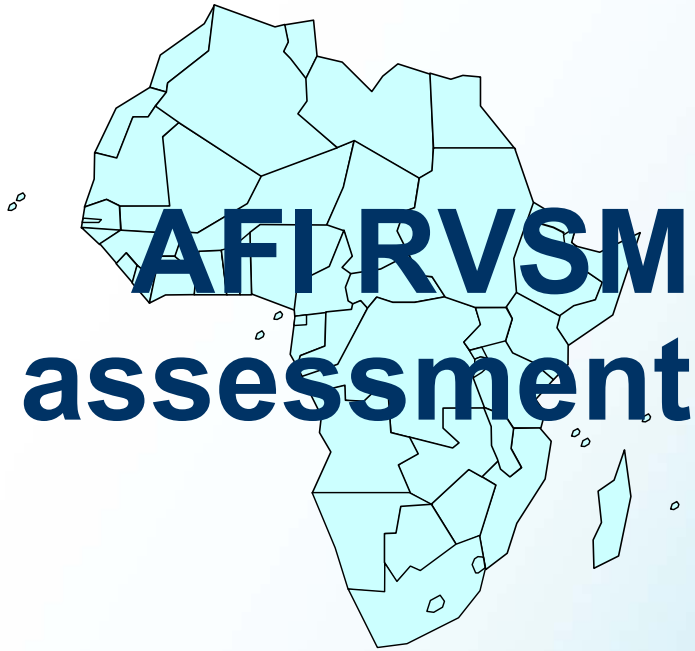
AFI RVSM Seminar/Workshop (Nairobi 18 – 22 July 2005)

ALTRAN Technologies Presentation on AFI RVSM Safety Assessment Process

INTERNATIONAL CIVIL AVIATION ORGANIZATION

EASTERN AND SOUTHERN AFRICAN OFFICE (ESAF)

RVSM NSP Workshop
(Nairobi, 18 - 22 July 2005)



AFI RVSM safety assessment process

Presented by

Julien LAPIE

ALTRAN Technologies, CNS/ATM Division, Toulouse (France)

ALTRAN TECHNOLOGIES

Introduction

Objectives

- to describe the AFI RVSM safety assessment process
- to describe the different deliverables and their roles in the AFI RVSM Programme

Contents

- Background
- AFI RVSM safety policy
- AFI RVSM safety sub-program deliverables:
  - FHA, CRA, NSP, PISC and POSC

Background

- **2001 (June): APIRG/13**
  - endorsed the objectives of capacity and potential economical benefits of the RVSM implementation
  - conclude that the implementation should be progressed as a priority item
- **2003 (September) : APIRG/14**
  - mandated the AFI RVSM TF to develop a strategic plan for implementation
- **2003 (November) : ARTF/2**
  - developed a strategic action plan composed of five sub-programs including the AFI RVSM safety sub-program
- **2004 (June) : ARTF/4**
  - developed the AFI RVSM Safety Policy

AFI RVSM safety policy

Aim

- to provide the framework to facilitate the safety regulation process of the AFI RVSM Program

Contents

- the AFI RVSM safety policy sets out:
  - the safety policy
  - the AFI RVSM Safety objectives
- it describes:
  - the tasks and actions necessary to ensure safe implementation
  - the different deliverables of the AFI RVSM safety sub-program, their roles and their interactions/links

AFI RVSM safety deliverables

Functional Hazard Assessment (FHA)

- Conducted by ALTRAN TECHNOLOGIES – CNS/ATM Division
- Adopted by the ARTF/6

Collision Risk Assessment (CRA)

- Conducted by NLR / To be completed for ARTF/7

National Safety Plans (NSP)

- To be developed by States before implementation

Pre-Implementation Safety Case (PISC)

- To be developed by ARPO before implementation

Post-Implementation Safety Case (POSC)

- To be developed by ARPO approximately one year after implementation

AFI RVSM FHA

Scope

- The whole AFI RVSM concept:
  - AFI RVSM core airspace in a mature situation
  - AFI RVSM switch-over period

Objectives

- To identify and classify the hazards and associated risks under RVSM
- To specify the FHA safety objectives to be met by the AFI RVSM System
- To develop mitigations strategies through FHA safety requirements specification

