



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

MINIMUM AVIATION SYSTEM PERFORMANCE SPECIFICATION (MASPS) FOR FLIGHT GUIDANCE SYSTEM (FGS) COUPLED TO TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

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5. Copies of this document may be obtained from:

EUROCAE

102, rue Etienne Dolet

92240 MALAKOFF

France

Telephone: 33 1 40 92 79 30

Fax: 33 1 46 55 62 65

Email: eurocae@eurocae.net

Website: www.eurocae.net

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CHAPTER 1

PURPOSE AND SCOPE

1.1 INTRODUCTION

This document contains Minimum Aviation System Performance Specification (MASPS) for Flight Guidance System (FGS) coupled to the Traffic alert and Collision Avoidance System (TCAS). These standards specify system characteristics that should provide guidance to designers, manufacturers, installers and users of the system and equipment.

These standards do not address the operational procedures governing TA/RAs, in particular the reporting of RAs to controllers by flight crew is not part of the system that is described.

- Section 2 of this document provides Minimum Performance requirement for the intended functions.
- Section 3 of this document provides a set of acceptable test procedures to show compliance demonstration of the performance requirements.

Compliance with these standards is recommended as one means of assuring that the system/equipment will perform its intended functions(s) satisfactorily under all conditions normally encountered in routine aeronautical operation. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies.

The intended users of this MASPS are those providing FGS coupling to TCAS: The MASPS therefore apply potentially to any aircraft fitted with TCAS II. This can include jet airline aircraft, regional airline aircraft, general aviation turbine-powered aircraft and helicopters.

1.2 SYSTEMS OVERVIEW

1.2.1 Flight Guidance System (FGS)

A Flight Guidance System (FGS) usually includes the following functions:

- an Autopilot that provides aircraft guidance
- a Flight Director that provides display cues to support manual piloting
- an Autothrust that provides thrust control.

Some FGS implementations may not contain all of the above functions. In this case, the requirements included in this MASPS only apply to the implemented functions.

1.2.2 Traffic Alert and Collision Avoidance System (TCAS II)

The Traffic alert and Collision Avoidance System (TCAS II) system considered in this document is TCAS II version 7.1 (as described by [ED-143/DO-185B]) that provides Traffic Advisories (TA) and Resolution Advisories (RA) in the vertical dimension to either increase or maintain the existing vertical separation between aircraft. The requirements below will have to be updated for any future Collision Avoidance system that has:

- lateral manoeuvre guidance.
- a different set of vertical manoeuvres.
- a different set of vertical manoeuvre assumptions.

1.2.3 FGS Coupled to TCAS

The purpose of this document is to provide guidance when designing, installing and testing Flight Guidance System coupling to TCAS. It includes two possible functions:

- Automatic guidance (Autopilot) and/or display cues to support pilot guidance (Flight Director) upon Resolution Advisories. This function is called hereunder Autopilot/flight director TCAS RA mode. Requirements applicable to this function are included in section 2.1 of this document.
- Automatic vertical speed reduction near altitude target when aware of nearby traffic at or approaching an adjacent altitude or flight level. Requirements applicable to this function are included in section 2.2 of this document.

1.2.4 Requirement Allocation

The function requirement included in section 2 of this document do not apply to The Traffic alert and Collision Avoidance System (TCAS II). All requirements applying to this equipment are included in [ED-143/DO-185B]. No specific interfaces are required on TCAS to be able to perform the functions described in this document.

The functional requirement of section 2 applies to the Flight Guidance System, including associated displays and warnings. As there exist many implementations of the Flight Guidance System, this document does not intend to define an allocation of requirement to equipments, nor to define tests at equipment level.

Section 3 includes tests that may be performed at equipment level, however the general intend of the section 3 is to define test at function level, once integrated on the aircraft.

