



AudioSoft

White Paper

Solutions to ICAO Radar Recording Requirements for ATC

A three point plan for keeping your airport up-to-date with current legislation

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Executive Summary

On 23rd November 2005 there was a key change in the policy of the International Civil Aviation Organisation (ICAO): **Radar recording of primary and secondary surveillance data is no longer recommended but mandated.**

This white paper explains the changes in ICAO legislation and the current status of ATC requirements and recommendations for voice logging and radar recording. Primarily it outlines the current known state of radar recording standards and assesses how you can adhere to such standards. The document attempts to provide understanding of the latest requirements and recommendations, as made by the following authorities:

- ▶ ICAO
- ▶ UK CAA
- ▶ Eurocontrol
- ▶ EuroCAE

This white paper outlines the options for radar recording and recommends the best solution.

Audience

This white paper is relevant to:

- ▶ Those responsible for the operation of the recording system at any airport
- ▶ Those whose airports either currently use radar or may do so in the future

Step 1: Understand the Requirements on your airport

Mandated requirements and recommendations are being continually updated to improve airport safety by organisations such as the International Civil Aviation Organization (ICAO), the UK CAA (United Kingdom Civil Aviation Authority), Eurocontrol and EuroCAE (the Organization for Civil Aviation Equipment).

“The International Civil Aviation Organization (ICAO), a specialized agency of the United Nations, was created with the signing in Chicago, on 7 December 1944, of the Convention on International Civil Aviation. ICAO is the permanent body charged with the administration of the principles laid out in the Convention.” Further information may be found on the ICAO website [5].

Radar recording is detailed by ICAO within [6]. Historically a recommendation of radar recording of surveillance data from primary and secondary radar equipment has been made. This recommendation also stated that recordings should be retained for a minimum 14 day period.

A key change in the policy of the International Civil Aviation Organization (ICAO) is detailed in [1], which specifies that **“Radar Recording of primary and secondary surveillance data is no longer recommended but mandated”** as of 23rd November 2005.

“Automatic recordings shall be retained for a period of **at least thirty days**” continues [1]. “When the recordings are pertinent to accident and incident investigations, they shall be retained for longer periods until it is evident that they will no longer be required”.

- ▶ If your airport is in the United Kingdom, see Section 2.1
- ▶ If your airport falls under EU legislation, see Section 2.2
- ▶ If your airport falls under local or Rest of the World legislation, see Section 2.3

UKCAA specific information

“The CAA is the UK’s independent aviation regulator, with all civil aviation regulatory functions (economic regulation, airspace policy, safety regulation and consumer protection) integrated within a single specialist body.

“The Safety Regulation Group (SRG) sets certain national safety standards. In parallel, it oversees the activities of the aviation community and its level of compliance with both national and European safety standards” [8].

The ICAO requirement for radar recording of primary and secondary surveillance data is supported by the UKCAA and it is recommended by UKCAA that “the radar recording and radio telephone (RTF) recording equipment should be integrated to allow synchronised playback” [9].

In addition ATISIN 127: Automatic Recording of Surveillance Data by ATS Units refers states, ‘The CAA intends to mandate surveillance data recording by using the directing provision in Article 125 (3). CAP 670 will be revised to require the automatic recording and retention of surveillance data obtained from any surveillance system used in the provision of an Air Traffic Service. This will include systems such as Radar, ADS, multi-lateration and Surface Movement Radar.’

▶ See also Section below for European legislation.

Eurocontrol and EUROCAE specific information

“Eurocontrol manage the Eurocontrol Programme for Performance Enhancement in European Air Traffic Management (EATM). This programme aims to create a seamless ATM system across 41 ECAC participating States”, [7].

The ICAO requirement for radar recording of primary and secondary surveillance data is supported by Eurocontrol in [2]. Radar recordings now need to be “retained for a period of at least 30 days” state ICAO, longer if they are “pertinent to accident and incident investigations”.

EUROCAE takes this further in [3], recommending that voice recordings be synchronised with the replay of radar playback to an accuracy of a second tolerance.

Local and Rest of the World legislation

ICAO legislation applies to all states listed in [4]. In some cases, local legislation stipulates further requirements or recommendations. Please consult AudioSoft or your local representative for specific local requirements.

Step 2: Options to meet radar recording requirements

Of particular significance given the recent changes in ICAO legislation are the options for the type of radar recording capabilities. Essentially, one can choose to record the radar data or to use a screen capture solution or both. However, there are multiple options for each of these solutions. Two of these are for recording of primary radar data and for recording of secondary radar data, which are defined in Section 7.