Approach and methodology

- Methodological framework : EURONCTROL SAM
- Three brainstorming sessions conducted in South Africa

AFI RVSM FHA

Results for the AFI RVSM core airspace

- Identification and classification of 28 risks
- All of them are considered as tolerable, except one 'pilot deviates from clearance' in ENV_2, provided the proposed mitigation is implemented (104 FHA safety requirements)
- 16 additional safety recommendations

Results for the AFI RVSM switch-over period

- Identification and classification of 20 risks
- All of them are considered as tolerable provided the proposed mitigation is implemented (66 FHA safety requirements)
- 3 additional safety recommendations

Results to be used as inputs to…

- the PISC (that will also propose a proper resolution of the residual risk)
- the NSP

AFI RVSM CRA

Scope

- The vertical collision risks (accidents)

Objectives

- To provide evidence that :
  - the technical vertical collision risk meets the technical TLS required by ICAO ($2{,}5.10^{-9}$ accidents per flight hour)
  - the overall vertical collision risk meets the overall TLS required by ICAO (5.10^{-9} accidents per flight hour)

Approach and methodology

- Modelling and numerical assessment based on traffic data provided by States

Results to be used as inputs to…

- the PISC

AFI RVSM PISC

Objective

- To demonstrate by means of argument and evidence that the risks under RVSM are tolerable
- It will trigger the RVSM implementation from a safety point of view

