Safety Case for

CHANGES TO VFR OPERATIONS

SASI WS – 12 June 2009

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Dept. of Civil Aviation of Cyprus –

Safety Department

Background

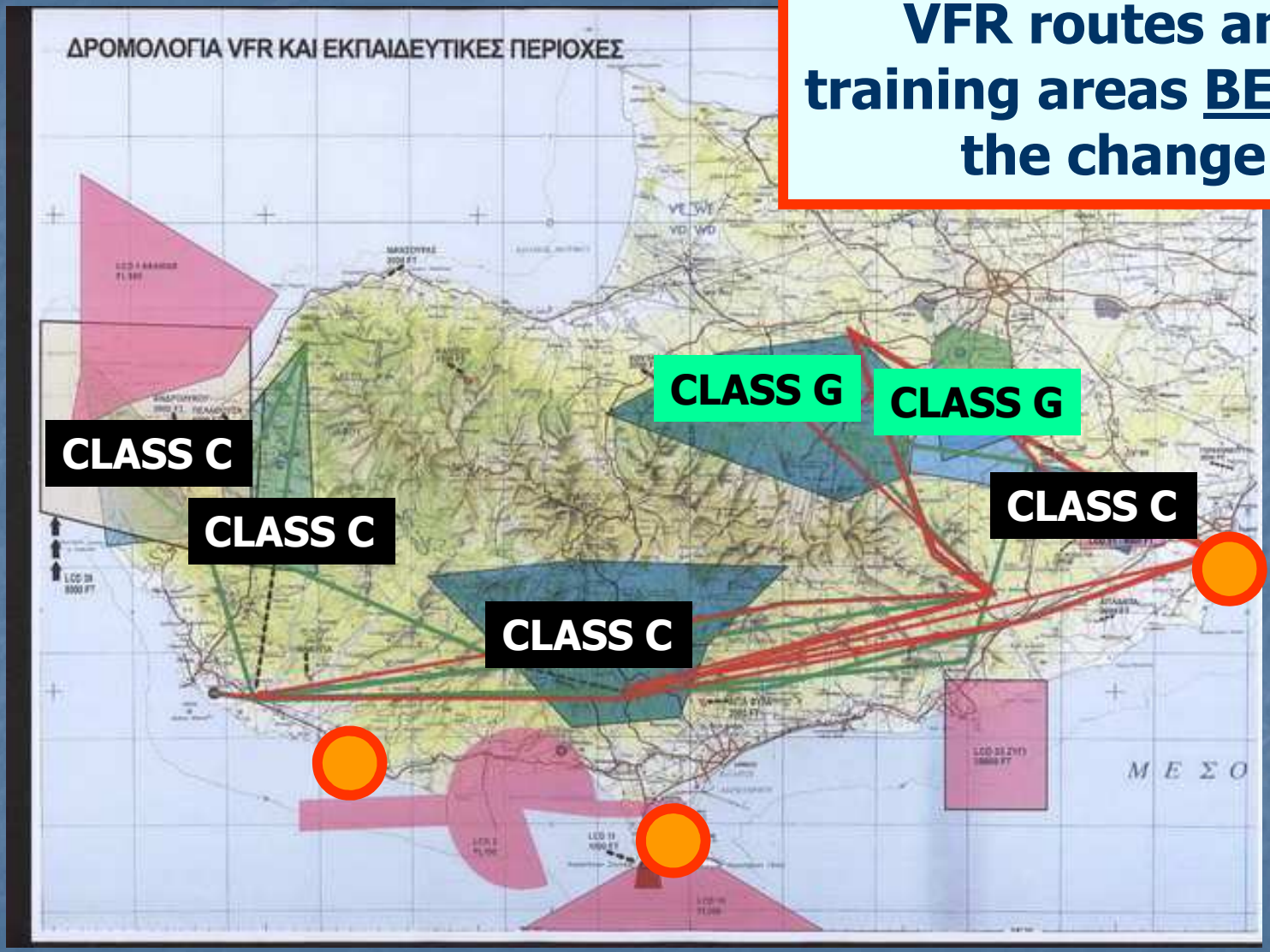
Background

- Local VFR operations were radically changed in 2006 with the introduction of new routes and training areas

- Immediate strong reaction by ATCOs resisting change, claiming minimal prior consultation and highlighting specific safety concerns

- **No formal safety assessment was carried out**

Background



VFR routes and training areas <u>BEFORE</u> the change

Background

Despite no actual accident, it was widely *believed* among ATCOs that current VFR operations were exposing aviation to high risks due to a number of *safety concerns*. Examples of these were…

• names of the VFR routes are similar and can easily be confused e.g. "Paphos Route A", "Larnaca Route A"

• VFR routes over high terrain with no landma

• inconsistencies between the night VFR pr the AIP and the Manual of Air Traffic Servi

• high R/T workload

• by own admission, ATCOs treated VFR oper tions in a non-uniform way (according to personal judgment)

Rationale for change (justification)

etc…

Background

- **Complete redesign of the airspace configuration (training areas and routes) was initiated in 2008…**

- **…in consultation with all stakeholders (VFR pilots, IFR pilots, ATCOs, military helicopter pilots…**

- **Formal safety assessment was also initiated, <u>in parallel</u> with the design activity**

Objective of the safety assessment team

…to build a safety case which argued that the proposed change was acceptably safe