1.3 REFERENCES

[ED-143/DO-185B]	Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) Airborne Equipment
[DO-325 AppC]	Minimum Operational Performance Standards for Automatic Flight Guidance and Control System and Equipment Appendix C
[AC20-151A]	Airworthiness approval of Traffic Alert and Collision Avoidance Systems (TCAS II) Version 7.1 and associated Mode S Transponders
[AC120-55C]	Air Carrier Operational Approval and Use of TCAS II
[TCAP VR]	SESAR 4.8.2 D03: Validation Report -TCAP Validation report for new possible altitude capture laws
[TCAP SPR]	SESAR 4.8.2 D04: Safety and Performance Requirements for new possible altitude capture laws
[APFD VR]	SESAR 4.8.2 D06: Validation Report -APFD Validation report for automatic responses to ACAS RA
[ER-11]	Validation of the FGS coupled to TCAS MASPS requirements
[ICAO 9863]	Airborne Collision Avoidance System (ACAS) Manual 2nd Edition.
[APFD SPR]	SESAR 4.8.2 D07: Safety and Performance Requirements for automatic responses to ACAS RAs
[ACAS Man]	ICAO Airborne Collision Avoidance System (ACAS) Manual. Doc 9863 AN/461

1.4

GLOSSARY

ACAS ¹	Airborne Collision Avoidance System
FGS	Flight Guidance System
AMC	Acceptable Means of Compliance
DFDR	Digital Flight Data Recorder
fpm	feet per minute
ft	feet
g	gravity force
HUD	Head Up Display
ICAO	International Civil Aviation Organization
m	metre
m/s	metres per second
MASPS	Minimum Aviation System Performance Specification
MOPS	Minimum Operational Performance Standards
PFD	Primary Flight Display
RA	Resolution Advisory
s	seconds
TA	Traffic Advisory
TCAS	Traffic alert and Collision Avoidance System
VSI	Vertical Speed Indicator
VSL	Vertical Speed Limit

¹ The term ACAS is used when it comes from existing document that uses this term. Elsewhere, the term TCAS is used. No distinction is intended.

CHAPTER 2

FUNCTION REQUIREMENTS

2.1 AUTOPILOT/FLIGHT DIRECTOR/AUTOTHRUST COUPLED TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEMS (TCAS) RESOLUTION ADVISORY (RA) MODE

If implementing Autopilot and/or Flight Director and/or Autothrust TCAS RA mode, the following requirements and guidance apply:

2.1.1 Autopilot/Flight Director TCAS RA Mode

- a. For CS 25 aircraft, the Autopilot, Flight Director, and Autothrust functions should meet the performance and functional requirements of CS 25.1329 and its associated AMC (Acceptable Means of Compliance).
- b. For CS 23, CS 27 and CS 29 aircraft categories, the Autopilot should meet the performance and functional requirements of the respective CS XX.1329.
- c. For CS 23, CS 27 and CS 29 aircraft categories, the Flight Director should meet the performance and functional requirements of the respective CS XX.1335.

2.1.1.1 Aircraft Manuals

- a. A detailed description of the installed system and recommended flight crew operating procedures **shall** be provided for use of the TCAS, to include the impact on normal flight crew operating procedures, abnormal operating procedures and any limitations associated with the flight crew's use of the TCAS implementation through Autopilot coupled operations. This **shall** supplement recommendations for flight crew response to a TCAS Resolution Advisory when manually flown following Flight Director commands.
- b. The Aircraft Flight Manual should provide at least the following information:
 - “9.1 Limitations:
 - (a) Deviation from the ATC assigned altitude is authorised only to the extent necessary to comply with an ACAS¹ Resolution Advisory (RA).
 - (b) If applicable, any limitation of use of the Autopilot/Flight director TCAS RA mode.
 - 9.2 Emergency Procedure:

None
 - 9.3 Normal Procedures:

The ACAS flight procedures should address the following:

 - (a) For a non-crossing RA, to avoid negating the effectiveness of a co-ordinated manoeuvre by the intruder aircraft, advice that vertical speed should be accurately monitored to comply with the RA.
 - (b) For a crossing RA, a warning that non-compliance by one aircraft can result in reduced vertical separation with the need to achieve safe horizontal separation by visual means.
 - (c) A caution that under certain conditions, commanded manoeuvres may conflict with FGS speed envelope protection and may significantly reduce stall margins. Expected crew procedure in such situation should be defined, including the need to respect the stall warning where this may occur.
 - (d) When a Climb RA is given with the aircraft in landing configuration, a normal go-around procedure should be considered.