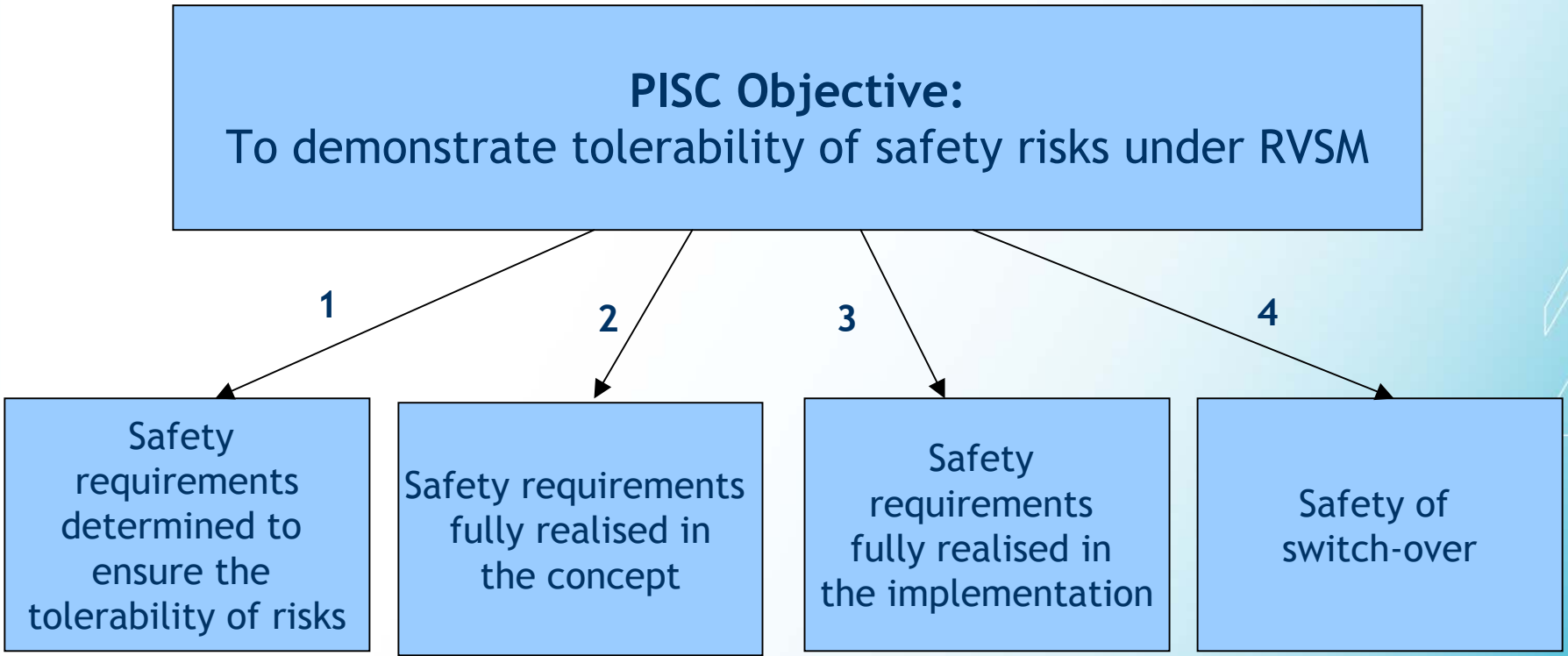
Approach

- An overall argumentation will be developed to demonstrate PISC objective
- It will be based on 4 main high-level arguments:
  - That the RVSM safety requirements are complete and correct
  - That the RVSM safety requirements are fully realised by the concept
  - That the RVSM safety requirements are fully realised by the implementation
  - That the switch-over period will not endanger the safety of operations

