1. PURPOSE

This Technical Bulletin provides an acceptable, but not the only, means to address Airborne Collision Avoidance System (ACAS) issues related to installation and use of ACAS II regarding compliance with RACs 4.2.2.11., 4.5.6.36. and 4.6.3.13.

2. DISTRIBUTION

This bulletin is intended to be used by all Air Safety Inspectors, Operations and Airworthiness, as apply.

3. BACKGROUND

ACAS systems are now implemented for operations in the Colombian air space and other applications. This Technical Bulletin provides information for Colombian air carriers, aircraft and ACAS manufacturers, various inspectors, foreign air carriers operating in Colombian airspace, and other aviation organizations regarding standard means acceptable to the UAEAC to establish and ensure continued compliance with the RACs related to ACAS. This information is intended to promote timely and comprehensive program implementation, to encourage development of standard practices for the application of ACAS, and to provide for suitable follow-up to ACAS events. The FAA international standard for Airborne Collision Avoidance System (ACAS) is referred to ACAS II.

4. RELATED REGULATIONS AND DOCUMENTS OR THEIR EQUIVALENT

a. RACs 4.2.2.11., 4.5.6.36., 4.6.3.13. and ICAO Annex 6, Part I.

b. UAEAC also recommends the use the following Federal Aviation Administration (FAA) ACs and Technical Standard Orders (TSO). ACs and TSOs may be obtained on the FAA Website:

(1) AC 20-131, Airworthiness and Operational Approval of Traffic Alert and Collision Avoidance Systems (ACAS II) and Mode S Transponders, current edition;

(2) TSO-C112, Air Traffic Control Radar Beacon System (ATCRBS/Mode S) Airborne Equipment; and

(3) TSO-C119A and TSO-C119B, Traffic Alert and Collision Avoidance System (ACAS) Airborne Equipment, ACAS II.

NOTE: Both TSO-C119A and TSO-C119B are in effect.

c. Also, the UAEAC uses as reference the RTCA Technical Standards Documents, as a mean to support this TB. These documents may be obtained on-line at www.rtca.org or from RTCA Secretariat, 1828 L Street, NW, Suite 807, Washington, D.C. 20036.

(1) DO-181C, Minimum Operational Performance Standards for ATCRBS/Mode S Airborne Equipment; and
(2) DO-185A, Minimum Operational Performance Standards for ACAS II Airborne Equipment, Volume II, Consolidated Edition (for ACAS Logic Version 7.0).

5. APPLICABILITY

This Technical Bulletin (TB) applies to air carriers operating under RAC Part Fourth, other organizations conducting approved training, and foreign air carriers conducting operations in Colombian airspace under Part 4, Chapter XXIX. This Technical Bulletin describes:

- ACAS operational approval process;
- Acceptable methods for ACAS training;
- Acceptable programs for maintenance;
- Operational policies for ACAS use;
- Appropriate actions in the event of a ACAS occurrence; and
- Criteria for foreign operator use of ACAS in Colombian airspace.

In addition, this TB addresses commonly asked ACAS questions in order to facilitate timely and consistent application of Colombian civil aviation regulations (RAC). The principles described may also be applied to those non-schedule air carriers, as well as any other aircraft operating under the rules that govern General Aviation, where the operator chooses to install a ACAS II system meeting Technical Standard Order (TSO)-C119A or TSO-C119B, Traffic Alert and Collision Avoidance System (ACAS) Airborne Equipment, ACAS II. It should be noted, however, the international standard for ACAS II, referred to as Airborne Collision Avoidance System (ACAS), includes the latest software version (v 7.0), as detailed by the International Civil Aviation Organization (ICAO).

6. ACTIONS

Air Safety Inspectors should follow and apply the following guides and procedures for all ACAS operational approval process, training methods, maintenance, operational policies, appropriate actions in the event of a ACAS occurrence; and criteria for foreign operators' use of ACAS in Colombian airspace.

6.1 APPROVAL TO USE ACAS IN OPERATIONS WITHIN COLOMBIAN AIRSPACE.

a. General.

(1) The use of ACAS in operations within the Colombian airspace requires both UAEAC airworthiness certification and operational approval. Airworthiness certification of ACAS refers to an UAEAC approval of changes in an aircraft's type design by a STC (RAC 9.2.6.4 a). Operational approval pertains to changes to training and maintenance programs, manuals, operational procedures, Minimum Equipment Lists (MEL), and other areas necessary for safe and effective ACAS use and the qualification of

aircrews through the approved training programs. An airworthiness TC/STC of a ACAS system alone does not constitute operational approval for use of ACAS under the appropriate provisions of RAC Part Fourth.

(2) Responsibilities of UAEAC regarding ACAS:

(i) UAEAC Technical Group teams approve ACAS installations (major alteration) by STCs, if applicable.

(ii) UAEAC through Flight Standards and Technical Group Teams formulate operational criteria for specific aircraft types related to training, checking, maintenance, Master Minimum Equipment Lists (MMEL), or other operational issues, as necessary.

(iii) UAEAC Flight Standards Office use information developed by Flight Standards personnel to review a particular operator's programs. Flight Standards Office approve a particular operator's training and maintenance programs, operational procedures, MELs, etc., provided they are consistent with criteria specified in the MEL, foreign Flight Standardization Boards (FSB) and Maintenance Review Boards (MRB) reports, and policy guidance from the Flight Standards office.

b. Airworthiness Approval.

Criteria for ACAS airworthiness approval (TC or STC) are addressed by the current version of FAA's AC 20-131, which is the reference for UAEAC, or an equivalent document. ACAS installations are to be made in accordance with a type design change, an aircraft manufacturer's approved service bulletin (SB), or by an STC. (RAC 9.2.6.4 a or 4.1.10)

c. Operational Approval.

(1) *Approval Criteria.* Operational approvals are based on criteria specified and, if applicable, training, maintenance, MMEL, or other operationally related criteria formulated by Technical Group Teams. If the criteria for training or checking are other than as specified, the criteria may be found in foreign Flight Standards Board (FSB) reports applicable to a particular aircraft type. Provisions for dispatch with inoperative equipment are specified by the MMEL for each aircraft type. Maintenance requirements are as identified herein, except as otherwise described by an foreign MRB report for a specific aircraft type, or in UAEAC-approved maintenance instructions identified in conjunction with an STC or manufacturer's SB, if applicable.

(2) *Approval Methods.* ACAS operational approval is accomplished through UAEAC approval of pertinent training programs, checklists, operations manuals, training manuals, maintenance programs, MELs, or other pertinent documents or document revisions applicable to the particular air carrier. An operator's ACAS programs are usually approved for each specific aircraft type. However, programs common to one or more types may be approved if ACAS program elements are common to different aircraft types, such as the same ACAS or procedures.

(3) *Approval Procedures.*

(i) Approval to use ACAS is issued by Flight Standards Technical Group and Principal Inspectors (POI/PMI). Operators should make early contact with their respective PIs to ensure timely UAEAC response. Usually such contact is initiated at the time preparations are being made for ACAS selection or purchase, and generally not later than ACAS TC/STC application.

(ii) Operations Specifications (OpSpecs) issuance is normally not required for Colombian operators. Installations, training, maintenance programs, MELs, and other ACAS program elements are reviewed and accepted or approved by the UAEAC in accordance with RACs 4.5.6.36. y 4.6.3.13.

6.2. FLIGHTCREW QUALIFICATIONS: USE OF ACAS.

a. *General.*

(1) *ACAS Qualification.* Air carriers must ensure appropriate flightcrew ACAS qualification.

The flight crew must demonstrate proficiency in the following:

(i) Knowledge of ACAS concepts, systems, and procedures; and

(ii) Cognitive, procedural, and motor skills necessary to properly respond to ACAS advisories.

(2) *Acceptable Qualification Methods.* First-time ACAS qualification must be accomplished for each airplane type. Qualification may be accomplished during initial, transition, or upgrade ground and flight training programs with appropriate differences. By this method, ACAS information will be integrated with other curriculum elements and modules. First-time ACAS qualification may also be accomplished as a stand-alone module of ground and flight training. Recurrent ACAS qualification will be accomplished during recurrent ground and flight training. Recurrent ground training will be a stand-alone module. However, ACAS will be fully integrated with the recurrent flight training during proficiency training (PT) or line-oriented flight training (LOFT). For first-time and recurrent ACAS qualification, an instructor will accomplish evaluation of ACAS objectives during training. There are no formal ACAS evaluation requirements for flight testing or checking. However, routine ACAS operations will be included in all evaluation environments and Operations Inspectors, Designated Examiners and Check Airmen should include ACAS as a routine discussion item.