- (e) Where some aircraft of the same type can be operated with or without Autopilot/Flight Director TCAS RA, a procedure should consider that the crew may not be aware whether or not Autopilot/Flight Director TCAS RA is installed. (Some aircraft fitted with the Autopilot/Flight Director TCAS RA mode and some not fitted, where the RA manoeuvre is expected to be executed by the crew.)"

2.1.1.2 Autopilot/Flight Director TCAS RA Mode Engagement/Disengagement

The ICAO ACAS1 Manual [ACAS Man] defines the intended crew reaction to a TCAS Resolution Advisory:

"5.2.3.3.1 Operating in TA/RA mode and then not following an RA is potentially dangerous. If an aircraft does not intend to respond to an RA and operates in the TA-only mode, other ACAS1-equipped aircraft operating in TA/RA mode will have maximum flexibility in issuing RAs to resolve encounters."

- a. If the system is designed so that the Autopilot/Flight Director TCAS RA mode engages automatically when a TCAS Resolution Advisory occurs, arming of the Autopilot/Flight Director TCAS RA mode at Traffic Advisory should be provided.

NOTE: *This recommendation has been found as an acceptable means to comply with §2.1.1.1 Normal procedure (e) and §2.1.1.6.b.2.*

- b. The Autopilot TCAS RA mode **shall** allow manual disengagement (i.e. flight crew interruption of automatic response to an ongoing RA).

NOTE 1: *The ability of the pilot to disengage the Autopilot/Flight Director automatic RA response needs to be demonstrated, including the impact on the TCAS (if any), flight control and aircraft behaviour in the event of pilot selection of Autopilot OFF during any stage of an Autopilot driven RA manoeuvre, along with how RA Flight Director commands can be de-selected and the aircraft subsequently returned to normal flight.*

NOTE 2: *The Autopilot Flight director TCAS RA mode may be temporally inhibited by pilot selection preferably prior to TA or RA (pilot inhibition does not prevent the issuance TCAS TA's or RA's). The temporary inhibition of the engagement mode needs to be indicated to the crew and limited to the shortest possible time (for example after the forthcoming TA/RA sequence).*

NOTE 3: *If the aircraft is considered not capable to follow RAs, it would be desirable that the pilot switches TCAS to TA-only mode. Such conditions are described in [ICAO 9863] 5.2.3 and [AC120-55C] 12. d (5).*

2.1.1.3 Autopilot/Flight Director TCAS RA Mode Behaviour

- a. The Autopilot/Flight Director TCAS **shall** be informed of each RA occurrence, update and termination, together with the type of the RA and either the vertical speed prescribed by the RA (if corrective) or the range of vertical speeds prohibited by the RA (if preventive).
- b. The Autopilot/Flight Director TCAS RA mode **shall** exhibit behaviour consistent with existing Autopilot/Flight Director modes behaviour and TCAS commands and warnings. In particular, if the Autopilot/Flight Director already offers mode(s) intended to protect the aircraft from hazards, activated automatically and possibly taking priority over the modes previously engaged by the crew, then the Autopilot/Flight Director TCAS RA mode should be indicated in a similar manner to those other hazard protection mode(s).
- c. The Autopilot/Flight Director TCAS RA mode **shall** be distinguishable from all other Autopilot/Flight Director modes

NOTE 1: *For example, Vertical Speed mode must not be used as a TCAS RA mode indication unless it is made distinguishable from basic Vertical Speed mode.*

NOTE 2: *It is expected that a new Autopilot/Flight Director TCAS RA mode status (engagement and armament if applicable) will be recorded in the DFDR.*

- d. When a TCAS Traffic Advisory is issued, the Autopilot/Flight Director **shall** remain in its current mode of operation.
- e. All Autopilot and all Flight Director RA indications **shall not** conflict with any RA indications recommended by [ED-143/DO-185B].

