Exploiting the full potential of TCAS II

Capt. Pascal Kremer

ERA / Luxair

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Content of this briefing

- Objective and scope of the study
- Stakeholders
- TCAS reports
- Hot spots
- Findings and recommendations
- Actions taken
- Way forward

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Objective

- Identify stakeholders
- Make a global analysis of TCAS taking into account all airspace users
- Identify weak points in:
  - Regulations
  - Training
  - Equipment
  - Procedures
  - Airspace design

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Objective

- Develop recommendations to adress identified issues
- Develop guidelines for the implementation of the recommendations

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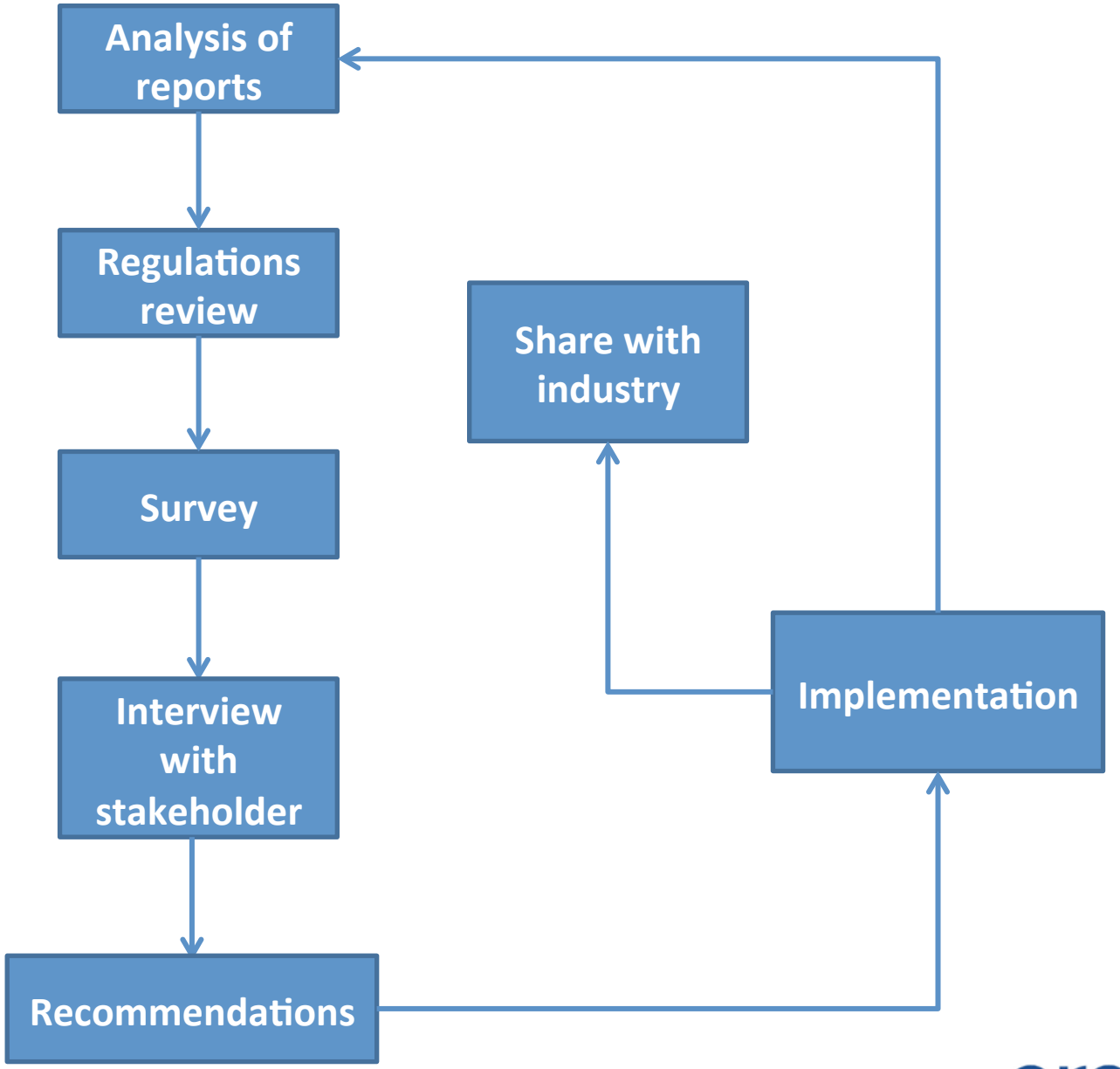
Scope