(3) Principal Operations Inspectors (POI) may give an operator credit when training is conducted by another operator or training center stand-alone ACAS program for first-time qualification if that program has been approved by the UAEAC and if aircraft, ACAS system, procedures, and other relevant factors or circumstances are the same

or equivalent to those of the operator seeking credit. The POI should consult with the appropriate division of Flight Standards, about the suitability of a proposed program for a particular version of ACAS or aircraft type.

b. *ACAS Training Program Requirements.*

(1) *Curriculum.* Appendix 6 contains the required areas of instruction for ground training for the first-time ACAS qualification. For subsequent type airplanes and for recurrent training, only the new, revised, or emphasized items need to be addressed. Appendix 6 also contains the objectives and related simulation characteristics required for flight training.

(2) *Evaluation of ACAS Knowledge and Skills (Maneuvers):*

(i) ACAS knowledge must be evaluated with written, oral, or computer-based instructional tests. Combinations of these methods may be used if the required body of knowledge is completely covered. For any of these methods, a passing grade of 90% must be achieved. First-time qualification in any type airplane must include evaluation of all knowledge areas. For recurrent training, complete coverage of the knowledge requirements must be completed every 36 months.

(ii) ACAS skills (maneuvers) must be evaluated by an instructor for first-time ACAS qualification in each type airplane. This evaluation may be accomplished by an instructor in a qualified Flight Training Device (FTD), Simulator, or Computer-Based Instructional System (CBI) approved for each maneuver. For recurrent training, all maneuvers must be provided during training in any 36 month period. Recurrent training is desirable in an FTD or Simulator approved for the maneuvers.

(3) *Line-Oriented Flight Training (LOFT).* LOFT programs using simulators equipped with ACAS should be enhanced by an interactive ACAS. In addition, LOFT programs should consider proper crew vigilance for aircraft that may not be transponder or Mode C equipped. Advisories accomplished during LOFT are creditable toward first-time or recurrent qualification.

c. *Training Center Approval.*

Training centers conducting training, such as contract training or aircraft manufacturers may have ACAS elements of those programs approved if curriculum requirements (ground and flight) provided in Appendix 6 are met.

d. *Initial Evaluation of ACAS Knowledge and Skills.*

Individual crewmember ACAS knowledge and skills must be evaluated prior to ACAS use. Acceptable means of initial assessment include the evaluation by an authorized instructor or check airman using written, computer-based, or oral tests, and a simulator, FTD, or CBI system capable of depicting traffic encounters.

e. *ACAS Recurrent Training.*

ACAS recurrent training should be integrated into and/or conducted in conjunction with other established recurrent training programs. Recurrent training for ACAS must include both ground and flight (maneuver) and should address any significant issues identified by line operating experience (OE), system changes, procedural changes, or unique characteristics such as the introduction of new aircraft/display systems or operations in airspace where high numbers of Traffic Advisories (TA) and Resolution Advisories (RA) have been reported.

f. ACAS Recurrent Evaluation.
Recurrent ACAS checking should be incorporated as an element of routine proficiency training.

g. Line Checks and Route Checks.
When ACAS-equipped aircraft are used during line or route checks, check airmen should routinely incorporate proper ACAS use as a discussion item.

h. LOFT.
LOFT programs using simulators equipped with ACAS should be enhanced by interaction with ACAS. In addition, LOFT programs should consider proper crew vigilance for aircraft which may not be transponder or Mode C equipped.

i. Crew Resource Management (CRM).
CRM programs should address effective teamwork in responding to ACAS events with emphasis on the following areas:

(1) The crew should conduct preflight briefings on how ACAS advisories will be handled; and

(2) The proper reaction to a TA by the pilot flying (PF) and the pilot-not-flying (PNF).

6.3 OTHER OPERATIONAL ISSUES.

a. Manuals and Other Publications.
Airplane flight manuals, operating manuals, maintenance manuals, general policy manuals, other manuals, publications, or written material (such as operating bulletins that may relate to ACAS use) must be appropriately amended to describe ACAS equipment, procedures, and operational policies according to the appropriate regulation.

b. MMEL/MEL.

(1) *General.* Operators formulate necessary ACAS revisions to their MELs for each particular fleet (for example, B727, DC10). MEL revisions must be consistent with the MMEL established for each aircraft type. A summary of the process for addressing the necessary changes to MEL items as well as examples of MMEL and acceptable MEL provisions for ACAS are provided in Appendix 2.

(2) The MMEL was changed April 6, 2000, and the relief category was changed from "C" to "B" for the entire system.

c. Aircraft with ACAS Differences.

Operators who have aircraft with ACAS differences in displays, controls, procedures, or involved with interchange operations must account for those ACAS differences. This is accomplished as part of an approved differences training program in accordance RACs, or as otherwise specified in applicable UAEAC Flight Standards Office reports concerning crew qualification pertaining to a particular airplane type.

d. Issues Unique to a Particular Operator.

Operators should address any ACAS issues that may be unique to their particular route environment, aircraft, procedures, or ACAS display and control features. Examples include the following:

(1) *Route Environment Issue.* Air carriers having takeoffs or landings outside of the reference ACAS performance envelope (for example, airport elevations outside of the range between sea level and 5,300 feet mean sea level (MSL), or temperatures outside the range of International Standard Atmosphere ((ISA) ±50° F) should advise crews of appropriate procedures and precautions regarding RA compliance. To ensure proper response to ACAS in limiting performance conditions (for example, ACAS RA during takeoff climb or in final landing configuration at high altitude airports such as Mexico City and La Paz), specific procedures or training may be needed, unless these situations can be adequately addressed by bulletin or manual information.

(2) *A Procedural Issue.* Air carriers should describe the use of TA-only mode of operation when required on certain aircraft with an engine failure.

(3) *A Unique ACAS Issue.* ACAS flight level or absolute display of traffic altitude on a traffic display should not be used during operations when the altimeter is set to zero relative to the intended field of landing field elevation (QFE).

e. Response to ACAS RA for Aircraft at Maximum Certified Altitude.

(1) Aircraft not inhibited to climb when at maximum certified altitude are expected to climb in response to ACAS climb RAs.

(2) Aircraft that are climb inhibited from ACAS climbs at maximum certified altitude will be issued a "DO NOT DESCEND" RA.

(3) In no case should a pilot maneuver opposite to an ACAS RA.

6.4 MAINTENANCE.

a. General.

Maintenance procedures for ACAS are approved or accepted as part of an operator's initial maintenance manual approval or as a revision to that manual. ACAS maintenance

procedures should be consistent with the ACAS manufacturer's maintenance procedures and/or aircraft manufacturer's maintenance procedures for ACAS.

b. Maintenance Training.

An operator must provide adequate ACAS maintenance training in accordance with the appropriate regulation to ensure that its maintenance personnel or contract maintenance personnel at facilities not staffed by the operator are able to properly implement ACAS related maintenance programs. This includes, but is not limited to, addressing installation, modification, correction of reported system discrepancies, use of test equipment, procedures, MEL relief, and return-to-service authorizations. The training procedures should address testing installed transponders and automatic pressure altitude reporting equipment on the ground in such a way that false targets are not generated in airborne ACAS systems. A method for eliminating potential interference with ACAS-equipped aircraft during transponder testing would be the use of shields for the transponder antennas. FAA's AC 20-131 provides more detailed information and guidance concerning the proper procedures to follow when conducting operational testing of ACAS II or transponders on the ground.

c. ACAS Software Updates.

When necessary, operators should ensure that appropriate ACAS software updates are incorporated. The current appropriate software for ACAS II is version 7.0. To ensure compatibility with international standards, the software should be installed as soon as practical. ICAO requirements for ACAS specify ACAS II with software version 7.0 reduces nuisance RAs in high speed climb to level-off situations.

6.5 ACAS OPERATIONAL USE.

a. General.