NOTE: *The flight crew is provided with adequate means to monitor compliance to the Vertical Speed RA cues while the Autopilot/Flight Director RA manoeuvre is flown.*

- f. In cases where there is insufficient aircraft performance available to comply with the displayed RA while manoeuvring laterally the vertical response should have priority.
- g. Subject to f, the Autopilot/Flight Director TCAS RA mode should have no effect on lateral guidance objectives. In particular, it should not lead to loss of Localizer capture or loss of Navigation mode.
- h. When a TCAS "Clear of conflict" is generated following a corrective RA, the Autopilot/Flight Director TCAS RA mode behaviour **shall** be predictable.

NOTE: *Autopilot/Flight Director may be used to assist in returning to the vertical path and altitude being maintained prior to the display of a corrective RA. §2.1.1.4.j proposes acceptable means to comply with this requirement.*

- i. If the aircraft is fitted with an alerting devices when reaching and/or leaving the targeted altitude, the alerting device should be inhibited when an RA is generated.

2.1.1.4 Autopilot/Flight Director TCAS RA Guidance

- a. Autopilot/Flight Director TCAS RA guidance performance **shall** be equivalent or better than manually flown manoeuvres described in [ED-143/DO-185B].

NOTE: *[ED-143/DO-185B] assumes the following aircraft response:*

- *A delay of 5s and a vertical acceleration of 0.25 g for the initial RA.*
- *A delay of 2.5s and a vertical acceleration of 0.35g for a reversal or for an increased rate RAs.*
- *Vertical speed stabilised at the requested rate.*

- b. Autopilot/Flight Director TCAS RA guidance target may include a tolerance (see Note 2) versus the required TCAS target but it **shall** be away from the No-Fly-Zone (the TCAS "Red Zone").

NOTE 1: *[ED-143/DO-185B], section 2.2.6.2.2.1.2 states: "...The nominal size of the green arc shall be approximately that defined by the distance between the 1,500 and 2,000 fpm marks on the vertical speed indicator scale. The size of the green arc shall remain constant no matter where the arc is placed on the display, with the exception of the multi-aircraft encounter described in subparagraph 2.2.6.2.2.1.4." When TCAS issues a climb (1,500 fpm), the green arc is allowed to go above 1,500, but not below.*

NOTE 2: *Requirements §2.1.1.4.d, e, g and h propose a margin that has been shown to be acceptable.*

- c. When the Autopilot/Flight Director TCAS RA mode engages in response to a monitor vertical speed Resolution Advisory, the Autopilot/Flight Director TCAS RA mode **shall** still proceed with any altitude capture that was performed by the previous Autopilot mode.

Assuming the Autopilot/Flight Director TCAS RA mode engages automatically when a TCAS Resolution Advisory occurs, respecting the requirements §2.1.1.4.d to §2.1.1.4.j allows complying with requirement 2.1.1.4.a. as demonstrated in [APFD VR] and [ER-11].

- If the implementation does not comply with requirement §2.1.1.4.d to §2.1.1.4.j then alternate means of compliance with 2.1.1.4.a **shall** be proposed.
- If the implementation is such that engagement of the Autopilot/Flight Director TCAS RA mode is performed through a manual crew selection, compliance with 2.1.1.4.a. cannot rely on the requirements §2.1.1.4.c to §2.1.1.4.j as additional crew delay must be considered. In such case, alternate means of compliance with 2.1.1.4.a **shall** be proposed.
- d. In response to a corrective Resolution Advisory prescribing a positive vertical speed, when engaged in the normal flight envelope and while not limited by speed protection (if any), the Autopilot/Flight Director TCAS RA mode **shall** fly the aircraft towards a target vertical speed equal to the vertical speed prescribed by the current RA plus 200 fpm to help flight crew monitoring of the RA response.

NOTE: *Other margins may be acceptable provided they are evaluated.*

- e. In response to a corrective Resolution Advisory prescribing a negative vertical speed, when engaged in the normal flight envelope and while not limited by speed protection (if any), the Autopilot/Flight Director TCAS RA mode **shall** fly the aircraft towards a target vertical speed equal to the vertical speed prescribed by the current RA minus 200 fpm to help flight crew monitoring of the RA response.