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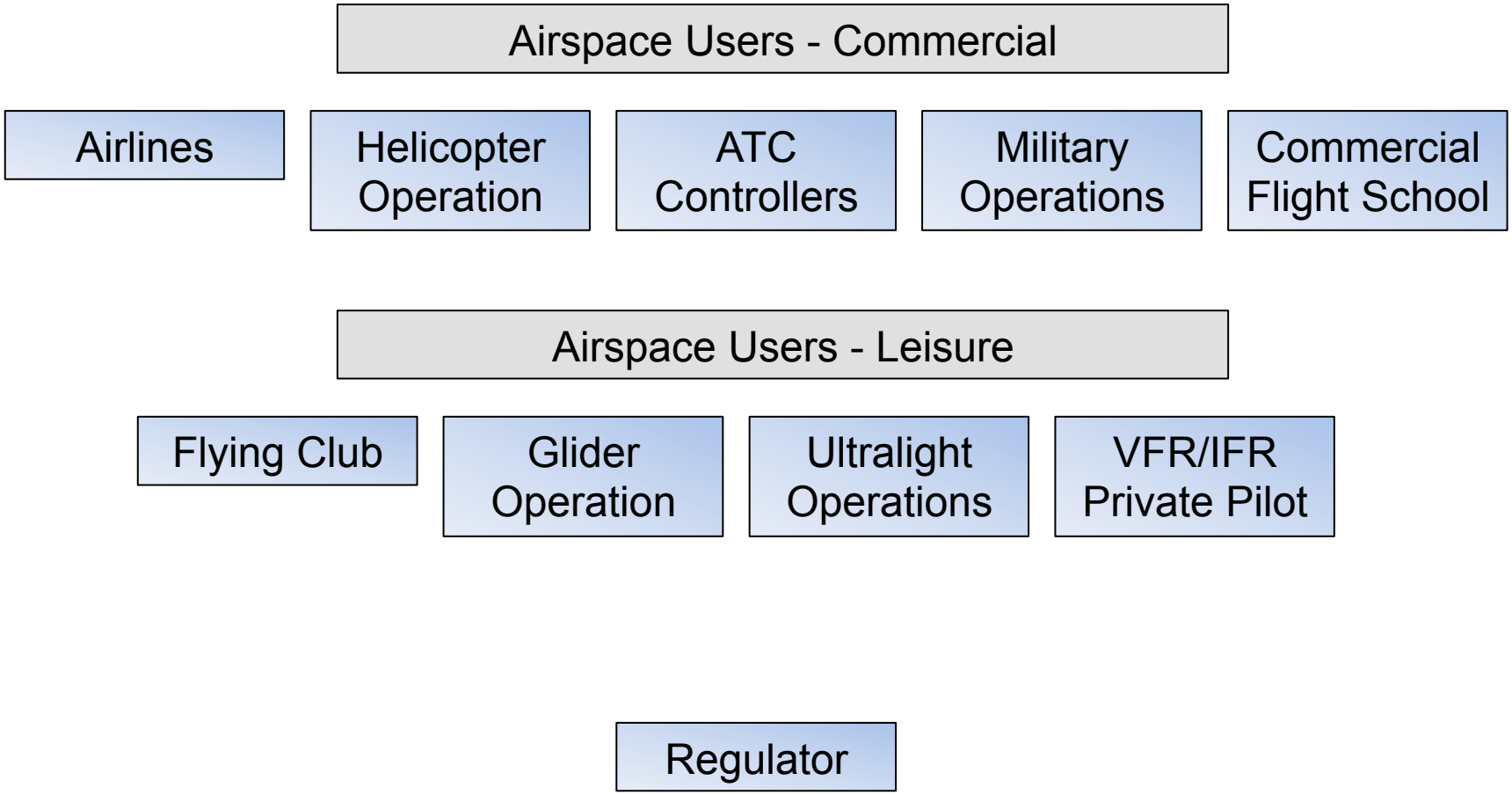
Stakeholders



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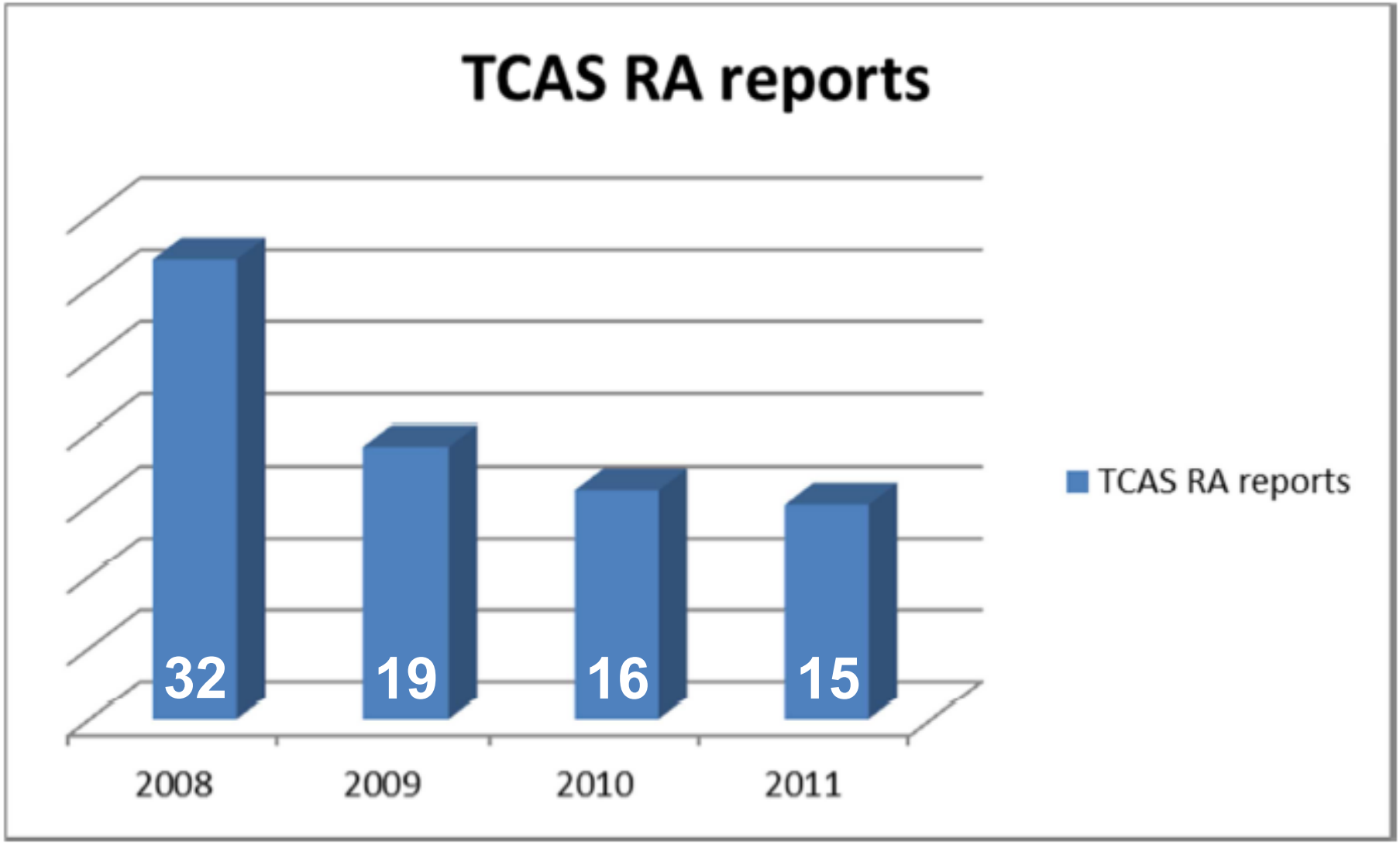