Operationally, those skills addressed and the guidance provided on ACAS training in paragraph 6.3 should be followed and implemented by each operator electing to use ACAS II and apply the appropriate regulation.

b. Pilot Responsibilities.

ACAS is intended to serve as a backup to visual collision avoidance, application of right-of-way rules, and air traffic separation service. For ACAS to work as designed, immediate and correct crew response to ACAS advisories is essential. Delayed crew response or reluctance of a flightcrew to adjust the aircraft's flight path as advised by ACAS due to Air Traffic Control (ATC) clearance provisions, fear of later UAEAC scrutiny, or other factors could significantly decrease or negate the protection afforded by ACAS. Flightcrews are expected to respond to ACAS in accordance with the following guidelines when responding to alerts:

(1) Respond to TAs by attempting to establish visual contact with the intruder aircraft and other aircraft which may be in the vicinity. Coordinate to the degree possible with other crewmembers to assist in searching for traffic. Do not deviate from an assigned

clearance based only on TA information. For any traffic that is acquired visually, continue to maintain or attain safe separation in accordance with current regulations and good operating practices.

(2) When an RA occurs, the PF should respond immediately by direct attention to RA displays and maneuver as indicated, unless doing so would jeopardize the safe operation of the flight or the flightcrew can assure separation with the help of definitive visual acquisition of the aircraft causing the RA. By not responding to an RA, the flightcrew effectively takes responsibility for achieving safe separation. In so choosing, the following cautions should be considered:

(i) The traffic may also be equipped with ACAS and it may maneuver in response to an RA that has been coordinated with your own ACAS.

(ii) The traffic acquired visually may not be the same traffic causing the RA.

(iii) Visual perception of the encounter may be misleading. Unless it is unequivocally clear that the target acquired visually is the one generating the RA and there are no complicating circumstances, the pilot's instinctive reaction should always be to respond to RAs in the direction and to the degree displayed.

(3) Satisfy RAs by disconnecting the autopilot, if necessary, using prompt and positive control inputs in the direction and with the magnitude ACAS advises. To achieve the required vertical rate (normally 1,500 feet per minute (fpm) climb or descent), first adjust the aircraft's pitch using the suggested guidelines shown in the table below. Then refer to the vertical speed indicator (VSI) and make all necessary pitch adjustments to place the VSI in the green arc.

SPEED	*PITCH ADJUSTMENT*
.80 MACH	2°
250 KIAS below 10,000 feet	4°
APPROACH below 200 KIAS	5° to 7°

(i) On aircraft with pitch guidance for ACAS RA displays, follow the RA pitch command for initial, increase, and weakening RAs.

(ii) For ACAS to provide safe vertical separation, initial vertical speed response is expected within 5 seconds of when the RA is first displayed. Excursions from assigned altitude, when responding to an RA, typically should be no more than 300 to 500 feet to satisfy the conflict. Vertical speed responses should be made to avoid red arcs or outlined pitch avoidance areas and, if applicable, to accurately fly to the green arc or outlined pitch guidance area.

(4) Respond immediately to any "increase" or "reversal" RA maneuver advisories. Initial vertical speed response to an increase or reversal RA is expected by ACAS within 2

1/2 seconds after issuance of the advisory. Again, avoid red arcs or outlined pitch avoidance areas and fly to the green arc or outlined pitch guidance area.

(5) The PNF should advise the PF on the progress of achieving the vertical rates commanded by ACAS. The PNF and any on-board observers will assist in the visual search for the intruder and continue to cross-check the ACAS displayed information with other available traffic information to ensure the RA response is being flown correctly.

(6) If an initial corrective RA is downgraded or weakened, such as a "climb" RA downgraded to a "do not descend" RA, pilots should respond to the weakening RA and adjust the aircraft's vertical speed accordingly, but still keep the needle or pitch guidance symbol out of the red arc or outlined pitch avoidance area. Pilots are reminded that attention to the RA display and prompt reaction to the weakened RA will minimize altitude excursions and potential disruptions to ATC. This will allow for proper ACAS-to-ACAS resolution of encounters and reduce the probability of additional RAs against the intruder or other traffic.

(7) Excessive responses to ACAS RAs are inappropriate and may increase interference with other traffic and result in additional RAs.

(8) In some instances it may not be possible to respond to a ACAS RA and continue to satisfy a clearance at the same time. Even if a ACAS RA maneuver is inconsistent with the current clearance, respond appropriately to the RA. Since ACAS tracks all transponder equipped aircraft in the vicinity, responding to an RA for an intruder assures a safe avoidance maneuver from that intruder and from other Mode C equipped aircraft. Guidance in this paragraph does not conflict with that in paragraph 6.6b (2). Exceptions noted in paragraph 6.6b (2) are meant to hold down obvious nuisance excursions and unsafe handling of the aircraft.

(9) If a ACAS RA requires maneuvering contrary to "right-of-way" rules, "cloud clearance" rules for visual flight rules (VFR), instrument flight rules (IFR), or other such criteria, pilots are expected to follow the ACAS RAs to resolve the immediate traffic conflict. Deviations from rules or clearances should be kept to the minimum necessary to satisfy a ACAS RA.

(10) If a ACAS RA response requires deviation from an ATC clearance, expeditiously return to the current ATC clearance when the traffic conflict is resolved, the ACAS "clear of conflict" message is heard, or follow any subsequent change to clearance as advised by ATC. In responding to a ACAS RA that directs a deviation from assigned altitude, communicate with ATC as soon as practicable after responding to the RA. When the RA is cleared, the flightcrew should advise ATC that they are returning to their previously assigned clearance or should acknowledge any amended clearance issued. In addition, the flight crew's discretionary use of other types of reports may be desired. See Appendix 5 for suggested phraseology.

(11) If a ACAS RA maneuver is contrary to other critical cockpit warnings, then those other critical warnings are respected as defined by ACAS certification and training (that is, responses to stall warning, windshear, and Ground Proximity Warning System (GPWS) take precedence over a ACAS RA, particularly when the aircraft is less than 2,500 feet Above Ground Level (AGL)).

(12) Pilots should use ACAS traffic information displays to increase their awareness of nearby traffic and to assist in establishing visual contact with other aircraft. Certain Electronic Flight Information System (EFIS) ACAS installations operating in conjunction with "track up" mode may require the pilot to make allowances for the difference between the aircraft heading and track when visually sighting nearby aircraft.

(13) Unless approved by the UAEAC, pilots are expected to operate ACAS while in-flight in all airspace, including oceanic, international, and foreign airspace.

(14) When feasible, flightcrews should use the same altitude data source that is being used by the PF to provide altitude information to ACAS and the ATC transponders. Using a common altitude source precludes unnecessary RAs due to differences between altitude data sources.

(15) Note and accurately report ACAS encounters and system anomalies in accordance with operator policies so that remedial improvements to ACAS or the National Airspace System (NAS) may be initiated.

(16) ACAS does not alter or diminish the pilot's basic authority and responsibility to ensure safe flight. Since ACAS does not respond to aircraft which are not transponder equipped or aircraft with a transponder failure, ACAS alone does not ensure safe separation in every case. ACAS RAs may, in some cases, conflict with flight path requirements due to terrain, such as an obstacle-limited climb segment or an approach to rising terrain. Since many approved instrument procedures and IFR clearances are predicated on avoiding high terrain or obstacles, it is particularly important that pilots maintain situational awareness and continue to use good operating practices and judgment when following ACAS RAs. Maintain frequent outside visual scan, "see-and-avoid" vigilance, and continue to communicate as needed and as appropriate with ATC.

c. ***The potential consequences of improperly maneuvering the aircraft in response to an RA include:***

(1) An aircraft seen visually may not necessarily be the aircraft causing the RA or may not be the only aircraft to which ACAS is responding.

(2) It is difficult to visually determine the vertical displacement of other aircraft especially when ground reference information is unreliable or at cruise altitudes where the earth's horizon is obscured. Therefore, disregarding RA information and maneuvering vertically based solely on visual acquisition may result in a loss of safe separation.

(3) ATC may not know when ACAS issues RAs. It is possible for ATC to unknowingly issue instructions that are contrary to the ACAS RA indications. Safe vertical separation may be lost during ACAS coordination when one aircraft maneuvers opposite the vertical direction indicated by ACAS and the other aircraft maneuvers as indicated by ACAS. As a result, both aircraft may experience excessive altitude excursions in "vertical chase" scenarios due to the aircraft maneuvering in the same vertical direction. Accordingly, during an RA, do not maneuver contrary to the RA based solely upon ATC instructions.