Option 1 – Primary Radar Recording
Background
Primary radar recording will record all the plot extracted primary radar data, such as plots or tracks. Due to a wide range of radar systems and protocols, solutions can be bespoke.
Business Objectives
Compliance with ICAO requirements for primary radar recording.
Advantages
<ul style="list-style-type: none">▶ Ideal for search and rescue as the data allows detailed interrogation▶ Allows evaluation of ATC and surveillance systems
Disadvantages
<ul style="list-style-type: none">▶ No knowledge of what was on controller's screen▶ Provides incomplete picture for incident investigation▶ Will also require recording of secondary surveillance radar data▶ May affect radar's safety case▶ Solution may have to be bespoke
Replay
Replay via existing radar system.
Cost Index
Cost index = 3 (where 1 = low, 5 = high)

Option 2 – Secondary Surveillance Radar Recording

Background

Secondary surveillance radar recording will record all the secondary radar data from transponders including track information, RTQC's, sector messages, etc. A wide range of different radar interfaces, protocols and formats can be supported. The recorded data is relatively small in size and hence this options provides a cost effective alternative to the data hungry capture of an ATC operators screen.

Business Objectives

Compliance with ICAO requirements for secondary surveillance radar recording.

Advantages

- ▶ Ideal for search and rescue as the data allows detailed interrogation
- ▶ Allows evaluation of ATC and surveillance systems
- ▶ Recorded data is relatively small in size

Disadvantages

- ▶ No knowledge of what was on controller's screen
- ▶ Provides incomplete picture for incident investigation
- ▶ May also require recording of primary radar data
- ▶ May affect radar's safety case

Replay

Replay via existing radar system or PC based replay.

Cost Index

Cost index = 2 (where 1 = low, 5 = high)

Option 3 – Passive Screen Capture of Controller Working Position

Background

Screen capture system that provides a comprehensive and system independent record of what was on the controller's screen. Records the ATC operator's screen by passively splitting the RGB or DVI video signal to the display. The recording of the display's video signal is system independent and guarantees a faithful record of screen activity. Multiple screens covering each sector can be recorded through a single interface so that both the executive (radar) controller and the planner controller's screens can be effectively managed and replayed.

Business Objectives

Compliance with ICAO requirement for radar recording through screen capture.

Assumptions

None.

Advantages

- ▶ Recording system is completely independent of the radar processing system
- ▶ Does not affect safety case of radar system
- ▶ All user actions as well as the displayed radar will be recorded
- ▶ Recorder can be set to alarm if video signal not present
- ▶ Ideal solution for training purposes as it faithfully recreates the controller's screen
- ▶ Captured screen images can be merged with the recorded audio and exported into industry standard formats for replay in a standard Windows media player.

Disadvantages

- ▶ Detailed interrogation of the radar data is not possible
- ▶ Data hungry; fully documented API required to minimise data storage by stopping recording on log out
- ▶ To avoid affecting the safety case of display system a video isolator is required
- ▶ Careful consideration of the transmission from screen to central position is required including placement of recorders and effective use of splitters and drivers

Replay

Replay on a standard desktop PC.

Cost Index

Cost index = 2 (where 1 = low, 5 = high)

Option 4 – X Server screen capture

Background

Screen capture system that provides detail of controller interaction by recording the ATC operator's screen via the radar system network. The X Server solution provides relatively low data storage requirements but is system dependent and will reflect system inaccuracies.

Business Objectives

Compliance with ICAO requirement for radar recording through screen capture.

Advantages

- ▶ All user actions as well as all the displayed graphics will be recorded

Disadvantages

- ▶ System dependent
- ▶ Detailed interrogation of the radar data is not possible
- ▶ Support for X Server interfaces dependent upon manufacturer's specification
- ▶ Audio synchronisation complicated by X Windows not being designed to operate in real time
- ▶ May affect safety case of display system software

Replay

Replay through the recording system via desktop PC.

Cost Index

Cost index = 3 (where 1 = low, 5 = high)

Option 5 – Network Recording

Background

Radar data is generally delivered from remote radar heads to radar processors and displays using modems and telephone or dedicated data lines. However the radar data is often distributed within the centre using IP based protocols, allowing it to be recorded from a single user configurable port.

Business Objectives

Compliance with ICAO requirements for radar recording by recording radar data.

Assumptions

Consult your network provider for network protocol information.