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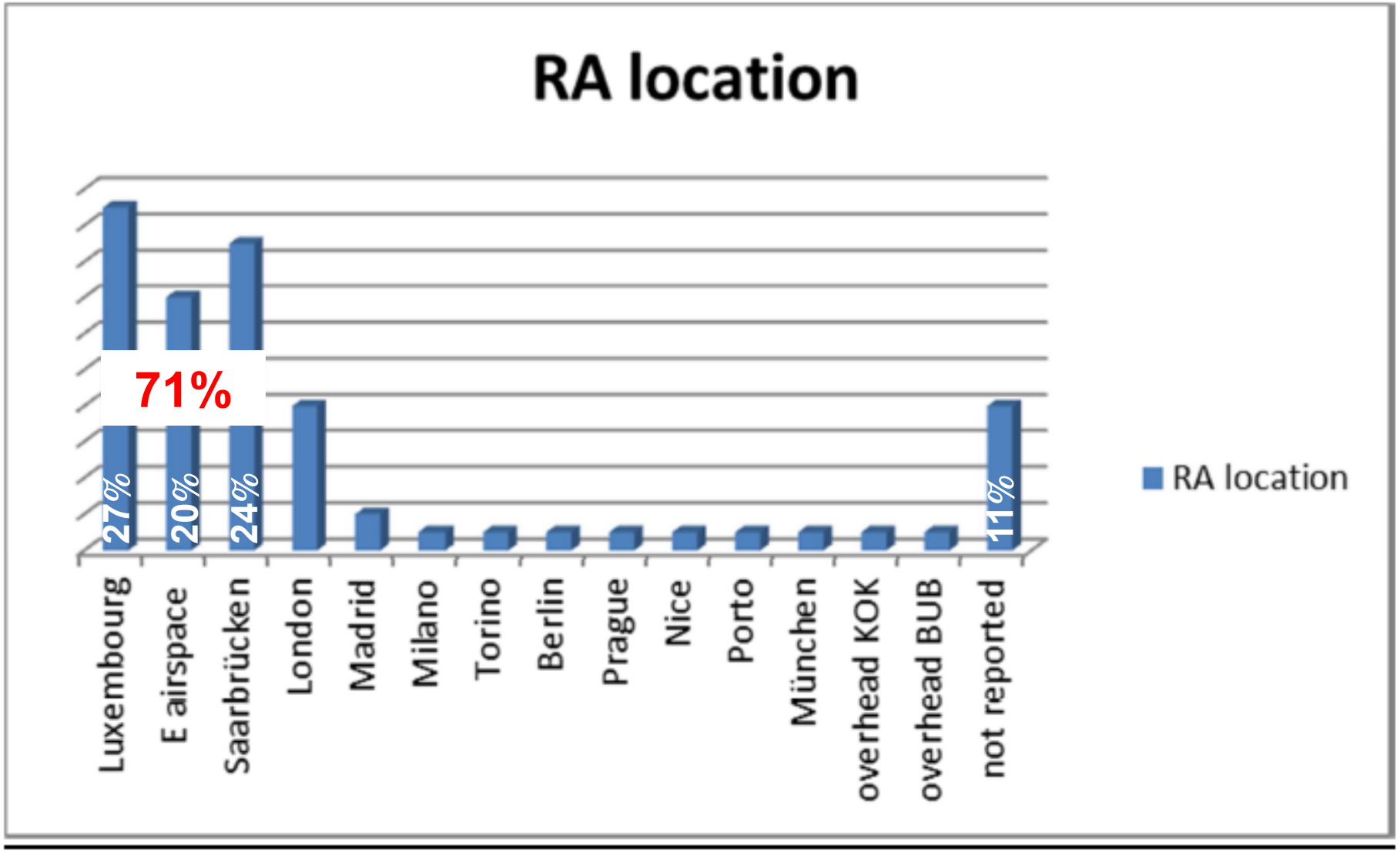