(4) ATC may not be providing separation service or be communicating with the aircraft causing the RA.

(5) Failure to maneuver during a coordinated encounter with another ACAS-equipped aircraft can result in loss of safe separation.

d. ACAS Good Operating Practices.

The following ACAS good operating practices have been identified:

(1) To preclude unnecessary transponder interrogations and possible interference with ground radar surveillance systems, ACAS should not be activated (TA-only or TA/RA mode) until taking the active runway for departure. Standby mode for a Mode S transponder is adequate in order for ATC to "see" the aircraft while taxiing on the airport surface.

(2) Following landing and clearing of the runway, ACAS should be selected to the "standby" mode as specified by the air carrier's operating procedures or local airport surveillance requirements.

(3) During flight, ACAS displays should be used to enhance situational awareness. Displays, which have a range selection capability, should be used in an appropriate range setting for the phase of flight. For example, use minimum range settings in the terminal and longer ranges for climb/descent and cruise as appropriate.

(4) It is appropriate to operate ACAS in the TA-only mode in circumstances where unnecessary RAs frequently occur and where such RAs are disruptive to the operation of the aircraft. These circumstances may include:

(i) During takeoff towards known nearby traffic which is in visual contact and which could cause an unwanted RA during initial climb, such as a visually identified helicopter passing near the departure end of the runway. The TA/RA mode should be selected after the potential for an unwanted RA ceases to exist, such as after climbing above a known VFR corridor.

(ii) In instrument or visual conditions during approaches to closely-spaced parallel runways.

(iii) In visual conditions, when flying in close proximity to other aircraft.

(iv) At certain airports, during particular procedures, or in circumstances identified by the operator as having a significant potential for unwanted or inappropriate RAs.

(v) In the event of particular in-flight failures, such as engine failure, as specified by the Airplane Flight Manual (AFM) or operator.

(f) During takeoffs or landings outside of the nominal ACAS reference performance envelope for RAs, as designated by the AFM or operator. ACAS reference performance for RAs is typically attainable during takeoffs and landings at airports within the envelope of ISA ±50° F, sea level to 5,300 feet MSL. When takeoffs or landings are outside of this envelope, use of "TA only" may be appropriate during the limited time period when ACAS reference performance cannot be achieved. This typically occurs when the aircraft is at low speed in specified limiting configurations during takeoff or landing at "hot day" high altitude airports, such as Mexico City or La Paz.

(g) When participating in Parallel Runway Monitoring (PRM) Operations.

(5) When safe, practical, and in accordance with the carrier's approved operating procedures, pilots should limit vertical speeds to 1,500 fpm or less when within 2,000 feet of assigned altitudes. This procedure will reduce the frequency of unnecessary RAs and be in conformance with the Aeronautical Information Manual (AIM) and ICAO guidance.

e. Operator Responsibilities.

Operators have the following general responsibilities regarding ACAS:

(1) Assure follow-up and evaluation of unusual ACAS events; and

(2) Periodically assess ACAS training, checking, and maintenance programs to ensure their correctness, pertinence, timeliness, and effectiveness.

f. ATC Responsibilities.

ATC responsibilities relating to ACAS are highlighted below.

(1) Controllers will not knowingly issue instructions that are contrary to RA guidance when they are aware that a ACAS maneuver is in progress. When an aircraft deviates from its clearance in response to an RA, ATC is still responsible for providing assistance to the deviating aircraft as requested until:

(i) The pilot informs ATC that the RA conflict is clear; and

(ii) The aircraft has returned to the previously assigned altitude; or

(iii) Alternate ATC instructions have been issued and acknowledged.

NOTE: See Appendix 5 for suggested phraseology.

(2) Workload permitting, controllers may continue to provide pertinent traffic information in accordance with ICAO standards.

(3) Maintain awareness of ACAS programs and program changes.

(4) Train ATC specialists on ACAS and expected flightcrew responses to ACAS advisories and provide familiarization flights for specialists on ACAS-equipped aircraft to the extent possible.

(5) When requested by the flightcrew, and if appropriate, provide separation from ACAS observed traffic and assistance in returning to the assigned clearance. Issue additional clearance instructions when the situation so requires.

(6) Advise pertinent UAEAC offices, such as Air Safety Secretariat or Flight Standards Directorate, via ACAS questionnaires about airspace or airports where excessive numbers of RAs occur. This facilitates initiation of corrective actions related to ACAS enhancements, ACAS procedures, and airspace adjustments. The information should then be forwarded to Air Navigation Services Directorate for further disposition.

(7) Advise UAEAC if you become or are aware of other hazardous conditions, situations, or events which may be related to ACAS.

6.6 ACAS EVENT REPORTING.

a. *General.*

Operators and manufacturers are encouraged to develop procedures to ensure effective identification, tracking, and follow-up of significant ACAS-related events, as appropriate. Such procedures should focus on providing useful information to:

(1) Properly assess the importance of ACAS events;

(2) Follow up on information related to specific ACAS events, as necessary; and

(3) Keep the industry and UAEAC informed of the performance of ACAS in the Colombian air space and in international operations.

b. *Pilot Reports.*

(1) ACAS-Specific Reports. Pilots should make the following reports for ACAS TAs and RAs, as necessary.

(i) Upon query from ATC, or after a deviation from an ATC clearance, make radio communications as appropriate to report a response to a ACAS advisory. For guidance, refer to AIC 06/09 "Applicable procedures for aircraft with ACAS equipment onboard" (ACAS, and for recommended phraseology refer to Appendix 5 of this BT.

(ii) Reports, as specified by the operator, concerning ACAS anomalies, procedural difficulties, or system failures typically are made by pilots through one or more of the following methods:

A. Pilot/observer questionnaire;
B. Logbook entry and Aircraft Communications Addressing and Reporting System (ACARS), etc.; or
C. Other record used by that operator, such as a captain's report. An example of a typical reporting form for ACAS event information is shown in Appendix 1.

(2) Other Reports Incidental to ACAS: Compliance with ATC Clearances and Instructions Reports. Unless required due to other circumstances, reports in compliance with RACs regarding emergency deviation from an ATC clearance are not necessary solely as a result of a ACAS maneuver.

c. *Maintenance Personnel Reports.*
Maintenance personnel should report ACAS problems that relate to system performance, manufacturers, and/or vendors to the appropriate Principal Avionics Inspector (PAI).

d. *UAEAC ATC.*
Report the following:

ACAS events to Air Safety Secretariat, as necessary.

e. *ACAS Manufacturer Reports.*
ACAS avionics manufacturers report problems found with specific ACAS systems in accordance with established service difficulty report (SDR) procedures. Generic problems, such as those that may relate to the definition of collision avoidance system algorithms as defined by RTCA/DO-185, should be reported to the Air Safety Secretariat.

6.7 UAEAC RESPONSE TO ACAS EVENTS.

Regulatory compliance issues. The UAEAC will not initiate enforcement action solely on the basis of a ACAS event. Letters of investigation will not be sent to pilots involved in a ACAS-related deviation provided:

a. The aircraft was equipped with ACAS, the system was operable, and the equipment was turned on at the time of the event;

b. The pilots have properly operated their aircraft in compliance with ATC clearances prior to the ACAS-related deviation;

c. The pilots have successfully completed their air carrier's UAEAC-approved ACAS training program; and

d. The pilots have otherwise complied with ATC clearances and instructions in accordance with the rules and regulations specified in the RACs.

6.8. FOREIGN AIR CARRIERS.

a. *General.*
RAC 4.29.18 requires ACAS II installation and use by certain foreign air carriers when operating in Colombian airspace. Foreign air carriers are not required to install and use ACAS for any aircraft or operations taking place outside of the Republic of Colombia 12 nm territorial limit, even though separation services may be provided by a Colombian ATC facility (for example, in oceanic airspace). Various states may abide by ICAO guidance found in ACAS Standards and Recommended Practices (SARPS).