…using a SES/ESARR4 compliant methodology, focusing equally on the *success* and *failure* approach

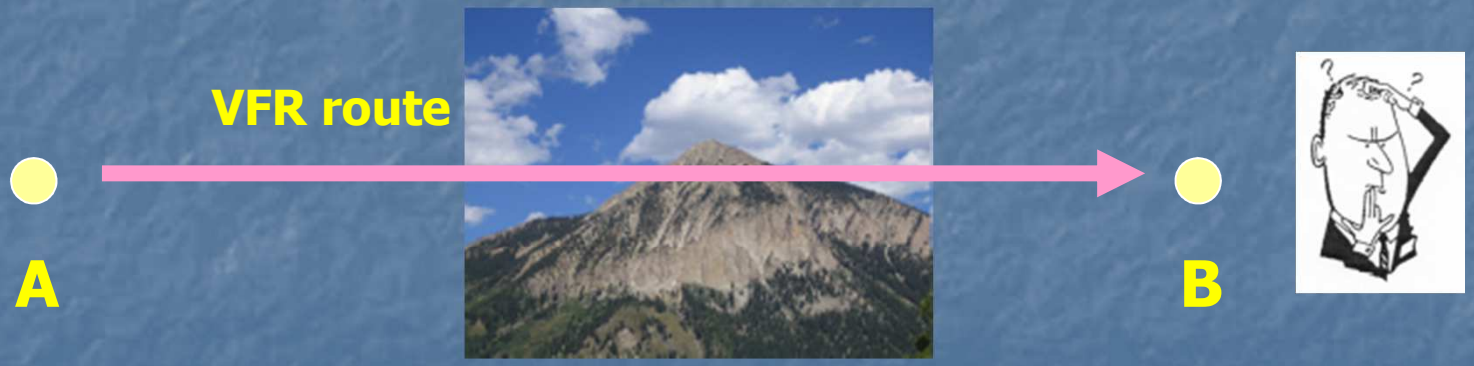
The decision was to do the assessment using internal resources, and, in so much as practicable, "*by the book*…" (using SCDM as reference)

Merits of the success approach (1)

Objective: to build the safety case…using a SES/ESARR4 compliant methodology, focusing equally on the success and failure approach

Success approach is…

…the way to ensure that the indented change or new system is feasible, sustainable, with the right functions and performance (accuracy, effectiveness etc..)



i.e. *success* = intrinsically safe

Merits of the success approach (2)

Success approach (as part of the SCDM) is also…

…an effective change management process, because…

…the "project" approach "drives" the change to its implementation,

…it minimises reaction to change by ATC staff and airspace users

…a chance to highlight the "positive" effects of the change

Focuses on what needs to be done for things to operate *safely* when all is "normal", i.e. during most of the time

Scope of the change

Air Traffic Management includes BOTH the **airspace design** AND the provision of **Air Traffic Services**

The geographical area:

Control zones of Larnaca and Paphos airports and the routes and training areas described in relevant AIC

Function:

Air Traffic Management of *local*[1] VFR flights and affected IFR traffic, **throughout the 24 hours of the day**, as per ICAO Annexes and Recommendations.

[1] The term "local" refers to flights originating from civil or military aerodromes in the Republic of Cyprus

Safety Assessment Team

- One ATCO / NSA officer to ensure regulatory compliance (comprehensive IANS safety training, some practical experience)
- One ATCO Larnaca (comprehensive IANS safety training but limited practical experience)
- One ATCO Paphos (some IANS safety training but no practical experience)
- EUROCONTROL assistance, but limited to very specific tasks (e.g. facilitation of FHA)

