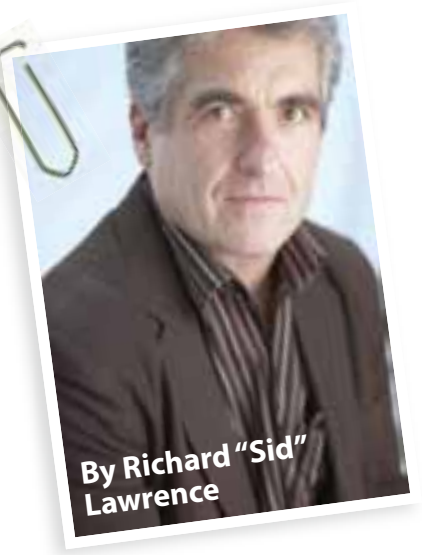

SAFETY REMINDER MESSAGE

Interceptions of Civil Operation of SSR and

Released on 22 December 2011

Synopsis

EUROCONTROL has learnt of incidences where flight safety has been compromised and unnecessary TCAS Resolution Advisories (RAs) triggered during interceptions of civil aircraft because of misunderstanding regarding the operation of aircraft transponders and the properties of ACAS II.

"During the past few months the EUROCONTROL Safety Alert service has been approached by a number of stakeholders requesting the promulgation of a Safety Alert covering a variety of topics. In the pages that follow, I will describe two of the Alerts that I hope will spark your interest.

As previously, my intention is to try and bring new information to the table. The aim is to feature more in the way of feedback, responses, comment and analysis to get the most from each Alert.

If you would like to know more about the EUROCONTROL Safety Alert service, register as a subscriber, submit a suggestion or have a subject that you wish to consider then please contact me at ***richard.lawrence@eurocontrol.int.***

The first alert is a Safety Reminder Message, "Interceptions of Civil Aircraft – Operation of SSR and ACAS II" ..."

ICAO Provisions – ACAS II

- **PANS OPS (Doc 8168, Vol I),**
  Definitions: "Airborne collision avoidance system (ACAS). An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders."
  Chapter 3, § 3.1.1 "Resolution Advisories (RAs)… propose vertical manoeuvres that are predicted to increase or maintain separation from threatening aircraft."

- **Annex 6, § 6.18.2:** "…all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5,700 kg or authorized to carry more than 19 passengers shall be equipped with an airborne collision avoidance system(ACAS II)."

ICAO Provisions – Interception of Civil Aircraft

- **Annex 2, Chapter 3, § 3.8.1, Note.** "As interceptions of civil aircraft are, in all cases, potentially hazardous, the Council has formulated special recommendations which Contracting States are urged to apply in a uniform manner".

- **Annex 2, Appendix 1, Attachment A, § 3, 3.2:** "An aircraft equipped with an airborne collision avoidance system (ACAS), which is being intercepted, may perceive the interceptor as a collision threat and thus initiate an avoidance manoeuvre in response to an ACAS resolution advisory. Such a manoeuvre might be misinterpreted by the interceptor as an indication of unfriendly intentions. ***It is important, therefore, that pilots of intercepting aircraft equipped with a secondary surveillance radar (SSR) transponder suppress the transmission of pressure-altitude information (in Mode C) replies or in the AC field of Mode S replies) within a range of at least 37 km (20 NM) of the aircraft being intercepted."*** (Note: ***Bold*** text is EUROCONTROL emphasis)

Alternatively, register your interest through the EUROCONTROL Website – Safety Alerts Board ***http://www.eurocontrol.int/safety/public/standard_page/safety_alert_board.html*** *or go to SKYbrary:* ***http://www.skybrary.aero/index.php/Portal:EUROCONTROL_Safety_Alerts*** *to access the Alerts featured here and all previous Alerts.*

Aircraft - ACAS II

■ **ICAO Doc 9863: Airborne Collision Avoidance System (ACAS) Manual, Appendix 7**

"A7.2 ADVICE FOR NON-MODE S-EQUIPPED FIGHTER AIRCRAFT

A7.2.1 Arrangements to be used by military fighter aircraft for covert intercepts

A7.2.1.1 When closing in on an aircraft to be intercepted, the military pilot disables Mode C. (Some military users switch the transponder off or to "Standby" resulting in no reply to any interrogation.) In this procedure, the lack of altitude information will prevent all RAs.

A7.2.1.2 At least under peace-time conditions, Mode A transmissions should be enabled at all times to make the fighter aircraft visible for SSR/IFF ground radar systems (but without altitude information).

A7.2.2 Arrangements to be used by military fighter for demonstrative intercepts

A7.2.2.1 During this type of intercept, it is highly desirable to avoid RAs, even though the intercepted aircraft detects the approaching Interceptor. There is no other alternative for non-Mode S-equipped fighters than to eliminate the altitude value in Mode C messages. In this case, only the framing pulses will be transmitted. If there is no altitude value in the Mode C messages, ACAS will detect the military aircraft, but only TAs can be generated. Ground-based systems can track the fighter aircraft, but without altitude information.