Advantages

- ▶ All the processed radar data can be recorded without the need for expensive interface cards
- ▶ Data can be re-transmitted as sync / async serial data with additional interface cards

Disadvantages

- ▶ Network dependent
- ▶ Replay latency could be variable due to system functions
- ▶ Radar recording is not 'independent' of radar system
- ▶ Support for network recording dependent upon manufacturer's specification
- ▶ Audio synchronisation complicated by network latency

Replay

Replay through existing radar system.

Cost Index

Cost index = 3 (where 1 = low, 5 = high)

Recommended Solution

It is recommended that consideration is given to a combination of screen capture (Option 3 or 4) and plot extracted radar recording (Options 1, 2 or 5) solutions, which together offer the utmost detail for accident and incident investigation and will ensure that your airport is fully compliant with ICAO legislation.

	Option 1: Primary Radar Recording	Option 2: Secondary Surveillance Radar Recording	Option 3: Passive Screen Capture of CWP	Option 4: X Server Screen Capture	Option 5: Network Recording	Combination of Option 1/2/5 with 3/4
Primary Radar data detail	✓✓	✗	✓✓	✓	✓✓	✓✓
Secondary Radar data detail	✗	✓✓	✓✓	✓	✓✓	✓✓
User actions detail	✗	✗	✓✓	✓✓	✗	✓✓
Ease of replay	✓	✓✓	✓✓	✓✓	✓	✓✓
Cost Index	✓	✓✓	✓✓	✓	✓	✓

Table 1: Analysis of different options for Radar Recording

✗ = unsatisfactory, ✓ = satisfactory, ✓✓ = excellent

Step 3: What should I do?

If you have an existing audio recording system that is fully compliant with ICAO requirements for audio recording:

- ▶ It is recommended that you discuss any differences between your airport's capabilities and ICAO requirements for radar recording with your Civil Aviation Authority.
- ▶ If you do not plan to replace your audio or radar system and your radar data needs to be recorded consult your audio and radar system manufacturers.

If you are going to replace your audio system:

- ▶ When upgrading any part of your recording system, the new ICAO requirements for radar recording must be complied with.
- ▶ Whilst it is possible to have separate solutions for recording audio and radar, utilising the same interface will reduce operator time and allow audio and radar to be synchronised.
- ▶ Consider how best to anticipate future legislation discussed in Section 1a-c in order to make the right choice in terms of flexibility and scalability.

If you are replacing or upgrading your radar system:

- ▶ When replacing or upgrading any part of your radar system, you need to comply with the new ICAO requirements for radar recording.
- ▶ Consult your local ICAO compliance offer for situation-specific information.

Summary

It is not enough for airports to simply satisfy the requirements of one local organisation; airports must be aware of all requirements that currently apply as well as understanding how legislation is likely to change in the future when recommendations become mandated requirements and further recommendations are added.

Leading radar recording products can provide the solution to all known requirements of radar recording with the benefit of audio synchronisation. They offer the flexibility of a single recording solution that is independent of radar processing systems, and therefore provide guaranteed data integrity.

References

1. ICAO State Letter reference AN 13/13/1-05/37 issued on the 24th March 2005, entitled "adoption of Amendment 43 to Annex 11".
2. Eurocontrol document reference Sur.ET1.St01-1000.STD-01-01, "Radar Surveillance in En-Route Airspace and Major Terminal Areas".
3. EUROCAE document ED-111, Chapter 4.
4. International Civil Aviation Organization (ICAO) Contracting States, http://www.icao.int/cgi/goto_m.pl?icao/en/howworks.htm .
5. International Civil Aviation Organization (ICAO) website, www.icao.int .
6. ICAO Annex 11 to the convention on International Civil Aviation section 6.4 Aeronautical radio navigation services.
7. Eurocontrol website, http://www.eurocontrol.int/eatm/public/subsite_homepage/homepage.html
8. United Kingdom Civil Aviation Authority website, www.caa.co.uk .
9. CAP670 initially produced 1998, now at revision 1/06, dated 30th June 2006, <http://www.caa.co.uk/application.aspx?categoryid=33&pagetype=65&applicationid=11&mode=detail&id=200> .

Glossary

ATC: Air Traffic Control

CWP: Controller Working Position

EuroCAE: European Organisation for Civil Aviation Equipment)

ICAO: International Civil Aviation Organisation

Primary Radar: A Radar in which the return signals are the echoes obtained by reflection from the target.

RTQC: Real Time Quality Control

SRG: Safety Regulation Group

Secondary Radar: A Radar in which the return signals are obtained from a beacon, transponder, or repeater carried by the target.

UKCAA: United Kingdom Civil Aviation Authority