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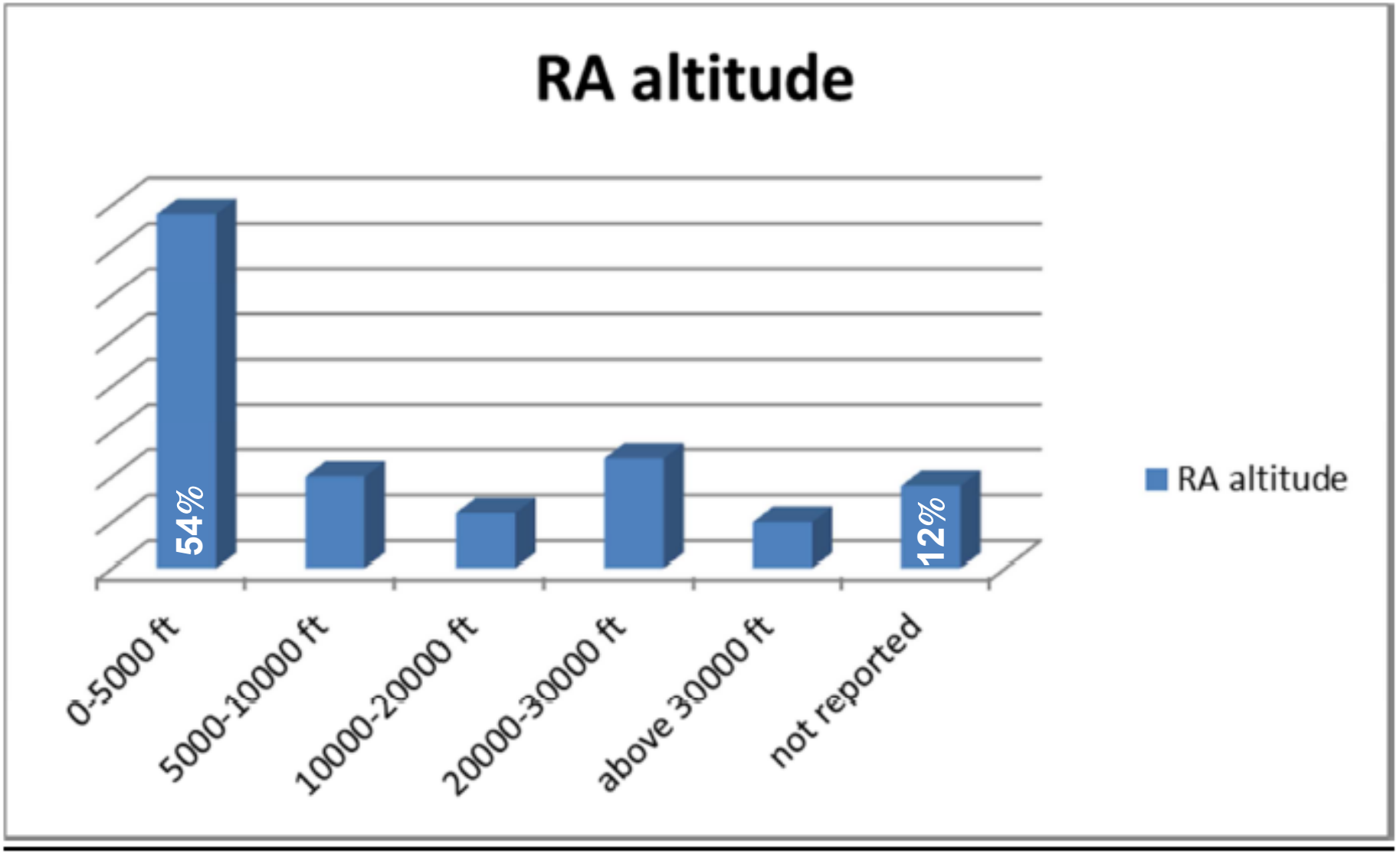

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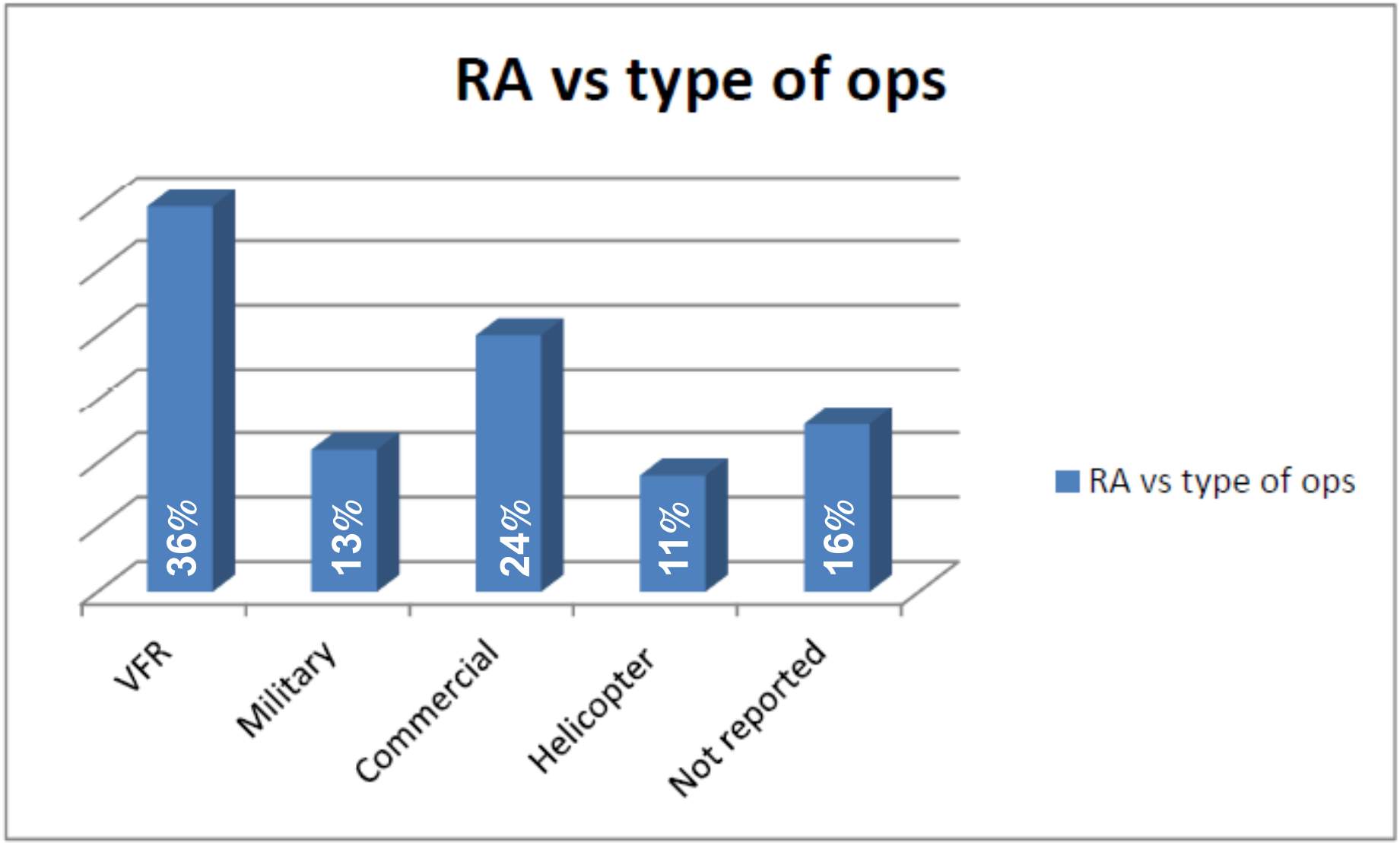