Parallel NSA – ANSP activity : DCAC resources: very limited

Management endorsed and supported activity

Safety Plan

CONTINUOUSLY UPDATED

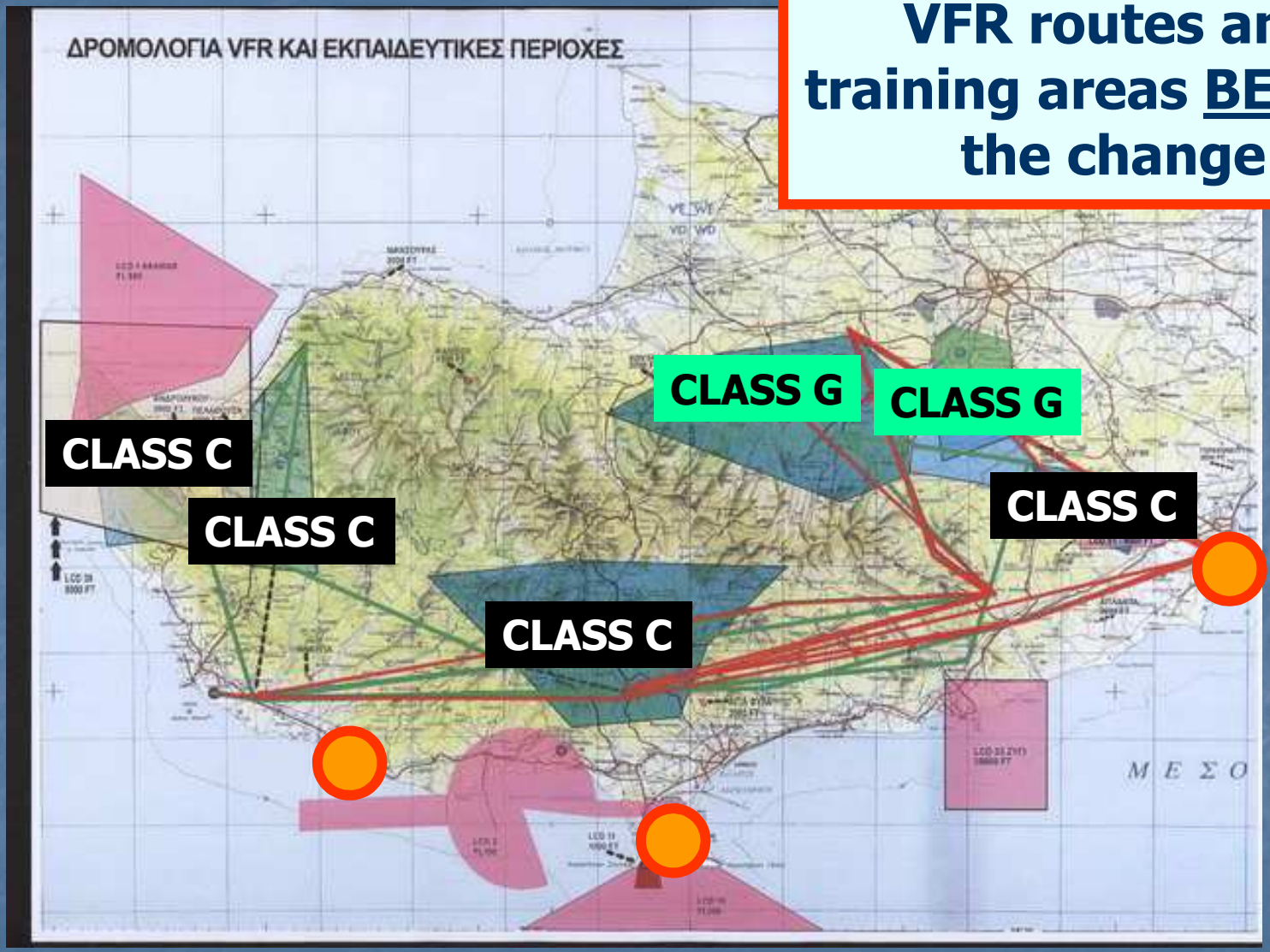
Nr.	DECISION	ACTION	DEADLINE	STATUS
01	Management support for the work to be ensured	All to speak to NN, PS to speak with PP.	26 Mar 2008	**DONE**
02	Identify stakeholders affected by new VFR arrangements	ES to speak to YTh and advise to arrange meetings with all	10 April 2008	**DONE**
03	ATCO(s) to review and validate airspace design	NM + Paphos ATCO (Persephoni advised and approves)	14April 2008	**PENDING**
04	Justification for change to be elaborated	GN to elaborate with the help of Y Th.	14 April 2008	**PENDING**
06	Identify stakeholders	ES, GN with YTh	14 April 2008	**DONE**
07	Compare proposed AIC with night VFR procedures in AIP to ensure consistency	GN to investigate	14 April 2008	**PENDING**
09	Clarify the scope of VFR circular (local or intl.) . Work so far has concentrated on local VFR !!!	ES to discuss with YTh	14 April 2008	**DONE**

Identifying the stakeholders

- ATCOs LCLK
- ATCOs LCPH
- ATCOs LCRA
- VFR pilots operating from local aerodromes
- Lakatamia Aerodrome military users
- Akrotiri Aerodrome military users
- Cyprus Airforce pilots