NOTE: *Other margins may be acceptable provided they are evaluated.*

- f. In response to a corrective Resolution Advisory prescribing a null vertical speed, when engaged in the normal flight envelope and while not limited by speed protection (if any), the Autopilot/Flight Director TCAS RA mode **shall** fly the aircraft towards a target vertical speed equal to the vertical speed prescribed by the current RA (i.e. 0 fpm).
- g. In response to a preventive Resolution Advisory that does not include the aircraft current vertical speed in its range of prohibited vertical speeds, when engaged in the normal flight envelope and while not limited by speed protection (if any), the Autopilot/Flight Director TCAS RA mode **shall** continue to fly the intended trajectory while maintaining the current vertical speed outside the range of forbidden vertical speeds. A margin of 200fpm **shall** be applied (as prescribed in §2.2.4.1.d and §2.2.4.1.e) except when the vertical speed limit is the null vertical speed.

NOTE: *When the RA only prohibits strictly positive or strictly negative vertical speeds, no margins are to added. The use of such margins in this case would cause aircraft to leave level flight unnecessarily.*

- h. In response to a preventive Resolution Advisory that does include the aircraft current vertical speed in its range of prohibited vertical speeds, when engaged in the normal flight envelope and while not limited by speed protection (if any), the Autopilot/Flight Director TCAS RA mode **shall** change the current vertical speed to be outside the range of forbidden vertical speeds. A margin of 200fpm **shall** be applied (as prescribed in §2.2.4.1.d and §2.2.4.1.e) except when the vertical speed limit is the null vertical speed.

- i. When engaged in normal flight envelope and while it is not limited by speed protection (if any), the Autopilot/Flight Director TCAS RA mode **shall** fly the aircraft on a vertical trajectory that provides a vertical displacement at least as large as the one that would be provided by at least one of the following responses applied to all Resolution Advisories:
 - (a) a delay of no more than 3 seconds and a vertical acceleration of at least 0.15 g;
 - or
 - (b) a delay of no more than 4 seconds and a vertical acceleration of at least 0.20 g;
 - or
 - (c) a delay of no more than 5 seconds and a vertical acceleration of at least 0.25 g.

NOTE: *These response parameters are applied to all RAs (i.e. including Increase and Reverse RAs).*
- j. When a corrective Resolution Advisory is terminated, the Autopilot/Flight Director TCAS RA mode **shall** guide the aircraft to the selected altitude.

NOTE 1: *An RA is generally terminated with a "Clear of Conflict" annunciation. It can be terminated without this annunciation in some cases: when the ownship aircraft passes below 900 ft height, in case of terrain alert, wind shear alert, stall warning, TA only mode selection, etc.*

NOTE 2: *This requirement assumes the Autopilot/Flight Director is designed to assist in returning to the altitude being maintained prior to the display of a corrective RA and such an implementation is consistent with the intent of §2.1.1.3.h. Other solutions may be acceptable but have not been evaluated.*

2.1.1.5 Autopilot/Flight Director TCAS RA and Speed Envelope Protection

- a. Since FGS speed protection may limit aircraft actual response in such a way that the TCAS vertical speed command will not be reached, the Autopilot/Flight Director TCAS RA guidance **shall** consider the behaviour of speed envelope protection during TCAS guidance including associated alerts.
- b. The Flight Director TCAS RA guidance **shall** not guide the aircraft into a stall condition when initiated in the normal flight envelope.
- c. The Autopilot TCAS RA guidance should not induce automatic autopilot disengagement when initiated in the normal flight envelope.
- d. Autopilot/Flight Director speed envelope protection **shall** take priority over responding to TCAS RAs. In case of vertical performance limitations leading to an under-response with respect to the TCAS expectations, the Autopilot/Flight Director TCAS RA mode **shall** remain engaged.

NOTE: *It is preferable to perform a manoeuvre even with a vertical rate lower than that expected by TCAS rather than using the existing RA climb inhibition feature. The Climb inhibition feature is to be implemented only to comply with [AC 20-151A].*
- e. Besides existing display devices, if the Autopilot/Flight Director TCAS function provides a dedicated indication to the flight crew that the Autopilot/Flight Director TCAS RA mode cannot achieve or maintain its target vertical speed due to vertical performance limitations, appropriate procedures and training requirements **shall** be defined to avoid improper crew response, such as reaction opposite to the current Resolution Advisory.