(1) *ACAS Approval for Foreign Air Carriers.* UAEAC does not approve ACAS installation, training programs, MELs, or maintenance programs for foreign operators operating non-Colombian registered aircraft. Such authorizations are addressed as specified by the state of the operator or by the ICAO. However, since compatibility of ACAS and Mode S transponders with other aircraft and Colombian facilities within Colombian airspace is essential, RAC 4.29 operations guidelines for ACAS are issued by UAEAC to all foreign air carrier operations within Colombian airspace. Compliance with these ACAS provisions ensures both ACAS system and procedural compatibility. The issuance of OpSpecs, or an amendment to existing OpSpecs for ACAS, must take place before a foreign air carrier operates a ACAS-equipped aircraft in Colombian airspace, in accordance with RAC 4.29.18. Standard provisions for foreign air carriers for ACAS are shown in Appendix 3.

(2) *Guidance.* Guidance for foreign air carriers operating under RAC 4.29 applies to non-Colombian registered aircraft as well as Colombian-registered aircraft flying in Colombian airspace. The "plan of State" of registry for Colombian-registered aircraft operated by foreign operators is, for practical purposes, that of the Republic of Colombia or the same as that for any Colombian operator in order to meet the requirements of RAC 4.29.14.

b. *Application and Approval.*
Foreign air carriers should contact the UAEAC to obtain application information related to ACAS operations. When a foreign air carrier submits the necessary information showing that its aircraft is in compliance, the UAEAC may approve those OpSpecs or an amendment. Standard OpSpecs provisions regarding ACAS for foreign air carriers are shown in Appendix 3, in accordance with RAC Chapter XXIX, Part 4. Although not

mandatory, foreign operator compliance with the provisions, or equivalent provisions specified by the state of the operator or specified by ICAO, is expected.

7. REPORTING:

All the information related to these activities will be registered in the following formats, as applicable:

- ***RAC 8337-6*** CIERRE DEL PROCESO DE APROBACIÓN / ACEPTACIÓN DE UN DATO TÉCNICO PARA LA EJECUCIÓN DE REPARACIONES MAYORES O ALTERACIONES MAYORES (Fuselaje, Motor, Hélices, Accesorios) (CLOSING OF APPROVAL / ACCEPTANCE PROCESS OF TECHNICAL DATA FOR MAJOR ALTERATION OR MAJOR REPAIR (AIRFRAME, ENGINE, PROPELLER AND APPLIANCES)); ó
- **RAC 337** REPARACIONES MAYORES O ALTERACIONES MAYORES (FUSELAJE, MOTOR, HÉLICES O ACCESORIOS) (MAJOR ALTERATION OR MAJOR REPAIR (AIRFRAME, ENGINE, PROPELLER AND APPLIANCE),
- ***SESA OP 015*** REPORTE DE CHEQUEO FINAL DE SIMULADOR / AVIÓN PARA PILOTOS,
- ***SESA OP 016*** REPORTE DE CHEQUEO DE PROEFICIENCIA DE SIMULADOR / AVIÓN,
- ***SESA OP 016E*** PROFICIENCY/QUALIFICATION CHECK SIMULATOR/AIRPLANE REPORT,
- ***SESA OP 016FW*** PILOT PROFICIENCY/QUALIFICATION CHECK SIMULATOR/AIRPLANE (FLY BY WIRE) REPORT

CR. (r) GERMAN RAMIRO GARCIA ACEVEDO.
SECRETARIO SEGURIDAD AÉREA

Ing. JAIRO ENRIQUE SALAZAR MANOSALVA
DIRECTOR ESTÁNDARES DE VUELO

Revisó: Ing. Edgar L. Cadena C.
Jefe Grupo Técnico

Proyectó: Ing. Jairo E. Salazar M.
Director Estándares de Vuelo

APPENDIX 1

SAMPLE ACAS EVENT REPORTING INFORMATION

PILOT EVENT QUESTIONNAIRE

The UAEAC and the airline industry have established the ACAS Program to assess the operational acceptability of ACAS in the Colombian airspace. Your participation in the program is essential to the success of the program. Please complete and return this questionnaire as quickly as possible. The information contained herein will be used only by the Program participants to assess the operation of ACAS *and will not be released to the public in a manner which allows the identification of you or the airline*. The information **WILL NOT** be used to initiate or pursue enforcement action against you or the crew. Once the data is entered into the ACAS databases the questionnaire will be maintained for no longer than 60 days, at which time it will be destroyed. Please fill out the form in full and check all that apply.

DATE: ____/____/____ TIME: _____UTC AIRLINE: _____FLIGHT #: _____

A/C TYPE: _____ TAIL NUMBER: _____ORIGIN: _____DESTINATION: _____

OWN ALTITUDE: _____FT OWN POSITION: _____/_____/_____
VOR RADIAL DME

PHASE OF FLIGHT:
- DEPARTURE (TAKEOFF TO 10,000 FT)
- CLIMB (10,000 FT TO TOC)
- CRUISE /DESCENT (TOC TO 10,000 FT)
- APPROACH (BELOW 10,000 FT)

ACAS DISPLAY RANGE SETTING: 5 NM 10 NM 20 NM 30 NM OTHER _____ NM

INTRUDER AIRCRAFT

ID (IF KNOWN): _____ ACAS-EQUIPPED (IF KNOWN)? YES NO

RELATIVE ALTITUDE AT **TA**: _____FT CLOCK POSITION: _____ EST. RANGE AT **TA**: _____NM

WERE MULTIPLE **TAS** (AURALS) ISSUED ON THE SAME AIRCRAFT? YES NO IF YES HOW MANY? _____

RELATIVE ALTITUDE AT **RA**: _____FT CLOCK POSITION: _____ EST. RANGE AT **RA**: _____NM

WERE MULTIPLE **RAS** ISSUED ON THE SAME AIRCRAFT? YES NO IF YES HOW MANY? _____

ESTIMATED CLOSEST PROXIMITY: RANGE _____ NM ALTITUDE _____ NM

INITIAL RA ISSUED: DESCEND, DESCEND CLIMB, CLIMB MONITOR VERTICAL SPEED

ADJUST VERTICAL SPEED, ADJUST CLIMB, CROSSING CLIMB DESCEND, CROSSING DESCEND

MAINTAIN VERTICAL SPEED, MAINTAIN MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN

DID THE INITIAL RA CHANGE ANY OF THE FOLLOWING?

ADJUST VERTICAL SPEED, ADJUST INCREASE CLIMB INCREASE DESCENT

CLIMB, CLIMB NOW DESCEND, DESCEND NOW

TYPE OF RA DISPLAY IN YOUR AIRCRAFT: IVSI PITCH CUES VERTICAL SPEED TAPE

FOR THE ENCOUNTER, PLEASE INDICATE THE SEQUENCE OF EVENTS (e.g., ATC ADVISORY 1, VISUAL CONTACT 2, TA 3, RA 4)

ATC ADVISORY:_____ TA:_____ RA:_____ VISUAL CONTACT:_____

WAS THE RA:

FOLLOWED: YES NO NECESSARY FOR THE SITUATION: YES NO

CONFLICT WITH ATC INSTRUCTIONS: YES NO RESULT IN A CLEARANCE DEVIATION: YES NO

IF YES, WHAT WAS THE DEVIATION? _____FT

REMARKS. (PLEASE PROVIDE COMMENTS/CONCERNS ON THIS ENCOUNTER)

_____

_____

_____

APPENDIX 2

ACAS MINIMUM EQUIPMENT LIST (MEL) AND MASTER MINIMUM EQUIPMENT LIST (MMEL) PROVISIONS

1. Each operator with authority to dispatch an aircraft with a ACAS system or component temporarily inoperative must do so in accordance with provisions of a MEL. MELs are approved for each operator and type of aircraft, within provisions of the MMEL for that type. When proposed MEL provisions are consistent with the MMEL, POIs may approve the MEL. If a less restrictive MEL or different MEL provisions are requested, a proposal for consideration of an MMEL change must be forwarded to the Air Safety Inspectors assigned for that operator. No relief will be granted for the voice command portion of the ACAS system when functioning in the TA-only mode. The audio will be provided via a speaker, which may also service windshear and ground proximity equipment. Enhanced features (those above and beyond the basic ACAS system) may be inoperative provided that the inoperative features do not degrade the system (for example, Flight Level traffic altitude selection feature for a traffic display).