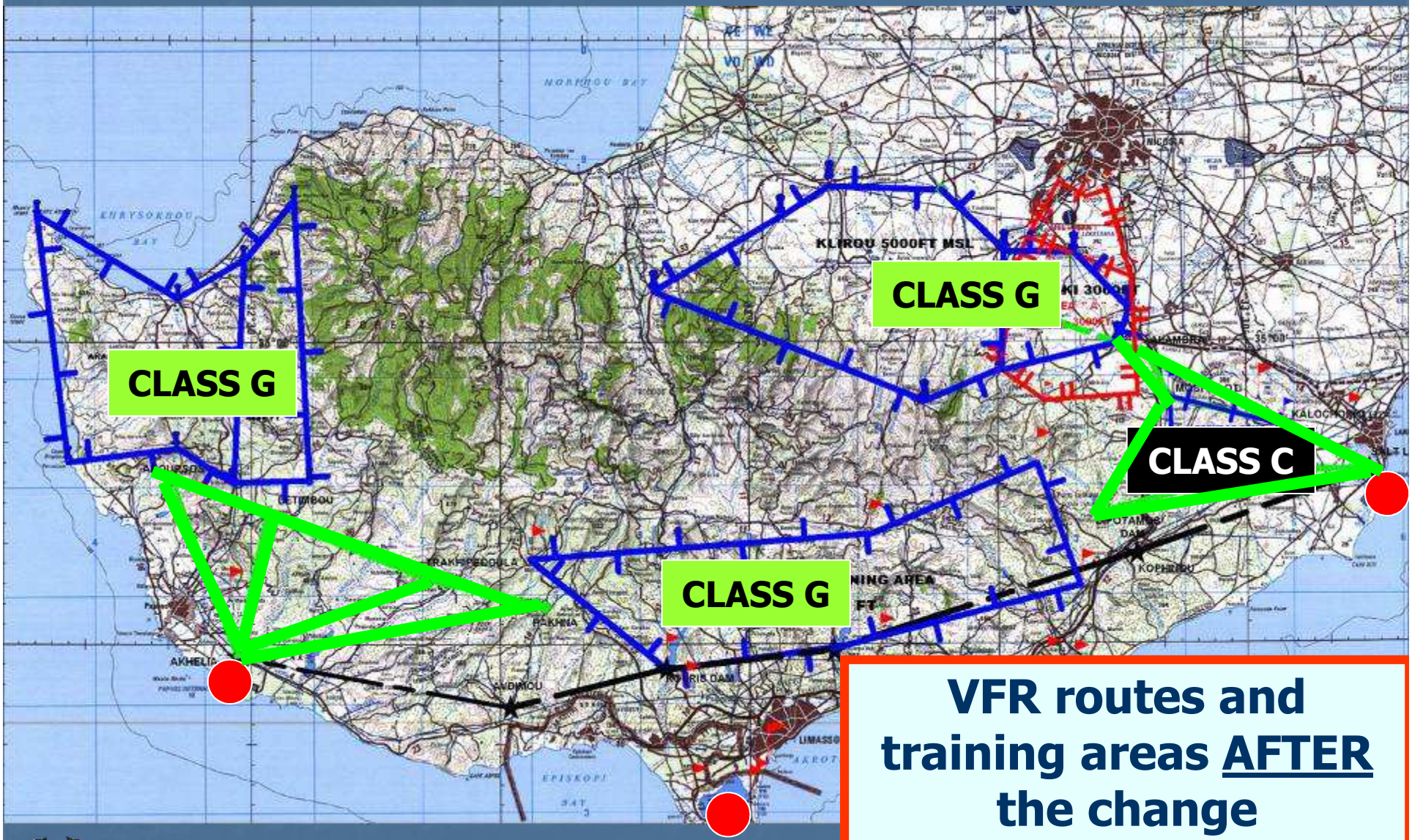
Must be consulted prior to implementation + invited to FHA

Background



VFR routes and training areas <u>BEFORE</u> the change

Proposed airspace design



VFR routes and training areas AFTER the change

Identification of change…

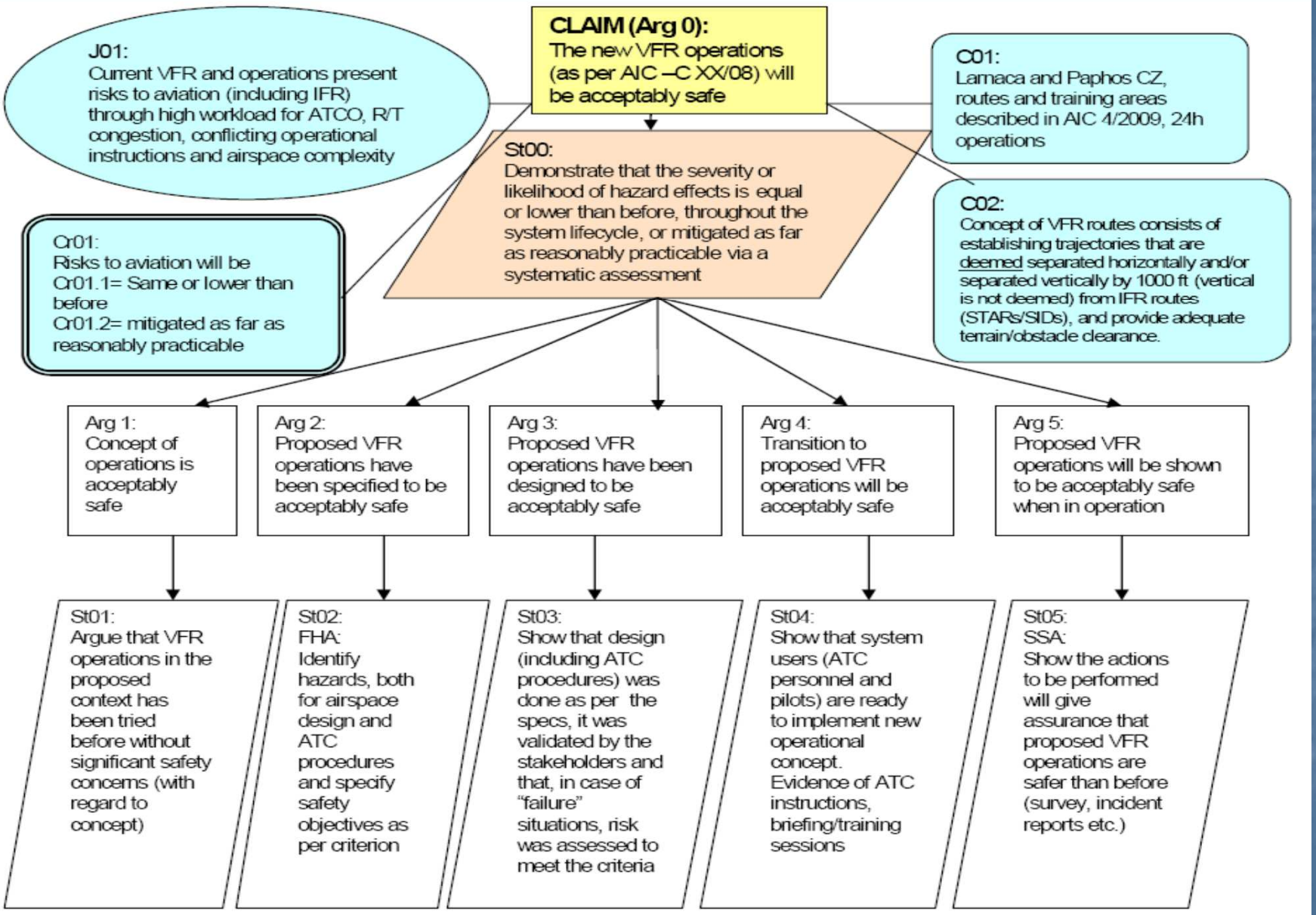
- New VFR routes
- New/renamed Training Areas
- New airspace classification for some Tr. Areas (C to G)
- New instructions for pilots