AFI RVSM PISC

PISC structure

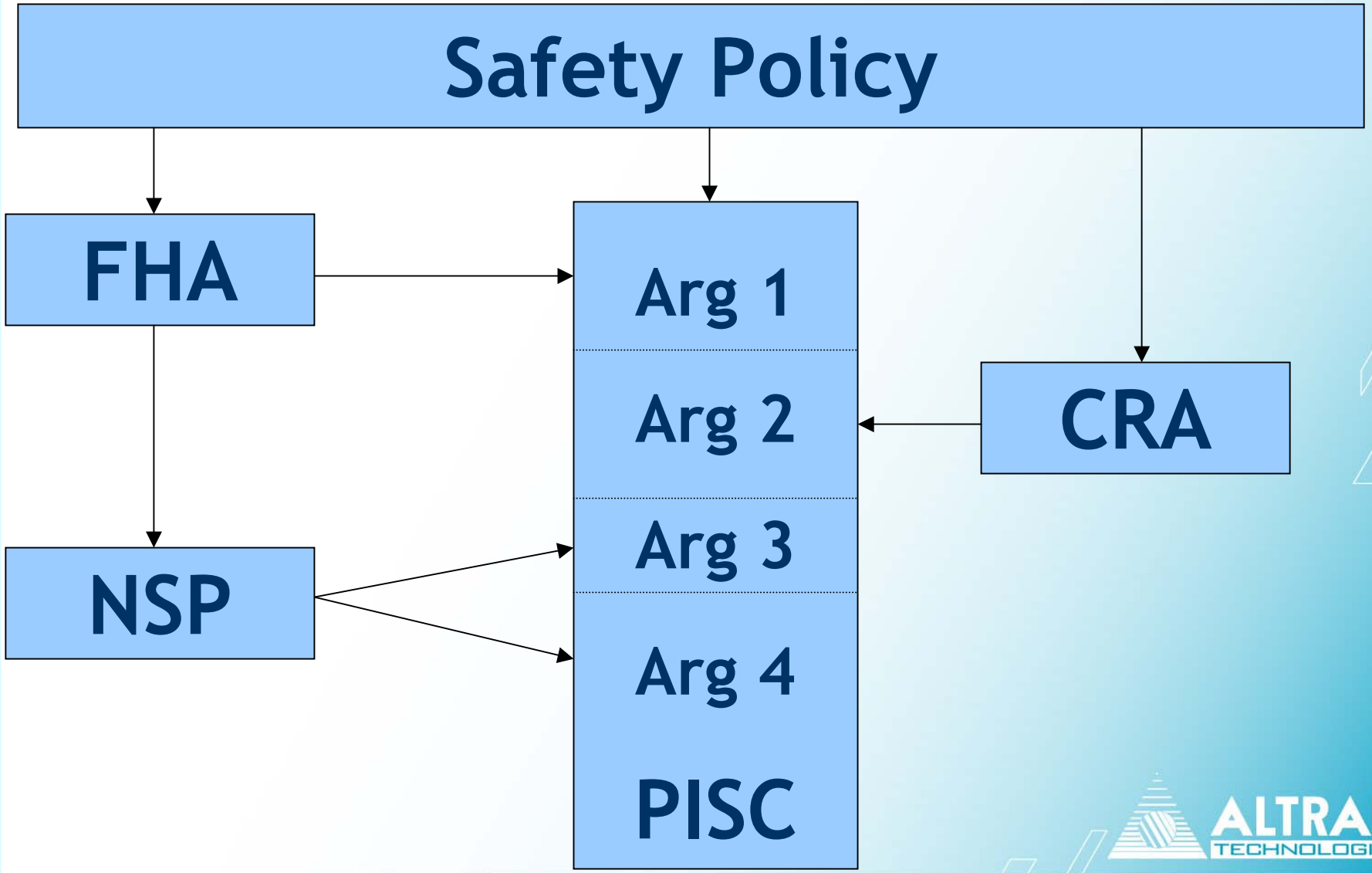
1 objective -> 4 high-level arguments



For each argument :

- Provision of evidence of the validation of argument
- Provision of trustworthy in that evidence

AFI RVSM safety deliverables



Conclusion

- **Any questions ?**

AFI RVSM Seminar/Workshop (Nairobi 18 – 22 July 2005)

ALTRAN Technologies Presentation on AFI RVSM Safety Assessment Process

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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RVSM NSP Workshop
(Nairobi, 18 - 22 July 2005)

AFI RVSM
National Safety Plans : Objectives and structure

Presented by

Julien LAPIE

ALTRAN Technologies, CNS/ATM Division, Toulouse (France)

ALTRAN TECHNOLOGIES

Introduction

Objectives

- to describe the objectives of the NSP and their implication within the PISC development process
- to describe the structure of the NSP

Contents

- PISC Background
- Responsibilities
- NSP generation process
- NSP template: objectives and structure
- Validation of NSP
- State safety readiness assessment

PISC Background

PISC Argument 3

- that « the SER are fully realised by the Implementation »
- it includes the report of the necessary evidence of States safety preparedness

States safety preparedness

- Sub-argument of Argument 3
- It includes:
  - a- « Each has produced details safety plans the safety policy to satisfy the requirements »
  - b - « Each States will certify compliance with its safety plan »
- The last point addresses the formal confirmation from the Director General of the national CAAs of the readiness of the State to safely implement RVSM

Responsibilities

… of the States

- States are ultimately responsible for the implementation of RVSM
- To this end, States will prepare NSP that will show in detail:
  - the respective State responsibility is discharged
  - what activities it is undertaking to ensure safe implementation
  - what activities are required to support the RVSM safety case (PISC)

… of the ARPO

- The ARPO has four roles to play with regards to the implementation:
  - To develop the RVSM concept
  - To provide guidance, coordination and support to States
  - To develop the PISC
  - To provide independent verification and validation of the implementation (including NSP)

Generation of NSP

NSP Generation process

Step 1 : Development of guidance material to support the States (NSP template)	ARPO (June 2004)
Step 2 : Preparation by each State of its NSP (including the review of the AFI RVSM FHA)	State (30th July)
Step 3 : Provision by the ARPO (validation panel) of feedback to each States (comments)	ARPO (23rd Sept)
Step 4 : Provision by each State of an updated version of the NSP when appropriate	State (30th Sept)
Step 5 : Approval of the NSP by the appropriate State Authorities	State (30th Sept)
Step 6 : Confirmation from DGCA of the State readiness	State (before TF/8)

NSP guidance framework

- The guidance is an example of NSP developed by the ARTF

NSP template framework

- It was developed within the following framework:
  - That States are sovereign and ultimately responsible for RVSM implementation
  - That States within the RVSM Programme have agreed to provide evidence of their safety preparedness with respect to RVSM implementation
  - That States meet those established obligations within ICAO, namely:
    - That the State has aircraft airworthiness and operator approval processes
    - That the State is responsible for the provision of an appropriate ATS

NSP guidance framework

Evidence asked

- The NSP guidance asks for evidence for each aspect (ATS provision and a/c airworthiness and operator approval):
  - That an appropriate ATS is provided (the evidence is that changes required for RVSM have been identified and implemented)
  - That the changes to the ATS have been approved by appropriate authorities within the State
  - That there are appropriate quality checks that the changes have been properly and effectively implemented
  - That safety risks associated with the State implementation of RVSM have been identified and mitigated

NSP guidance framework

NSP Structure

- Section 2: Aircraft and Operator Approvals for RVSM
- Section 3: ATS Training,
- Section 4: Changes to ATS Equipment,
- Section 5: Changes to ATS Procedures,
- Section 6: Airspace Design Changes,
- Section 7: RVSM Switchover,
- Section 8: Operational Monitoring of RVSM.