2. The provisions and repair category intervals were intended to grant the operator sufficient relief, especially during the early stage of the ACAS transition, in order to promote the installation process, as well as support the use of a practical system. Both equipment reliability and operational experience dictated if any revision to this MMEL relief was to be considered.

   The following list is the standard set of provisos for all aircraft for which relief is granted for the ACAS I and II systems:

ACAS MINIMUM EQUIPMENT LIST (MEL) AND MASTER MINIMUM EQUIPMENT LIST (MMEL) PROVISIONS

Traffic Alert and Collision Avoidance System (ACAS I)	B | - | O | (M) (O) May be inoperative provided: a) System is deactivated and secured; and b) Enroute or approach procedures do not require its use. C | - | O | (M) (O) May be inoperative provided: a) Not required by RACs; b) System is deactivated and secured; and c) Enroute or approach procedures do not require its use.
Traffic Alert and Collision Avoidance System (ACAS II)	B | - | O | (M) (O) May be inoperative provided:

	a) System is deactivated and secured; and b) Enroute or approach procedures do not require its use. C | - | O | (M) (O) May be inoperative provided: a) Not required by RACs; b) System is deactivated and secured; and c) Enroute or approach procedures do not require its use.
1) Combined Traffic Alert (TA) and Resolution Advisory (RA) Dual Display System(s)	C | 2 | 1 | May be inoperative on the non-flying pilot side provided: a) TA and RA visual display is operative on the flying pilot side; and b) TA and RA audio function is operative on the flying pilot side.
2) Resolution Advisory (RA) Display System(s)	C | 2 | 1 | May be inoperative on non-flying pilot side. C | - | O | (O) May be inoperative provided: a) TA visual display and audio functions are operative; b) TA-only mode is selected by the crew; and c) Enroute or approach procedures do not require its use.
3) Traffic Alert Display System(s)	C | - | O | (O) May be inoperative provided: a) RA visual display and audio functions are operative; and b) Enroute or approach procedures do not require its use.

APPENDIX 3

RACs PROVISIONS FOR USE OF ACAS IN COLOMBIAN AIRSPACE

1. An appropriate Mode S transponder must be installed and operated on a suitable code specified by ATC during flight in Colombia's airspace. In addition, a valid unique aircraft-specific Mode S address must be assigned to the airplane, and the Mode S transponder must be set to this address. Valid addresses are those consistent with the ICAO Mode S address allocation plan contained in appendix C, part I, ICAO Annex 10, and plan of the State of registry for the specific aircraft. The unique address, when properly set, may not be altered, set to a duplicated address, or set to an address that potentially interferes with ATC or ACAS safety functions (for example, must not be set to all "ones" or all "zeros," or the country address must not be set without the unique aircraft specific address). This guidance is appropriate for non-Colombian registered or Colombian-registered aircraft operated by a foreign air carrier in national airspace.

2. A ACAS II System capable of coordinating with ACAS units meeting TSO-C119A or TSO-C119B must be installed. Except as provided for by MEL provisions acceptable to the State of the operator, the ACAS system must be operated in an appropriate ACAS mode during flight in Colombian airspace.

3. Training and procedures for use of ACAS as specified by ICAO, this Bulletin, or other equivalent criteria acceptable to UAEAC must be used when operating in Colombian airspace.

4. Unsafe conditions or performance related to ACAS operation which potentially could affect continued safe operations in the Colombian air space must be reported to the UAEAC's Air Safety Secretariat within 10 business days of the time that such a hazard is identified.

APPENDIX 4

ACRONYMS AND ABBREVIATIONS

ACARS	Aircraft Communications Addressing and Reporting System
ACAS	Airborne Collision Avoidance System (with Change 7.0)
AC	Advisory Circular
AD	Airworthiness Directives
AFM	Airplane Flight Manual
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AIM	Aeronautical Information Manual
ALIM	Altitude Limit
ATCRBS	ATC Radar Beacon System
ATC	Air Traffic Control
CBI	Computer-Based Instructional System
CPA	Closest Point of Approach
CRM	Crew Resource Management
EFIS	Electronic Flight Instrument System
FAA	Federal Aviation Administration
FPM	Feet per Minute
FTD	Flight Training Device
GPWS	Ground Proximity Warning System
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IRS	Inertial Reference System
ISA	International Standard Atmosphere
LOFT	Line-Oriented Flight Training
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
MRB	Maintenance Review Board
MSL	Mean Sea Level
nm	Nautical Mile
NMAC	Near Midair Collision
OE	Operating Experience
OPSPECS	Operations Specifications
PAI	Principal Avionics Inspector
PF	Pilot Flying
PI	Principal Inspector
PMI	Principal Maintenance Inspector
PNF	Pilot-not-Flying
POI	Principal Operations Inspector
PRM	Parallel Runway Monitor
PT	Proficiency Training
QFE	Altimeter Reference to Zero Feet at Field Elevation

RA	Resolution Advisory
RACs	Colombian Aeronautical Regulations
RTCA	Requirements for Technical Concepts for Aviation
SARPS	Standards and Recommended Practices (ICAO)
SB	Service Bulletin
SDR	Service Difficulty Report
STC	Supplemental Type Certificate
TA	Traffic Advisory
TC	Type Certificate
TCAS	Traffic Alert and Collision Avoidance System
TSO	Technical Standard Order
VFR	Visual Flight Rules
VSI	Vertical Speed Indicator
ZTHR	Altitude Threshold

APPENDIX 5.

PHRASEOLOGY FOR ACAS EVENTS

In order to keep everyone informed during a ACAS maneuver, radio communication should be in terminology common to all parties on the frequency regarding a ACAS RA. The following phraseology is suggested and should contain:

(1) Name of the ATC facility;
(2) Aircraft identification (ID); and
(3) Nature of the ACAS deviation.

When the flightcrew receives a ACAS RA to either climb or descend from their assigned altitude, or the RA otherwise affects their ATC clearance or their pending maneuver or maneuver in progress, the crew should inform ATC when beginning the excursion from clearance or as soon as workload allows in the following manner:

"XYZ Center, (Aircraft ID), ACAS Climb/Descent"

EXAMPLE:

"New York Center, Quantum 321, ACAS Climb"
"Cleveland Center, Universal 602, ACAS Descent"

Following such a communication, the designated air traffic facility is not required to provide approved standard separation to the ACAS maneuvering aircraft until the ACAS encounter is cleared and standard ATC separation is achieved. If workload permits, traffic information should be provided in accordance with ICAO standards.
When the RA is clear, the flightcrew should advise ATC that they are returning to their previously assigned clearance or subsequent amended clearance in the following manner:

"ABC Center, (Aircraft ID), clear of conflict, returning to assigned altitude."

EXAMPLE:

"Boston Center, Northern 429, clear of conflict, returning to assigned altitude."

When the deviating aircraft has renegotiated its clearance with ATC, the designated air traffic facility is expected to resume providing appropriate separation services in accordance with ICAO standards.

NOTE: Communication is not required if the pilot is able to satisfy the RA guidance and maintain the appropriate ATC clearance.

APPENDIX 6

ACAS II GROUND AND FLIGHT TRAINING REQUIREMENTS

Introduction.

This appendix provides a set of training standards for ACAS II pilot training. The information contained in this appendix related to TAs is also applicable to ACAS I users. Training standards are divided into the areas of instruction required for ground training (academics) and the performance objectives for the maneuvers required in flight training.