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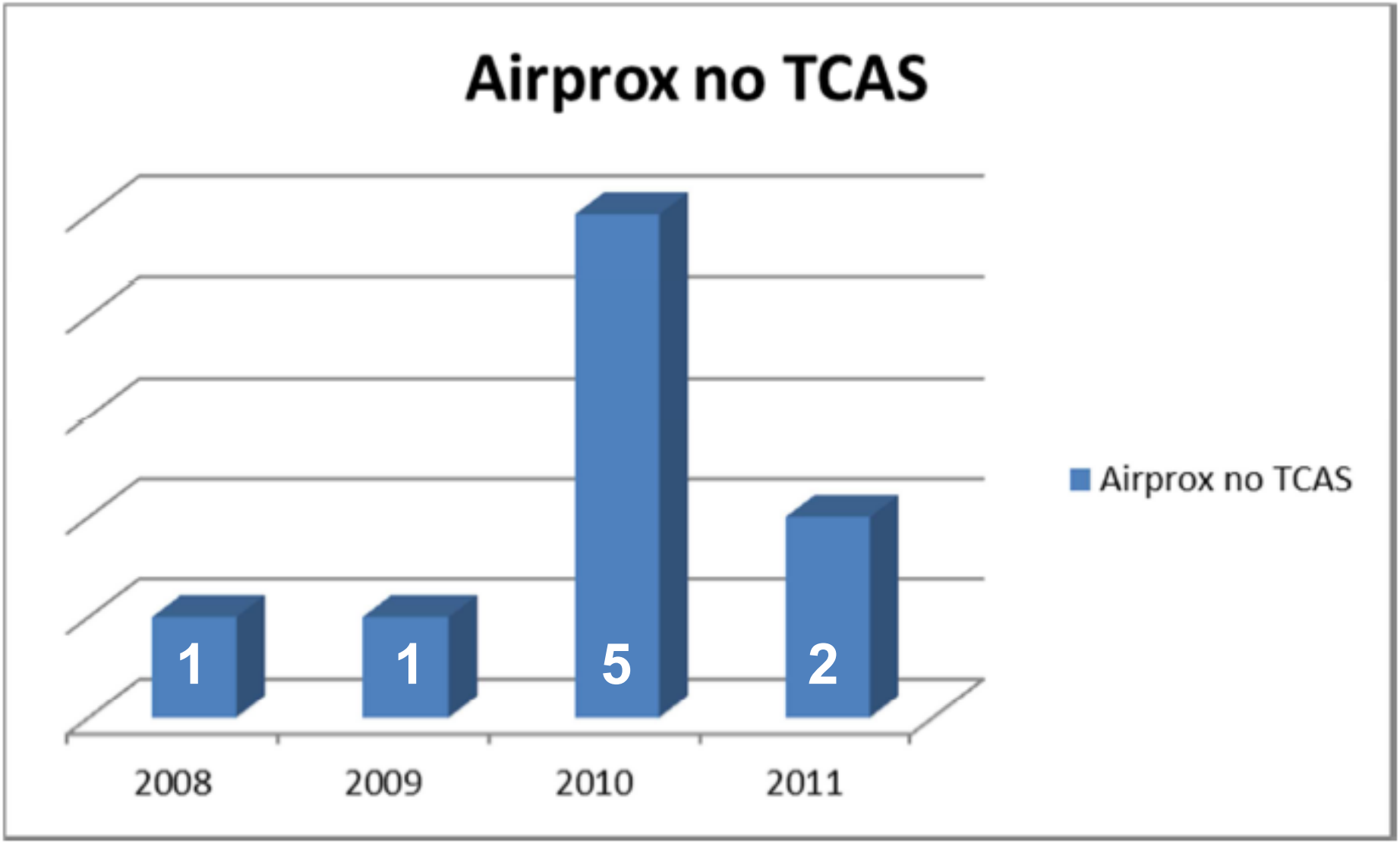

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General

Finding(s)

- There is no global analysis of TCAS issues, hot spots in Luxembourg
- TCAS data is not shared among the different airspace users
- Lessons learned after real encounters and briefings after major incidents do not reach all airspace users
- No joint training has been done between different airspace user groups

Recommendation(s)

- Share safety data and lessons learned

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Equipment

Finding(s)

- There is no compatibility between the different airborne collision avoidance systems

Recommendation(s)

- Improve / develop the compatibility between the different airborne collision avoidance systems

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Equipment

Finding(s)

- Many airspace users do not know the limits of their collision avoidance system

Recommendation(s)

- If compatibility of the different collision avoidance systems cannot be guaranteed, make sure that the equipment users are aware of the limits of their equipment

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Airspace

Finding(s)

- Aircraft flying the VFR pattern and holding at the end of downwind are triggering TCAS RAs against aircraft on final approach
- Many airspace users have a lack of knowledge on how TCAS works and how they can help to avoid triggering TCAS RAs

Recommendation(s)

- Design VFR holding patterns so that interference with traffic on final approach is not possible

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Airspace

Finding(s)

- Aircraft flying on the ‘edge’ of uncontrolled airspace trigger TCAS RAs against aircraft flying in controlled airspace
- Many airspace users have a lack of knowledge on how TCAS works and how they can help to avoid triggering TCAS RAs

Recommendation(s)

- Separate controlled from ‘un-controlled’ airspace by at least 1000 feet.