Validation of NSP

Review purpose

- To establish compliance with the Guidance
- It is not intended to form an approval process c

Review criteria

- Criteria used by EUROCONTROL for European implementation:
  - Conformance of NSP with supplied guidance material
  - Inclusion in NSP of the national risk factors (hazard log matrix)
  - Continuous development of NSP to complete and report on activities undertaken

State safety preparedness

Preparedness assessment matrix

State	Safety plan developed for PISC	State hazard log included in safety plan	Safety plan approved	Good conformance with guidance material	DG CA confirmation letter received

Conclusion

- **Any questions ?**

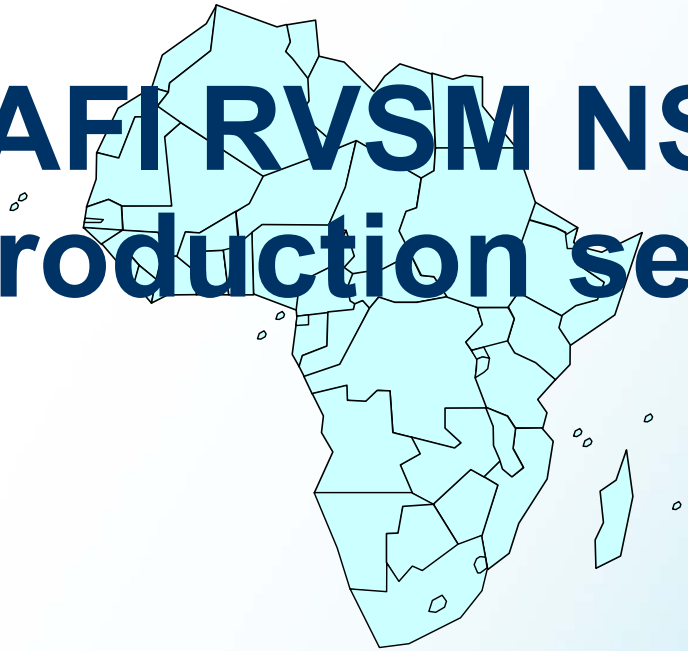
AFI RVSM Seminar/Workshop (Nairobi 18 – 22 July 2005)

ALTRAN Technologies Presentation on AFI RVSM NSP: How FHA Results are to be worked

INTERNATIONAL CIVIL AVIATION ORGANIZATION

EASTERN AND SOUTHERN AFRICAN OFFICE (ESAF)

RVSM NSP Workshop
(Nairobi, 18 - 22 July 2005)



AFI RVSM NSP: Introduction section

Presented by

Julien LAPIE

ALTRAN Technologies, CNS/ATM Division, Toulouse (France)

ALTRAN TECHNOLOGIES

Introduction

Objectives

- to describe how the FHA results are used within the NSP

Contents

- How FHA results are presented
- Links between the FHA and NSP
- How the FHA results should be reviewed and incorporated in the NSP