2.1.1.6 Autopilot/Flight Director TCAS RA Failures

- a. The Autopilot/Flight Director **shall** consider TCAS behaviour in all cases where a Resolution Advisory may be aborted without “Clear of conflict” (aircraft passes below 900 ft height, Terrain alert, Windshear alert, stall warning, TA only mode selection, etc.). The Autopilot/Flight Director TCAS RA mode behaviour **shall** be predictable in such conditions.
- b. Loss of availability of the Autoflight/Flight Director TCAS RA mode:
 1. The loss of availability of the Autopilot/Flight Director TCAS RA mode while the TCAS RA mode is engaged **shall** result in both an aural and visual alert to flight crew so that flight crew can take appropriate actions.
 2. The loss of availability of the Autopilot/Flight Director TCAS RA mode **shall** be obvious to the flight crew before RA mode engages unless the Autopilot/ Flight Director TCAS RA mode is manually selectable.
- c. The Autopilot/Flight Director TCAS RA mode **shall** consider the effect of failures that may differ from other autopilot modes such as:
 - TCAS failure during an RA manoeuvre;
 - Autopilot/Flight Director failure during an RA manoeuvre;
- d. New failure modes in the Autopilot/Flight Director/Autothrust, TCAS system as well as wiring faults should be assessed in the system safety assessment and validated and substantiated through simulation and flight test.

2.1.2 Autopilot/Flight Director/Autothrust TCAS Mode

- a. Autopilot/Flight Director TCAS mode **shall** interact compatibly with Autothrust modes and engagement status.
- b. If the aircraft is fitted with Autothrust, Autothrust should be engaged when Autopilot/Flight Director TCAS RA mode engages.

NOTE: *This does not preclude implementation of Autopilot/Flight Director TCAS RA mode without Autothrust.*

2.1.3 RA Displays

The guidance in this subsection is specific to an Autopilot/Flight Director/Autothrust implementation (or some combination thereof).

- a. If the design provides visual TCAS RA pitch cues for a pilot to follow, they should also comply with the requirements in [ED-143/DO-185B]. That document contains requirements for TCAS RA displays. Refer to paragraph [ED-143/DO-185B], paragraph 2.2.6.2, RA Displays.

NOTE: *[ED-143/DO-185B], §2.2.6.2, RA Displays specifies requirements for the following TCAS RA displays:*

§2.2.6.2.2 RA/Vertical Speed Indicator (VSI) (Round Dial);

§2.2.6.2.3 RA/VSI (Integrated Tape VSI on a Primary Flight Display (PFD));

§2.2.6.2.4 Pitch Cues on a PFD;

§2.2.6.2.5 Flight Director Guidance;

§2.2.6.2.6 Head-up display / Flight Path target.

- b. All Autopilot and/or Flight Director and/or Autothrust TCAS RA mode indications **shall not** conflict with any existing RA indications.

NOTE: *The flight crew is provided with adequate means to monitor compliance to the Vertical Speed RA guidance cues while the Autopilot/Flight Director flown RA manoeuvre is conducted.*

- c. If several TCAS RA guidance types are displayed simultaneously on a PFD or on a HUD (for example, Flight Director and Pitch cues on a PFD or Flight Path target on HUD), the combination of guidance types **shall** be shown to be compatible.

NOTE: *Simultaneous display of Flight Director guidance, and other RA guidance may present conflicting guidance cues to the pilot and are discouraged. (For example, guidance for altitude hold mode and other TCAS RA pitch cues/guidance on PFDs or HUDs).*

- d. PFD and HUD guidance **shall** be shown to be compatible.

2.2 AUTOPILOT AUTOMATIC VERTICAL SPEED REDUCTION NEAR ALTITUDE TARGET

2.2.1 Introduction

ICAO PANS OPS, 8168-OPS/611, Volume I, Part III, Section 3, Chapter 3, paragraph 3.3 requests aircraft climbing or descending to an assigned altitude or flight level, especially with an autopilot engaged, to reduce climb / descent rate to less than 8m/s (or 1500 fpm) throughout the last 300m (or 1000ft) of climb or descent to the assigned altitude or flight level when aware of another aircraft at or approaching an adjacent altitude or flight level, unless otherwise instructed by ATC. These procedures are intended to avoid unnecessary ACAS¹ II resolution advisories in aircraft at or approaching adjacent altitudes or flight levels.