Airspace re-design – to be published through an Aeronautical Information Circular (AIC)

- New ATC procedures

NOT in the AIC – to be defined in ATC instructions

Initial safety Argument



Safety Criteria (our "measuring stick")

"Acceptably safe" meant… (options)

1. Risk equal or lower than before… (comparative)

2. Hazards mitigated "as far as reasonably practicable"

3. Risk was acceptable, as per the Risk Classification Scheme

Decision of what to use as criterion was re-visited during the assessment process (inexperience or "real life" necessity ?…)

Hazard Id techniques used

1. Safety considerations/concerns exercise – fairly unstructured brainstorming – suitable at early stages of the (airspace/procedure) design, after the high level concept has been agreed

2. Process (Task) analysis - systematic / structured approach towards the proposed design (hence, only appropriate when design is mature) . Involved a step by step analysis of a typical VFR flight in the proposed environment

Hazard Id techniques used (cont.)

Breaking up a typical flight in small steps…

Function / Task	ATM related ?	Hazard	Why ? (causes)
Pilot submits a flight plan	Y	Files an incorrect FPL (e.g. wrong routes etc)	-Unfamiliar with new routes, areas & procedures
Pilots makes a pre-flight check	N		
Pilot requests ATC clearance	Y	Undetected wrong readback ATCO gives incorrect clearance	- Workload - Radio interference / noise - Workload - Unfamiliar with new routes, areas & procedures
During flight, Pilot reports at designated reporting points	Y	Pilot fails / unable to report when over reporting points	- Inappropriate use of a/c instruments - Weather (poor visibility) – cannot see the landmarks - Confusing landmarks - Unfamiliar with landmarks

Hazard Id techniques used (cont.)

Ref	Probable causes	P_h[24]	Hazard	Worst credible Hazard Effect	P_e[25]	Sev/ity of Haz. effect (EC2096)	NOTES /
H16A	Unfamiliar with or lack of procedures	**Often**	Pilot **fails** to advise ATC prior to exiting Training Area	**Close proximity with other VFR traffic whilst exiting area.**	1:10	2	User experience (NK): It happened often that, approaching ALAMBRA he came in close proximity with other VFR coming out of MARKI TA. Recommend to put in AIC requirement for level flying before leaving

Structured – systematic FHA session involving all stakeholders (ATCOs, pilots, military)

RCS or not… a dilemma

Severity	Safety Targets (per flight hours)	Qualitative definition	Quantitative definition for DCAC ATM[5]
3	10^{-4}	Probable - Several similar occurrences on record – Has occurred more than once at the same location.	Once a month

QUALITATIVE APPROACH…
5 out 17 hazards identified with likelihood "***occasional***" would "***most usually***" have a **severity 3** effect

QUANTITATIVE APPROACH…
5 out 17 hazards identified with likelihood "***once a month***" would have a **severity 3** effect with **Pe=9/10** . In addition, 3 out 17 hazards identified could have a **severity 3** effect with **Pe=1/10**

Hence, we 'd have about 5 severity 3 occurrences per month… Therefore the safety objective on each hazard would be once every five months

RCS or not… a dilemma

Severity	Safety Targets (per flight hours)	Qualitative definition	Quantitative definition for DCAC ATM[5]
3	10^{-4}	Probable - Several similar occurrences on record – Has occurred more than once at the same location.	Once a month

Safety objective : hazard likelihood = once every five months

MITIGATIONS were put in place but…

Would the mitigations reduce the likelihood of the hazard from once a month to once every five months ?

RCS or not… a dilemma

Ref	Probable causes	P_h[24]	Hazard	Worst credible Hazard Effect	P_e[25]	Sev/ity of Haz. effect (EC2096)	NOTES / Proposed Mitigation (Safety Requirement)
H16A	Unfamiliar with or lack of procedures	Often	Pilot **fails** to advise ATC prior to exiting Training Area	**Close proximity with other VFR traffic whilst exiting area.**	1:10	2	User experience (NK): It happened often that, approaching ALAMBRA he came in close proximity with other VFR coming out of MARKI TA. Recommend to put in AIC requirement for level flying before leaving Include in AIC instruction to wait in TA until contact is established Include in AIC instruction to maintain alt. before leaving (not climb / descend) Disseminate AIC through email and ad hoc meetings

Do the mitigations reduce the likelihood of the hazard occurring (Ph) by the required amount ?...