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Airspace

Finding(s)

- The airspace structure in and around Luxembourg is contributing to the frequency of TCAS RAs
- Most of the high risk incidents were against aircraft which did not operate a transponder
- Many airspace users have a lack of knowledge on how TCAS works and how they can help to avoid triggering TCAS RAs

Recommendation(s)

- Adapt the airspace structure around the airport so that incoming traffic is protected from other traffic

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Training

Finding(s)

- There is confusion about which RAs to report to the controllers on the frequency
- Lessons learned after real encounters and briefings after major incidents are not included into formal training
- Many airspace users do not know the limits of their collision avoidance system
- Procedures are not always being followed (e.g. traffic in sight, use of correct phraseology)

Recommendation(s)

- Review / enhance TCAS training for pilots

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Training

Finding(s)

- There is a lack of TCAS initial and recurrent training which translates into a lack of knowledge
- Lessons learned after real encounters and briefings after major incidents are not included into formal training
- There is not enough practical training (e.g. simulator sessions of real encounters)

Recommendation(s)

- Review / enhance TCAS training for controllers

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Training

Finding(s)

- Many airspace users have a lack of knowledge on how TCAS works and how they can help to avoid triggering TCAS RAs

Recommendation(s)

- Train all airspace users who are not legally required to receive TCAS training on the basics of TCAS
- Produce an information brochure for all airspace users

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Actions taken

- Training of all airspace users

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Business case

CASE 1:

Initial Investment (year 1):

Training development 1250 Euros + Training materials 750 Euros = Total 2000 Euros

Subsequent inv

Training develc

New additiona

Delivering the

Reducing existi

Year 1: 1 go-ar

Year 2: 1 go-ar

Year 3: 1 go-ar

Year 4: 1 go-ar

Year 5: 1 go-ar

Year 6: 1 go-ar

Year	1	2	3	4	5	6
Investment	2.000	0	1.000	0	0	1.000
Charges						
New additional costs	800	800	800	800	800	800
Reduced existing income						
Total costs	**2.800**	**800**	**1.800**	**800**	**800**	**1.800**
New revenues						
Reduced existing costs						
Total income						
Cash flow						

Pay back period:	
Net present value:	
ROI:	

Year	1	2	3	4	5	6
Investment	2.000	0	1.000	0	0	1.000
Charges						
New additional costs	800	800	800	800	800	800
Reduced existing income						
Total costs	**2.800**	**800**	**1.800**	**800**	**800**	**1.800**
New revenues						
Reduced existing costs	4.500	4.500	4.500	4.500	4.500	4.500
Total income	**4.500**	**4.500**	**4.500**	**4.500**	**4.500**	**4.500**
Cash flow	**1.700**	**3.700**	**2.700**	**3.700**	**3.700**	**2.700**

Pay back period:	**<1**	year(s)
Net present value:	**18.200**	EUR
ROI:	**206,8**	%

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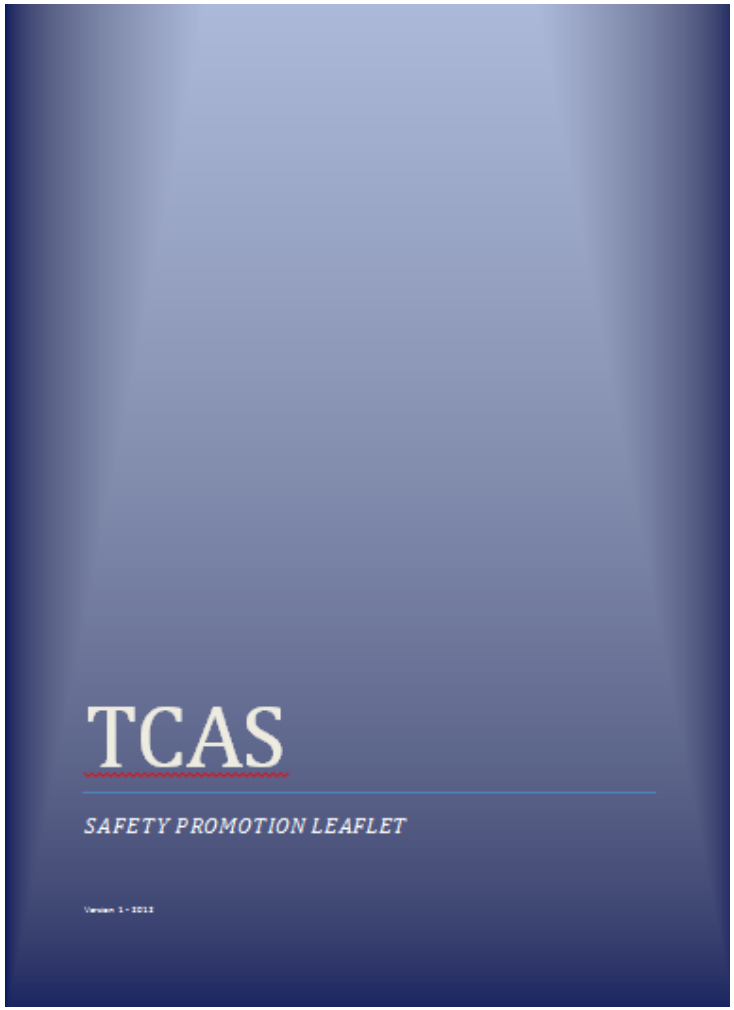
Actions taken

- TCAS safety promotion leaflet produced and distributed



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Actions taken

- TMZ east of Luxembourg

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Actions taken

- Mid Air Collision Avoidance meetings with US airforce

52ND FIGHTER WING

SEEK ATTACK DESTROY

Mid-Air Collision and Avoidance

MACA Pamphlet

Contents

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Actions taken

- Meetings with German flight clubs and pilot organizations
- Good cooperation with German Marpingen glider center
- Exchange of information on glider competitions, commercial airlines flight schedules, special events

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Actions taken

LUXAIR MEMO

Doc Nr:	OX-M-170	**Date:**	12 May 2011
From:	OX Capt. Pascal Kremer	**Department:**	Safety Department
To:	All Pilots	**Copy:**	
Subject:	**Awareness VFR traffic**		

Dear colleagues,

The weather has improved and the general aviation season is open. Please understand that many general aviation pilots are not used to the high speeds and size of airliners and therefore cannot make a sound judgement on separation and risks of collision.