With adequate TCAS and FGS integration, such recommendations can be part of an FGS's intended functions; performing such vertical speed reductions when approaching an assigned altitude target.

2.2.2 Altitude Acquire Vertical Speed Reduction

The intent of this function is not to have altitude acquire reducing vertical speed for every altitude capture, but to avoid a potential Resolution Advisory caused by TCAS when capturing altitude with nearby traffic at or approaching an adjacent altitude.

In the following paragraphs the following terms are used (Refer to Figure 1):

- The "Initial climb / descent Segment" refers to the initial trajectory.
- The "conventional altitude capture law" refers to the original trajectory between a steady climb/descent segment and level altitude segment. Note that the duration and time at which the conventional altitude capture law engages usually depends on initial vertical speed, aircraft speed and distance to targeted altitude.
- The "new altitude capture law" refers to the complete new trajectory from the steady climb/descent segment to a level altitude segment. This new trajectory is composed of 2 segments:
 - o A vertical speed reduction segment (where a given vertical speed is maintained).
 - o A final conventional altitude capture segment that makes the transition between the vertical speed segment and the altitude hold segment.

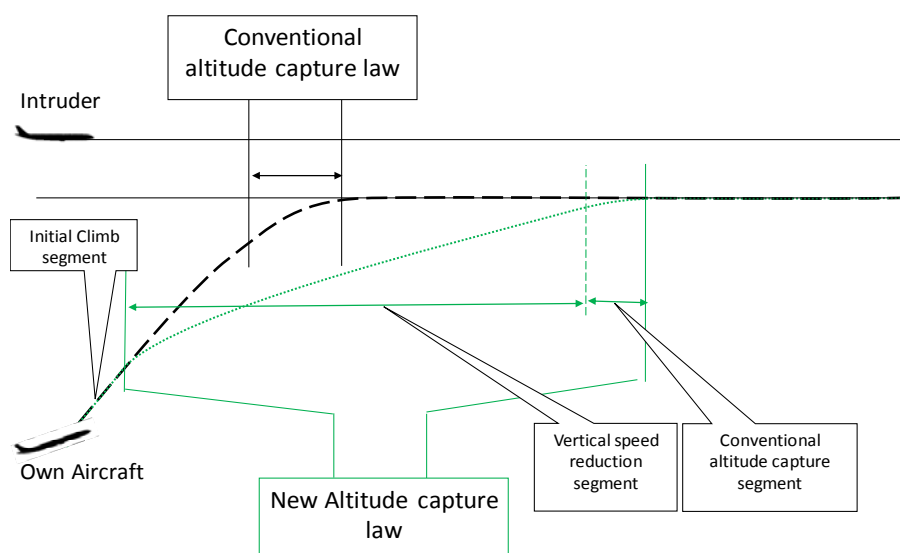


FIGURE 1: DEFINITION OF TERMS USED

2.2.2.1

Availability of the New Altitude Capture Law

- a. The new altitude capture law **shall** be available when the Autopilot or Flight Director is engaged.
- b. The new altitude capture law **shall** be available when the TCAS system is in 'TA/RA' or 'TA Only' modes. Note: Even when in "TA only mode", an own aircraft can result in an RA being triggered on-board an intruder aircraft (at, or approaching, an adjacent Flight Level) in a 1000 ft level-off encounter.
- c. The new altitude capture law **shall** be available when the Autopilot or Flight Director intends to perform an altitude capture as per Autopilot / Flight Director usual behaviour.

NOTE: *An example of Autopilot/ Flight Director usual behaviour can be aircraft convergence towards own selected altitude with conventional 'altitude capture' mode armed.*

- d. Precautions **shall** be taken to avoid the new altitude capture law activation close to the ground.

NOTE: *For example, inhibition in take-off and approach mode could be considered.*

- e. The new altitude capture law **shall** only be activated if the radio altimeter altitude of own aircraft is higher than 900 ft.

NOTE: *As the new altitude capture law is designed to reduce vertical speed, such reduction is not desirable at Take Off nor in approach close to the ground.*