RCS or not… a dilemma

Severity	Safety Targets (per flight hours)	Qualitative definition	Quantitative definition for DCAC ATM[5]
3	10^{-4}	Probable - Several similar occurrences on record – Has occurred more than once at the same location.	Once a month

Safety objective : hazard likelihood = once every five months

MITIGATIONS were put in place but…

Did the mitigation reduce the likelihood of the hazard from once a month to once every five months ?

Impossible to assess conclusively…

We could argue in any direction… What is the real value ?

RCS dropped (in this case) as safety criterion…

Safety Case acceptance…

1. …by the Management

initial rejection = process stopped, hence no ATCO training costs

A two stage acceptance was foreseen…

(a)<u>Preliminary report</u> – when risk was assessed and success part was complete up to the transition stage (i.e. just before the training of ATCOs)

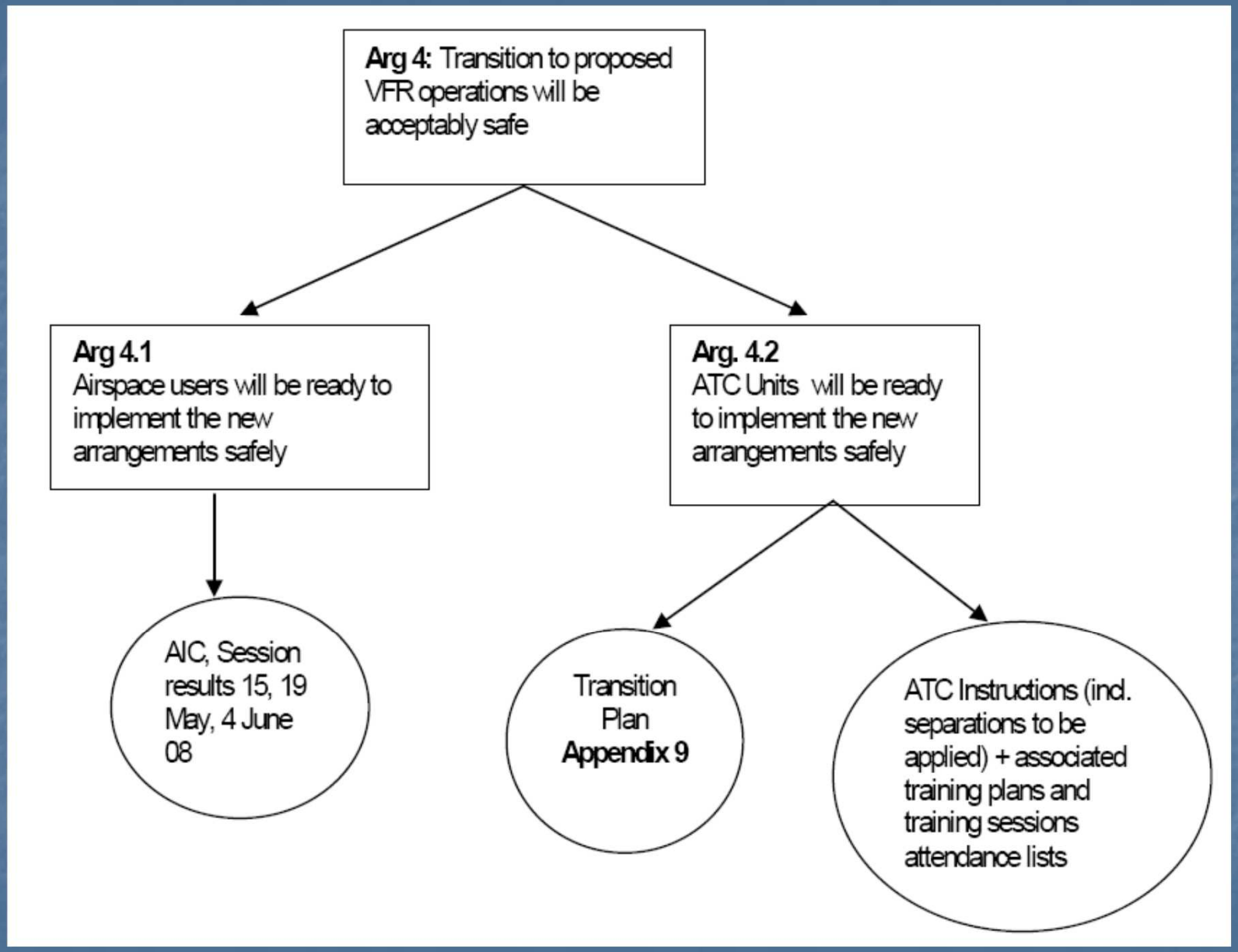
(b) <u>Final report</u> – when all activities were complete and safety evidences were available (submitted one month before planned implementation date)

Safety Case Methodology – final report contents

- Scope – operational concept
- Justification
- Assumptions
- Safety claim
- Safety criteria
- Safety Arguments
- Safety Plan
- Safety evidences (HazID tables, risk assessment, meeting results, training plans and attendance sample lists etc…)

…as per SCDM

Safety Case Methodology – final report contents



Safety Case Methodology – final report contents

Arg 4: Transition to proposed VFR operations will be acceptably safe

Arg 4.2: ATC units will be ready to implement the new arrangements because

- Local ATC Instructions have been drafted, reviewed and accepted by core group of ATCOs
- All active Larnaca / Paphos ATCOs have been briefed and trained for their implementation BEFORE the AIC effective date