1. *ACAS GROUND TRAINING.*
Ground training must cover the following areas:

a. *General Concepts of ACAS Operation.* ACAS ground training should cover, in general terms, ACAS theory to the extent appropriate to ensure proper operational use. Aircrews should understand basic concepts of ACAS logic, CPA, tau, altitude separation thresholds for the issuance of RAs, as well as the relationship between displayed traffic information and issuance of TAs and RAs. The ground training program should address the following:

(1) The meaning of TAs and preventive versus corrective RAs;

(2) Increase, reversal, crossing, and weakened RAs;

(3) That ACAS II assures separation from Mode C equipped aircraft;

(4) The detection and protection provided by ACAS against altitude reporting and non altitude reporting intruders;

(5) That the system detects multiple aircraft;

(6) ACAS-to-ACAS coordination;

(7) The potential impact of not following RAs;

(8) ACAS surveillance range versus display range;

(9) When an intruder will not be displayed;

(10) ACAS on ground performance; and

(11) The continued applicability of the see-and-avoid concept.

b. *Expected Flightcrew Response and Level of Protection Provided by ACAS.* Academic training should explain the normal, expected pilot response to TAs, RAs, use of

displayed traffic information to establish visual contact, and constraints on maneuvering based solely on TAs.

c. *ACAS General Limitation.* There are several system, operational, and/or performance limitations which should be understood that apply to all aircraft types. System limitations include the inability of ACAS to detect non-transponder equipped aircraft, no RAs issued for traffic without an altitude reporting transponder, etc. Operational limitations include some RA inhibit altitudes, certain RAs being inhibited by aircraft performance constraints, the inability to comply with an RA due to aircraft performance limitations after an engine failure, and appropriate response to RAs in limiting performance conditions, such as during heavy weight takeoff or while en route at maximum altitude for a particular weight.

d. *ATC Communication and Coordination.* Training should discuss communication and coordination with ATC related to or following a ACAS event, when to contact ATC, and accepted ACAS phraseology.

e. *ACAS Equipment Components Controls, Displays, Audio Alerts, and Annunciations.* Academic training should include a discussion of ACAS terminology, symbology, operation, and optional controls and display features, including any items particular to an air carrier's implementation or unique to its system.

f. *Interfaces and Compatibility with Other Aircraft Systems.* Training should discuss the role of the Mode S transponder with a correct, discreet address installed, radar altimeter inputs to ACAS, and weather radar/EFIS interfaces, including any items particular to an air carrier's implementation or unique to its system.

g. *Aircraft Flight Manual (AFM) Information.* AFM provisions should be addressed, including information on ACAS modes of operation; normal and atypical flightcrew operating procedures; and response to TAs, RAs, and any AFM limitations.

h. *MEL operating provisions.*

i. *Appropriate pilot response to ACAS RAs and TAs, ATC clearance compliance, nuisance alerts, and other such issues.*

j. *The air carrier's ACAS event reporting policies for flightcrews.*

k. Flightcrew procedures for reporting ACAS malfunctions or irregularities, if not otherwise addressed by routine maintenance procedures of that operator.

2. CLASSROOM TRAINING.

An understanding of ACAS operation and the criteria used for issuing TAs and RAs may be assessed using the following: Objectives and Criteria. This training should address the following topics:

a. *System Operation.*

(1) Objective: Demonstrate knowledge of how ACAS functions.

(2) Criteria: The pilot must demonstrate an understanding of the following functions:

(i) Surveillance:

A. ACAS interrogates other transponder-equipped aircraft within a nominal range of 14 nautical miles (nm).

B. ACAS surveillance range can be reduced in geographic areas with a large number of ground interrogators and/or ACAS II equipped aircraft.

(ii) Collision Avoidance:

A. TAs can be issued against any transponder-equipped aircraft which responds to the ICAO Mode C interrogations, even if the aircraft does not have altitude reporting capability.

B. RAs can be issued only against aircraft that are reporting altitude and in the vertical plane only.

C. RAs issued against a ACAS-equipped intruder are coordinated to ensure complementary RAs are issued.

b. *Advisory Thresholds.*

(1) Objective: Demonstrate knowledge of the criteria for issuing TAs and RAs.

(2) Criteria: The pilot must be able to demonstrate an understanding of the methodology used by ACAS to issue TAs and RAs and the general criteria for the issuance of these advisories to include:

(i) ACAS advisories are based on time to closest point of approach (CPA) rather than distance. The time must be short and vertical separation must be small, or projected to be small, before an advisory can be issued. The separation standards provided by Air Traffic Services are different from the miss distances against which ACAS issues an alert.

(ii) Thresholds for issuing a TA or RA vary with altitude. The thresholds are larger at higher altitudes.

(iii) The TA tau threshold (trigger point) varies from 15 to 48 seconds before the projected CPA and the RA tau threshold varies from 15 to 35 seconds.

(iv) RAs are chosen to provide the desired vertical miss distance at CPA. As a result, RAs can instruct a climb or descent through the intruder aircraft's altitude.

c. *ACAS Limitations.*

(1) Objective: To verify the pilot is aware of the limitations of ACAS.

(2) Criteria: The pilot must demonstrate a knowledge and understanding of the ACAS limitations including:

(i) ACAS will neither track nor display non-transponder equipped aircraft, nor aircraft not responding to ACAS Mode C interrogations.

(ii) ACAS will automatically fail if the input from the aircraft's barometric altimeter, radio altimeter, or transponder is lost.

NOTE: In some installations, the loss of information from other onboard systems such as an Inertial Reference System (IRS) or Attitude Heading Reference System (AHRS) may result in a ACAS failure. Individual operators should ensure their pilots are aware of what types of failures will result in a ACAS failure.

(iii) An intruder aircraft within 380 feet AGL (nominal value) may or may not be displayed by your ACAS (i.e., declared to be airborne or on the ground, respectively) depending upon whether the intruder is Mode S or ATCRBS Mode C equipped and whether your ACAS-equipped aircraft is airborne or on the ground.

(iv) ACAS may not display all proximate transponder-equipped aircraft in areas of high density traffic.

(v) Because of design limitations, the bearing displayed by ACAS is not sufficiently accurate to support the initiation of horizontal maneuvers based solely on the traffic display.

(vi) Because of design limitations, ACAS will not track intruders with a vertical speed in excess of 10,000 fpm. In addition, the design implementation may result in some short term errors in the tracked vertical speed of an intruder during periods of high vertical acceleration by the intruder.

(vii) Ground Proximity Warning System (GPWS) warnings and windshear warnings take precedence over ACAS advisories. When either a GPWS or windshear warning is active, ACAS aural annunciations will be inhibited.

d. *ACAS Inhibits.*

(1) Objective: To verify the pilot is aware of the conditions under which certain functions of ACAS are inhibited.

(2) Criteria: The pilot must demonstrate a knowledge and understanding of the various ACAS inhibits including:

(i) Increase Descent RAs are inhibited below 1,450 (±100) feet AGL.

(ii) Descend RAs are inhibited below 1,100 (±100) feet AGL.

(iii) All RAs are inhibited below 1,000 (±100) feet.

(iv) All ACAS aural annunciations are inhibited below 500 (±100) feet AGL. This includes the aural annunciation for TAs.

(v) Altitude and configuration under which Climb and Increase Climb RAs are inhibited. Know if your aircraft type issues Climb and Increase Climb RAs when operating at the aircraft's certified ceiling. If your aircraft type provides RA Climb and Increase Climb commands at certified ceiling, the commands are to be followed.

NOTE: In some aircraft types, Climb or Increase Climb RAs are never inhibited.

e. ***Use of Controls.***

(1) Objective: To verify the pilot can properly operate all ACAS and display controls.

(2) Criteria: Demonstrate the proper use of controls including:

(i) Aircraft configuration required to initiate a Self Test.

(ii) Steps required to initiate a Self Test.

(iii) Recognizing when the Self Test was successful and when it was unsuccessful. When the Self Test is unsuccessful, recognizing the reason for the failure, and if possible, correcting the problem.

(iv) Recommended usage of range selection. Low ranges are used in the terminal area and the higher display ranges are used in the en route environment and in the transition between the terminal and en route environment.

(v) If available, recommended usage of the Above/Below mode selector. Above mode should be used during climb and the Below mode should be used during descent.

(vi) Recognition that the configuration of the display does not affect the ACAS surveillance volume.

(vii) Selection of lower ranges when an advisory is issued to increase display resolution.

(viii) If available, selection of the display of absolute altitude instead of relative altitude and the limitations of using this display if a barometric correction is not provided to ACAS.

(ix) Proper configuration to display the appropriate ACAS information without eliminating the display of other needed information.

NOTE: The wide variety of display implementations makes it difficult to establish more definitive criteria. When the training program is developed, this general criteria should be expanded to cover specific details for an operator's specific display implementation.

f. *Display Interpretation.*

(1) *Objective:* To verify a pilot understands the meaning of all information that can be displayed by ACAS.

(2) Criteria: The pilot must demonstrate the ability to properly interpret information displayed by ACAS including:

(i) Other traffic, i.e., traffic within the selected display range that is not proximate traffic, or causing a TA or RA to be issued.