Objective of Safety Plan

Section 1.1

How FHA results are presented

Hazards / risks and proposed mitigation

Hazard description	Env. Type	Sev	Safety objective Criticity	After mitigation	Risk elimination (hazard)	Risk reduction (causes)	Risk control (effects)
AH $_{core}$_1 Height keeping system failure	**ENV_1** **ENV_2** **ENV_3** **ENV_4**	**2** **2** **2** **2**	Objective: Extremely remote Non Safety Critical	-- --	**Elimination** not possible	**Causes:** Technical failure **Reduction factors:** Limited by a/c certification approval and operator maintenance capabilities **Safety requirement:** **Req $_{Core}$_1** The aircraft shall meet MASPS requirements	**Effects:** Loss of vertical separation (due to vertical deviation) limited by the application of the appropriate contingency **Control factors:** - Contingency application - ATC and flight crew training (contingency) **Safety Requirements :** **Req $_{Core}$_2** Contingency Procedures shall be defined to provide 2000 feet separation for non RVSM civil aircraft **Req $_{Core}$_3** Contingency Procedures shall be defined to execute lateral/level deviation from RVSM level **Req $_{Core}$_4** Contingency Procedures shall be defined to exit non RVSM civil aircraft from RVSM Airspace **Req $_{Core}$_5** Controllers shall be trained appropriately with regards to contingency procedures in case of MASPS requirements failure **Req $_{Core}$_6** Flight crew shall be trained appropriately with regards to contingency procedures (RVSM status degradation)

How FHA results are presented

Hazards / risks and allocation of requirements

		Procedures	Training	Equipment
Req Core_5 Controllers shall be trained appropriately with regards to contingency procedures in case of MASPS requirements failure AH Core 1, AH Core 2, AH Core 3, AH Core 4	AIR			
	ENV 1		☺	
	ENV 2		☺	
	ENV 3		☺	
	ENV 4		☺	

Links between FHA and NSP

Risk management within NSP

- The NSP guidance asks for evidence that safety risks associated with the State implementation of RVSM have been identified and mitigated
- For this purpose, each section of the NSP contains a « risk management » paragraph
- These paragraphs ask for evidence of the activities:
  - undertaken for mitigating the identified risks
  - related with the system element considered (ATS training,…)
- These paragraphs should not contain the risks associated with the element but the mitigation activities related to the element
- The rationale is that a risk is not specifically related to an element but to operational issues. Risk Management deals with mitigation activities which are related to an element of the RVSM system

Links between FHA and NSP

Risk management within NSP

- The NSP should contain :
  - A hazard log matrix to be included in Appendix as it de-correlated from the system elements
  - The list of the mitigation activities for each element of the system in the appropriate paragraph

Working with FHA results

A step by step approach

- Step 1 : to develop the hazard log matrix applicable to your airspace
- Step 2 : to assess these risks (severity) and to specify the safety objectives
- Step 3 : to develop the mitigation strategy to ensure risk tolerability
- Step 4 : to allocate the requirements to the system elements and to identify the activities to ensure their realisation

Inputs needed

- the FHA results
- the AFI RVSM Severity Classification Scheme
- the AFI RVSM Risk Classification Scheme