The transition safety plan for the ATC units is shown in Appendix 9. Local ATC instructions (sample extracts) are presented in Appendices 2 and 3. Training plan for ATCOs and a sample attendance list for the training sessions held is presented in Appendix 12. **VFR operations must begin only when the actions contained in the Transition Plan have been completed.**

Safety Case Methodology – final report contents

Risk assessment (comparative)

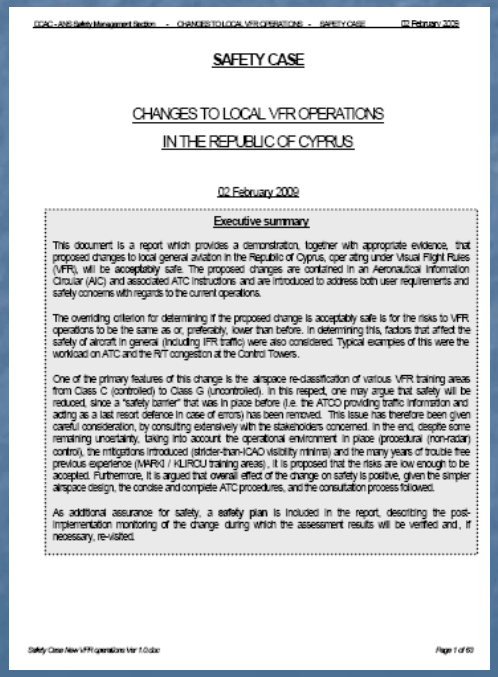
Ref.	TOPIC	BEFORE	PROPOSED	CHANGE RELATED HAZARDS	RELATED EFFECTS	RISK ASSESSMENT	RATIONALE
C8	Conditions for Night VFR	Training only	Training + pleasure flight	**Inability** or **failure** to stay on cleared route (deviates left/right of track) Pilot **inability** or **failure** to maintain cleared altitude	Close proximity to other air traffic (IFR/VFR) requiring avoiding action and/or controlled flight into terrain As above	No change to risk, assuming volume of night VFR traffic remains at current level	To obtain a "Night qualification" one had to fly solo for a few hrs. Volume of night VFR not expected to change significantly *(BUT will be monitored during post implementation stage)*
C9	Suspension of VFR operations	No mention	Defined	**Inability** or **failure** to stay on cleared route (deviates left/right of track) Pilot **inability** or **failure** to maintain cleared altitude	Close proximity to other air traffic (IFR/VFR) requiring avoiding action and/or controlled flight into terrain As above	Likelihood of hazards is reduced Safety Criterion satisfied ? YES	ATS can exercise professional judgment when ad-hoc, unforeseen hazards appear in the environment. Added defense
C11	Procedure for coordination with ATC when changing from Class C to G and v.v.	Specified	Specified, requirement for 5 min. "warning" call added	Pilot **fails** to advise ATC prior to exiting Training Area	ATC unable to provide traffic information to concerned a/c	Likelihood of hazards is reduced. Safety Criterion satisfied ? YES	ATC has more time to plan

Safety Case acceptance…

2. …by the NSA

(a) Final report submitted three weeks before planned implementation date

(b) NSA acceptance one day before planned implementation date (SC reviewed as per (EC) 1315 / 2007)



SAFETY CASE

CHANGES TO LOCAL VFR OPERATIONS

IN THE REPUBLIC OF CYPRUS

02 February 2009

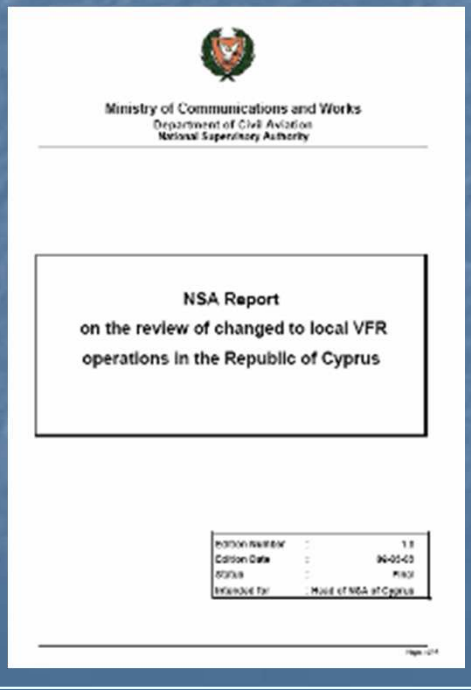
Executive summary

This document is a report which provides a demonstration, together with appropriate evidence, that proposed changes to local general aviation in the Republic of Cyprus, operating under Visual Flight Rules (VFR), will be acceptably safe. The proposed changes are contained in an Aeronautical Information Circular (AIC) and associated ATC instructions and are introduced to address both user requirements and safety concerns with regards to the current operations.

The overriding criterion for determining if the proposed change is acceptably safe is for the risks to VFR operations to be the same as or, preferably, lower than before. In determining this, factors that affect the safety of aircraft in general (including IFR traffic) were also considered. Typical examples of this were the workload on ATC and the R/T congestion at the Control Towers.