A7.2.2.2 There should be an indication on the control panel or the IFF function display of the fighter aircraft when the altitude reply information is inhibited in this way.

A7.3 ADVICE FOR MODE S-EQUIPPED FIGHTER AIRCRAFT

A7.3.1 Covert intercepts are intended to prevent the fighter from responding to ACAS interrogations while the fighter can still respond to ATC ground-based interrogations.

A7.3.1.1 In this case, the intercepting pilot will select an Intercept Mode. Under these conditions all replies to UFΦ (short air-air surveillance) and UF16 (long air-air surveillance) interrogations will be suppressed. Nevertheless the fighter's transponder will respond to all ground-based ATC system interrogations. Therefore, the fighter remains visible to ATC.

A7.3.1.2 The fighter with activated Intercept Mode will continue to be a threat to all ACAS-equipped aircraft, if the Intercept Mode is not cancelled after the end of the mission.

A7.3.2 Demonstrative intercepts are intended to keep the Interceptor visible to both the intercepted aircraft and to ground surveillance.

A7.3.2.1 To avoid that an ACAS-equipped aircraft generates an RA against an approaching Mode S-equipped fighter, the height value in ACAS replies (DF 0 or 16) must be suppressed, but replies are still available for Mode S ground interrogations. If there is no altitude information in the replies to ACAS interrogations, the fighter will be recognized by ACAS, but only TAs can be generated. For ground-based Mode S interrogators there will be no difference from the normal behaviour, and the controllers have control of the whole air situation.

A7.3.2.2 A software change will be necessary to military Mode S transponders on fighter aircraft, and when the Intercept Mode is enabled there should be an indication within the pilot's normal viewing area."

SAFETY REMINDER MESSAGE (CONT'D)

Analysis

Regarding the actions when an RA is generated, according to **PANS OPS, Chapter 3, § 3.2,(c)** "…in the event of an RA, pilots shall respond immediately by following the RA as indicated, unless doing so would jeopardize the safety of the aeroplane." So, pilots will "follow the RA".

Regarding the suppression of Mode C data, the situation varies between those aircraft that are Mode S-equipped and those that are not. For the latter, depending on the type of intercept being conducted, the intercepting aircraft's SSR Mode C should be inhibited as per **ICAO Doc 9863, § A7.2.** This will preserve flight safety whilst still permitting the prosecution of the intercept.

However, for those fighter aircraft that are Mode S-equipped the picture is less clear. Only very few air forces' interceptors currently have the Mode S Intercept Mode available and pilots of these aircraft can follow the advice in **ICAO Doc 9863, § A7.3** above. This de-activates the air-to-air communication of Mode C data but preserves the air-to-ground link so that controllers can still see the interceptor and its altitude. For those Mode S-equipped fighters that do not have Intercept Mode capability, the issue is that Mode S continues to send out altitude information to all air and ground receivers even if the Mode C element is suppressed.

The solution to this difficulty, adopted by a number of air forces, is for the interceptor to switch OFF the Mode S transponder, in total, at the appropriate point in the interception. The pilot can still relay altitude information to the military control authority who in turn can advise their civilian counterparts. To enable this to happen safely there needs to be explicit and detailed cooperation and coordination between the military authorities controlling the interceptor and the civilian authorities controlling the intercepted aircraft (as is required by ICAO Annex 2).

Finally, military flight crews should also be aware that, since ACAS II will not track any aircraft with a vertical rate in excess of 10,000ft/min, operating outside these parameters during an intercept will render ACAS II ineffective.

Your attention is required

State Military and Civil Authorities are invited to take note of the subject and ensure that their national regulations and administrative directives relating to the interception of civil aircraft comply with ICAO Annex 2 and follow the advice contained in ICAO Doc 9863.

Aircraft Operators and Air Navigation Service Providers are invited to note the subject for information and awareness.

EUROCONTROL Comment

The interception of civil aircraft clearly requires close cooperation and coordination between the authorities prosecuting the mission, i.e. the military pilots and military air defence/ATC, and the civil ATC provider looking after the civil aircraft.

Within Europe, the NATO EUROCONTROL ATM Security Coordination Group (NEASCOG) monitors these activities and takes any necessary steps to ensure such operations are conducted safely and efficiently.

Further reading

- SKYbrary - ACAS
- EUROCONTROL ACAS II Training Brochure: http://www.eurocontrol.int/msa/gallery/content/public/documents/ACAS_training_ver20.pdf
- ICAO Annexes 6 and 10 (Volume IV).
- ICAO Doc 4444, PANS ATM.
- ICAO Doc 9433 - Manual concerning Interception of Civil Aircraft: (4.1.2.16, Note).