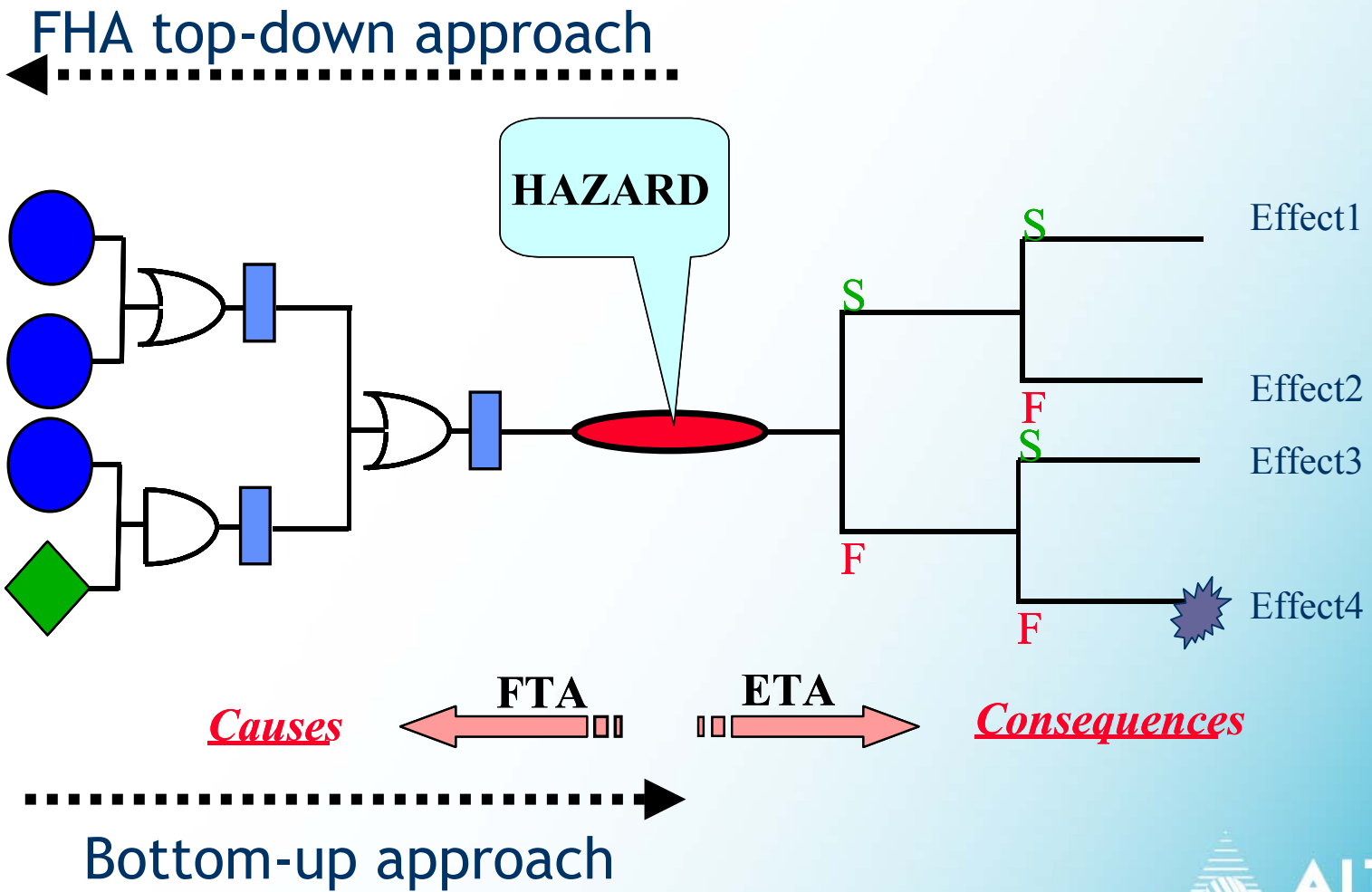
Working with FHA results

Step 1 : Hazard log matrix

- To review the hazard identified in the FHA and to assess their relevance within your national airspace
- To identify additional hazard that could not be covered by the FHA:
  - Methodology (bottom-up approach) :
    - to identify the potential failures of your elements (mainly the ATC equipment element)
    - to identify the operational effects & the operational risks associated

Working with FHA results

Step 1 : Hazard log matrix



Working with FHA results

Step 1 : Hazard log matrix

- Expected results to be included in a NSP appendix:
  - Hazards applicable to your national airspace

Hazard Id	Hazard description
FHA hazards relevant in your airpsace…	
Additional hazards…	

  - FHA Hazards judged as not relevant for your airspace

Hazard Id	Rationale for exclusion
…	

Working with FHA results

Step 2 : Hazards severity and of safety objectives

- For the FHA hazards : to review the severity class and to adapt it to your environmental conditions
- For the additional hazards : to assess the severity
- Consequently, to review or to specify the safety objectives

Step 3 : Risk mitigation

- For the FHA hazards : to review the mitigation factors and to adapt them to your local RVSM system
- For the additional hazards : to identify the mitigation factors and to derive from the mitigation activities to be undertaken

Working of FHA results

Step 4 : Allocation of the mitigation activities

- Consequently, to allocate the mitigation activities to your RVSM system elements
- Expected results to be included in appendix:

Hazard Id	Hazard description	Mitigation in place/required
FHA hazards relevant in your airspace…		Changed or FHA-proposed mitigation
Additional hazards…		

- Expected results to be included in the appropriate risk management paragraph

Mitigation	Actions / Activities	Hazard Id
Mitigation allocated to the system element	Activities undertaken to ensure realisation of the mitigation	

Conclusion

- **Any questions ?**