Special care should be taken on flights between Luxembourg and Saarbrücken due to the intense VFR and glider activity in this area.

Please take a minute and review AON 3.

May we ask you to report any occurrence and/or hazard that you may identify in order to allow the Safety Department to take the appropriate proactive measures to reduce the risks. Furthermore you should inform ATC via radio about any occurrence.

Thank you very much in advance for your cooperation.

Should you have any questions or comments please feel free to contact us.

Best regards
Pascal Kremer
Safety Officer

- Enhance awareness of own crews
- Memos at the beginning of the summer season when VFR traffic picks up

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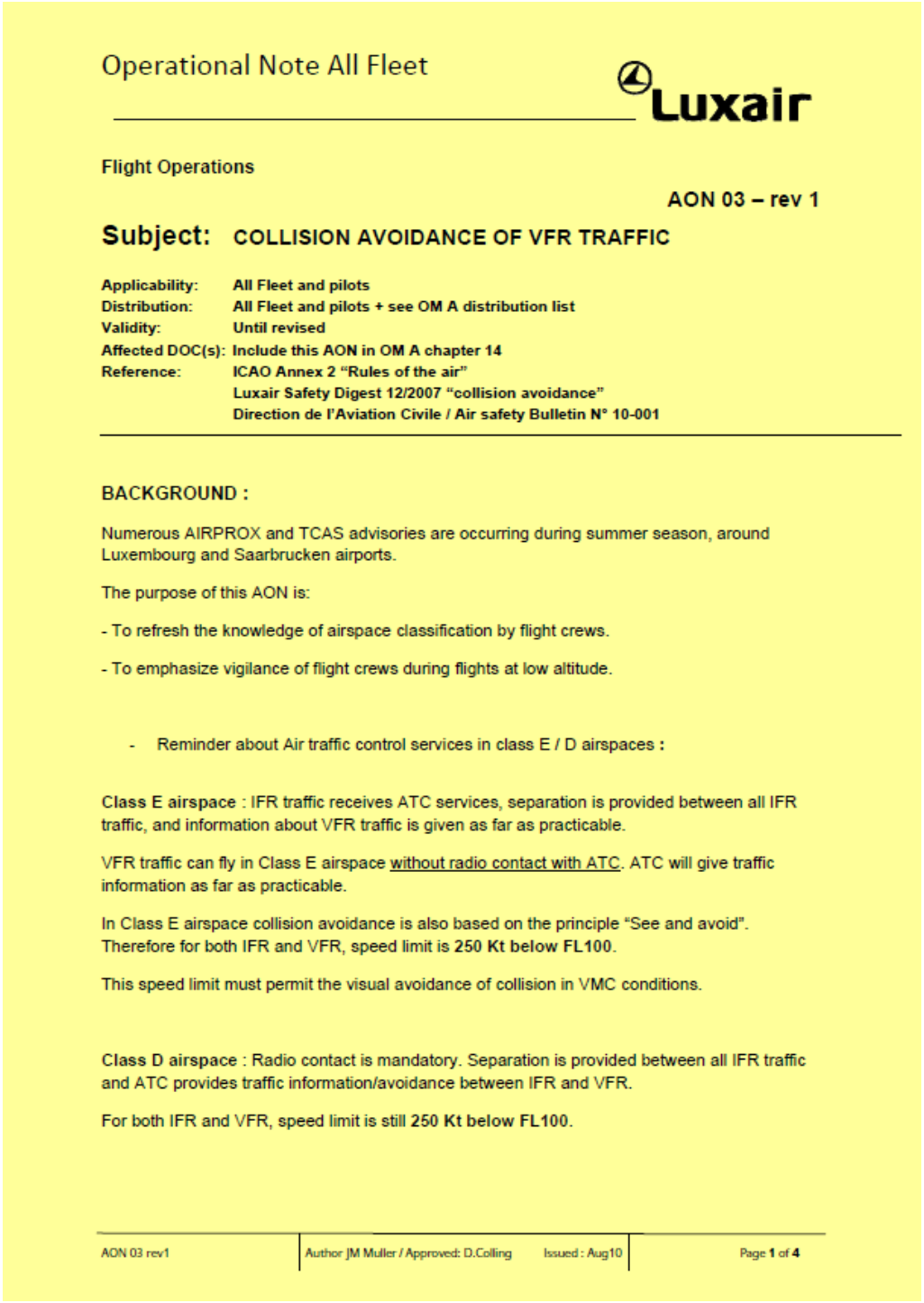

Operational Note All Fleet

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Flight Operations

AON 03 – rev 1

Subject: COLLISION AVOIDANCE OF VFR TRAFFIC

Applicability: All Fleet and pilots
Distribution: All Fleet and pilots + see OM A distribution list
Validity: Until revised
Affected DOC(s): Include this AON in OM A chapter 14
Reference: ICAO Annex 2 "Rules of the air"
Luxair Safety Digest 12/2007 "collision avoidance"
Direction de l'Aviation Civile / Air safety Bulletin N° 10-001

BACKGROUND :

Numerous AIRPROX and TCAS advisories are occurring during summer season, around Luxembourg and Saarbrucken airports.

The purpose of this AON is:

- To refresh the knowledge of airspace classification by flight crews.

- To emphasize vigilance of flight crews during flights at low altitude.

- Reminder about Air traffic control services in class E / D airspaces :

Class E airspace : IFR traffic receives ATC services, separation is provided between all IFR traffic, and information about VFR traffic is given as far as practicable.

VFR traffic can fly in Class E airspace without radio contact with ATC. ATC will give traffic information as far as practicable.

In Class E airspace collision avoidance is also based on the principle "See and avoid". Therefore for both IFR and VFR, speed limit is **250 Kt below FL100**.

This speed limit must permit the visual avoidance of collision in VMC conditions.