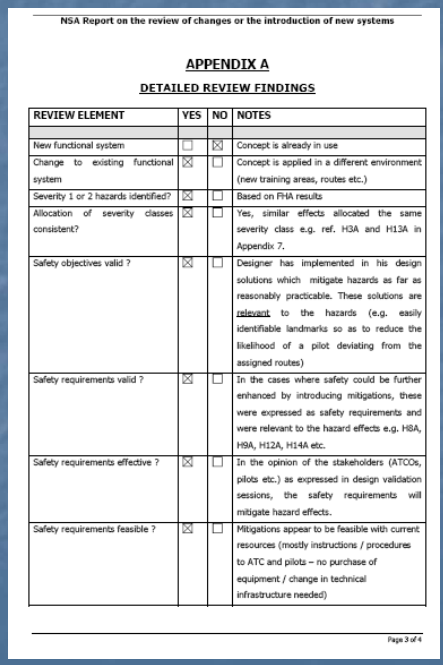
One of the primary features of this change is the airspace re-classification of various VFR training areas from Class C (controlled) to Class G (uncontrolled). In this respect, one may argue that safety will be reduced, since a "safety barrier" that was in place before (i.e. the ATCO providing traffic information and acting as a last resort defense in case of errors) has been removed. This issue has therefore been given careful consideration, by consulting extensively with the stakeholders concerned. In the end, despite some remaining uncertainty, taking into account the operational environment in place (procedural (non-radar) control), the mitigations introduced (stricter-than-ICAO visibility minima) and the many years of trouble free previous experience (MARKI / KLIROU training areas), it is proposed that the risks are low enough to be accepted. Furthermore, it is argued that overall effect of the change on safety is positive, given the simpler airspace design, the concise and complete ATC procedures, and the consultation process followed.

As additional assurance for safety, a safety plan is included in the report, describing the post-implementation monitoring of the change during which the assessment results will be verified and, if necessary, re-visited.



Ministry of Communications and Works
Department of Civil Aviation
National Supervisory Authority

NSA Report
on the review of changed to local VFR operations in the Republic of Cyprus



NSA Report on the review of changes or the introduction of new systems

APPENDIX A

DETAILED REVIEW FINDINGS

REVIEW ELEMENT	YES	NO	NOTES
New functional system	☐	☒	Concept is already in use
Change to existing functional system	☒	☐	Concept is applied in a different environment (new training areas, routes etc.)
Severity 1 or 2 hazards identified?	☒	☐	Based on FHA results
Allocation of severity classes consistent?	☒	☐	Yes, similar effects allocated the same severity class e.g. ref. H3A and H13A in Appendix 7.
Safety objectives valid ?	☒	☐	Designer has implemented in his design solutions which mitigate hazards as far as reasonably practicable. These solutions are relevant to the hazards (e.g. easily identifiable landmarks so as to reduce the likelihood of a pilot deviating from the assigned routes)
Safety requirements valid ?	☒	☐	In the cases where safety could be further enhanced by introducing mitigations, these were expressed as safety requirements and were relevant to the hazard effects e.g. H8A, H9A, H12A, H14A etc.
Safety requirements effective ?	☒	☐	In the opinion of the stakeholders (ATCOs, pilots etc.) as expressed in design validation sessions, the safety requirements will mitigate hazard effects.
Safety requirements feasible ?	☒	☐	Mitigations appear to be feasible with current resources (mostly instructions / procedures to ATC and pilots – no purchase of equipment / change in technical infrastructure needed)

Problems / difficulties

Initial…

Airspace design doesn't "fail" – What kind of hazards are there ?

FHA – limited experience in conducting one ! Worries about facilitation of an FHA session for an airspace/procedure change…

On going…

Safety Criteria – what is/are the most appropriate ?

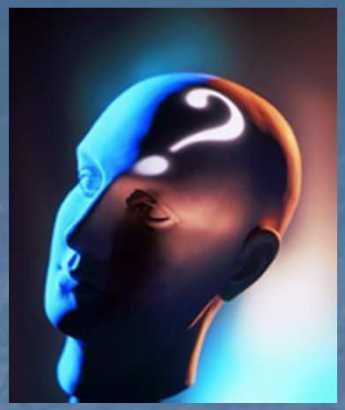
Design specification / validation – no reference guidelines for VFR operations. No "specs" for the airspace designer…

Organising meetings with operational stakeholders (ATCOs + pilots)

Lessons learnt

- Distinction between system specification and design stages are not clear when assessing airspace design + procedures (basically, airspace/procedure specification=design)
- Gathering operational staff + stakeholders for meetings is very difficult, hence thorough meeting preparation is a **must** to get the answers you need
- HazID and risk assessment process need not necessarily rely only on one method. Combination of techniques may be used… RCS seems most suited to hardware changes… Comparative method seems most suited to simple changes
- Managing a safety case is project in itself (need to manage limited resources to get results)… Hence, project management skills/experience are recommended for the safety assessment Team Leader/Manager
- Management endorsement + NSA involvement from the start is highly advisable so as to minimise time needed for acceptance of the safety case. Intermediate acceptance stage was a good idea.

Safety Assessments…



How WE see it…

The process by which common sense and best (*management*) practices have been applied to ensure that the organisation (people, equipment, procedures) and the users are ready to implement a change smoothly / effectively, and…

SUCCESS APPROACH (= *MANAGEMENT*… NOT LEAVING THINGS TO CHANCE…)

…if / when things go wrong, we 've done our best to mitigate the effects

FAILURE APPROACH

In this respect, we don't get caught up too much in particular safety assessment techniques or methods to use, rather we focus on what is most appropriate for the particular case

Thank you

Discussion / Questions ?

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