Class D airspace : Radio contact is mandatory. Separation is provided between all IFR traffic and ATC provides traffic information/avoidance between IFR and VFR.

For both IFR and VFR, speed limit is still **250 Kt below FL100**.

AON 03 rev1 | Author JM Muller / Approved: D.Colling | Issued : Aug10 | Page 1 of 4

- Operational notes reminder of airspace structure and ATC services provided

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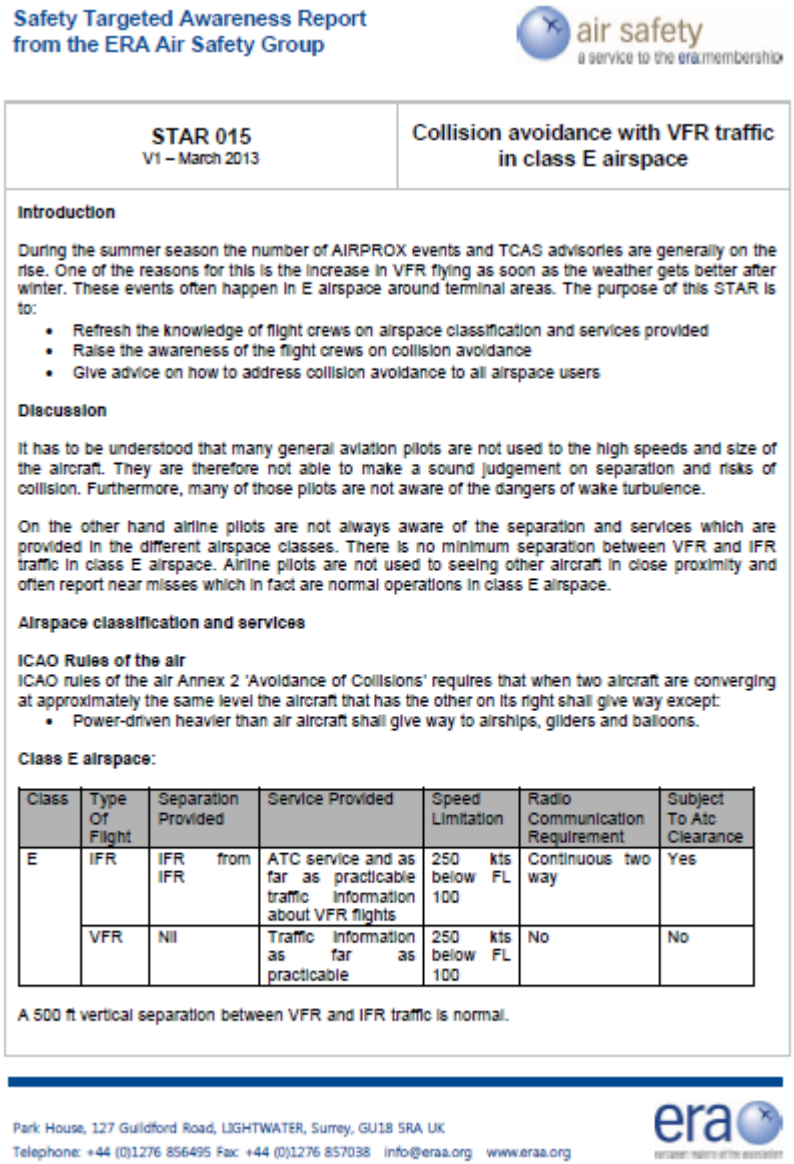
Actions taken

- Sharing with the industry
- ERA STAR
- Conferences
- ECAST
- Eurocontrol
- EASp ?



Safety Targeted Awareness Report
from the ERA Air Safety Group

air safety
a service to the era membership

STAR 015 V1 – March 2013	Collision avoidance with VFR traffic in class E airspace

Introduction

During the summer season the number of AIRPROX events and TCAS advisories are generally on the rise. One of the reasons for this is the increase in VFR flying as soon as the weather gets better after winter. These events often happen in E airspace around terminal areas. The purpose of this STAR is to:

- Refresh the knowledge of flight crews on airspace classification and services provided
- Raise the awareness of the flight crews on collision avoidance
- Give advice on how to address collision avoidance to all airspace users

Discussion

It has to be understood that many general aviation pilots are not used to the high speeds and size of the aircraft. They are therefore not able to make a sound judgement on separation and risks of collision. Furthermore, many of those pilots are not aware of the dangers of wake turbulence.

On the other hand airline pilots are not always aware of the separation and services which are provided in the different airspace classes. There is no minimum separation between VFR and IFR traffic in class E airspace. Airline pilots are not used to seeing other aircraft in close proximity and often report near misses which in fact are normal operations in class E airspace.

Airspace classification and services

ICAO Rules of the air
ICAO rules of the air Annex 2 'Avoidance of Collisions' requires that when two aircraft are converging at approximately the same level the aircraft that has the other on its right shall give way except:

- Power-driven heavier than air aircraft shall give way to airships, gliders and balloons.

Class E airspace:

Class	Type Of Flight	Separation Provided	Service Provided	Speed Limitation	Radio Communication Requirement	Subject To Atc Clearance
E	IFR	IFR from IFR	ATC service and as far as practicable traffic information about VFR flights	250 kts below FL 100	Continuous two way	Yes
	VFR	Nil	Traffic information as far as practicable	250 kts below FL 100	No	No

A 500 ft vertical separation between VFR and IFR traffic is normal.

Park House, 127 Guildford Road, LIGHTWATER, Surrey, GU18 5RA UK
Telephone: +44 (0)1276 856495 Fax: +44 (0)1276 857038 info@eraa.org www.eraa.org

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Conclusion

To exploit the full potential of TCAS II it is not enough to enhance the technical specifications of the system

BUT

there is a need that every stakeholder understands and plays his role in the system

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Thank you for your attention

Capt. Pascal Kremer
pascal.kremer@luxairgroup.lu

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