(ii) Proximate traffic, i.e., traffic that is within 6 nm and ±1200 feet.

(iii) Non-altitude reporting traffic.

(iv) No bearing TAs and RAs.

(v) Off-scale TAs and RAs. The selected range should be changed to ensure that all available information on the intruder is displayed.

(vi) Traffic advisories. The minimum available display range which allows the traffic to be displayed should be selected to provide the maximum display resolution.

(vii) Resolution advisories (Traffic Display). The minimum available display range of the traffic display which allows the traffic to be displayed should be selected to provide the maximum display resolution.

(viii) Resolution advisories (RA Display). Pilots should demonstrate knowledge of the meaning of the red and green areas displayed on the RA display and when the green areas will and will not be displayed. Pilots should also demonstrate an understanding of the RA display limitations (i.e., if a vertical speed tape is used and the range of the tape is less than 2,500 fpm, an Increase Rate RA cannot be properly displayed).

(ix) If appropriate, awareness that Navigation Displays oriented on Track-Up may require a pilot to make a mental adjustment for drift angle when assessing the bearing of proximate traffic.

NOTE: The wide variety of display implementations will require the tailoring of some criteria. When the training program is developed, these criteria should be expanded to cover details for an operator's specific display implementation.

g. *Use of the TA-Only Mode.*

(1) Objective: To verify that a pilot understands the appropriate times to select the TA-only mode of operation and the limitations associated with using this mode.

(2) Criteria: The pilot must demonstrate the following:

(i) Knowledge of the operator's guidance for the use of TA-only.

(ii) Reasons for using this mode and situations in which its use may be desirable. If TA-only is not selected when an airport is conducting simultaneous operations from parallel runways separated by less than 1,200 feet, and to some intersecting runways, RAs can be expected.

(iii) The TA aural annunciation is inhibited below 500 feet AGL. As a result, TAs issued below 500 feet AGL may not be noticed unless the TA display is included in the routine instrument scan.

(iv) When this mode is selected, TAs will be issued at the time an RA is normally issued.

h. *Crew Coordination.*

(1) Objective: To verify the pilot adequately briefs other crew members on how ACAS advisories will be handled.

(2) Criteria: The pilot must demonstrate their preflight briefing addresses the procedures that will be used in responding to TAs and RAs including:

(i) Division of duties between PF and PNF.

(ii) Expected call-outs.

(iii) Communications with ATC.

(iv) Conditions under which an RA may not be followed and who will make this decision.

NOTES:

1. Different operators have different procedures for conducting preflight briefings and for responding to ACAS advisories. These factors should be taken into consideration when implementing the training program.

2. The operator must specify the conditions under which an RA need not be followed, reflecting advice published by the State Civil Aviation Authority. This should not be an item left to the discretion of a crew.

3. This portion of the training may be combined with other training such as CRM.

i. ***Reporting Requirements.***

(1) Objective: To verify the pilot is aware of the requirements for reporting RAs to the controller and other authorities.

(2) Criteria: The pilot must demonstrate the following:

(i) The use of the phraseology contained in PANS-RAC (ICAO DOC. 4444).

(ii) Where information can be obtained regarding the need for making written reports to various states when an RA is issued. Various states have different reporting requirements and the material available to the pilot should be tailored to the airline's operating environment.

j. ***ACAS Flight Training (Maneuver).***

The scenarios included in the maneuver training should include corrective RAs, initial preventive RAs, maintain rate RAs, altitude crossing RAs, increase rate RAs, RA reversals, weakening RAs, and multi-aircraft encounters. Training must provide pilots the opportunity to reach the ACAS proficiency indicated in the following TA and RA response objectives. This proficiency may be assessed and certified by a ACAS qualified instructor.

k. ***TA Responses.***

(1) Objective: To verify the pilot properly interprets and responds to TAs.

(2) Criteria: The pilot must demonstrate the following:

(i) Proper division of responsibilities between the PF and PNF. The PF should continue to fly the airplane, and be prepared to respond to any RA that might follow. The PNF should provide updates on the traffic location shown on the ACAS display, using this information to help visually acquire the intruder.

(ii) Proper interpretation of the displayed information. Both pilots confirm that the aircraft they have visually acquired is that which has caused the TA to be issued. Use should be made of all information shown on the display, note being taken of the bearing and range of the intruder (amber circle), whether it is above or below (data tag), and its vertical speed direction (trend arrow).

(iii) Other available information is used to assist in visual acquisition. This includes ATC party-line information, traffic flow in use, etc.

(iv) Because of the limitations that may exist with various display systems, the PF should not maneuver the aircraft based solely on the information shown on the ACAS display. No attempt should be made to adjust the current flight path in anticipation of what an RA would advise.

(v) When visual acquisition is attained, right-of-way rules are used to maintain or attain safe separation. No unnecessary maneuvers are initiated. The limitations of making maneuvers based solely on visual acquisition, especially at high altitude or without a definite horizon, are understood.

I. ***RA Responses.***

(1) Objective: To verify the pilot properly interprets and responds to RAs.

(2) Criteria: The pilot must demonstrate the following:

(i) Proper division of responsibilities between the PF and PNF. The PF responds to the RA with positive control inputs, when required, while the PNF provides updates on the traffic location and cross-checks between the traffic display and monitors the response to the RA. Proper CRM should be used.

(ii) Proper interpretation of the displayed information. The pilot recognizes the intruder causing the RA to be issued (red square on display). Pilot responds appropriately.

(iii) For corrective RAs, the response is initiated in the proper direction within 5 seconds of the RA being displayed.

(iv) Recognition of the initially displayed RA being modified. Response to the modified RA is properly accomplished:

- For Increase Rate RAs, the vertical speed is increased within 2 1/2 seconds of the RA being displayed.
- For RA reversals, the vertical speed is reversed within 2 1/2 seconds of the RA being displayed.
- For RA weakenings, the vertical speed is modified to initiate a return towards the original clearance within 2 1/2 seconds of the RA being displayed.
- For RAs which strengthen, the vertical speed is modified to comply with the revised RA within 2 1/2 seconds of the RA being displayed.

(v) Recognition of altitude crossing encounters and the proper response to these RAs.

(vi) For preventive RAs, the vertical speed needle remains outside the red area on the RA display.

(vii) For Maintain Rate RAs, the vertical speed is not reduced. Pilots should recognize that a Maintain Rate RA may result in crossing through the intruder's altitude.

(viii) If a decision is made to not follow an RA, no changes in the existing vertical speed are made in a direction opposite to the sense of the displayed RA. Pilots should be aware that if the intruder is also ACAS-equipped, the decision to not follow an RA

may result in a decrease in separation at CPA because of the intruder's RA response.

(ix) When the RA weakens, pilot initiates a return towards the original clearance, and when Clear of Conflict is annunciated, pilot completes the return to the original clearance.

(x) The controller is informed of the RA as soon as time and workload permit, using the standard phraseology.

(xi) When possible, an ATC clearance is complied with while responding to an RA. For example, if the aircraft can level at the assigned altitude while responding to a Reduce Climb or Reduce Descent RA, it should be done.

(xii) If pilots simultaneously receive instructions to maneuver from ATC and an RA which are in conflict, the pilot should follow the RA.

(xiii) Knowledge of the ACAS multi-aircraft logic and its limitations. For example, ACAS only considers intruders which it believes to be a threat when selecting an RA. As such, it is possible for ACAS to issue an RA against one intruder which results in a maneuver towards another intruder that is not classified as a threat. If the second intruder becomes a threat, the RA will be modified to provide separation from that intruder.

(xiv) The consequences of both responding to, and not responding to, an RA.

m. Characteristics of Training Equipment Suitable for Maneuver Training.

(1) *Acceptable Characteristics.* Flight training devices, simulators, and CBIs must have certain characteristics to be effective. This is due to the interactive nature of ACAS, the variety of encounter scenarios possible, the immediate and standardized pilot response required, and the instant and correct display interpretation that is necessary. Thus, training equipment used for ACAS flight training should have the following characteristics:

(i) The ability to functionally represent ACAS displays, controls, indications, and annunciations;

(ii) Ability to depict selected traffic encounter scenarios, including ACAS display and audio advisories;

(iii) Ability to show proper ACAS reaction to depicted scenarios and advisories; and

(iv) Ability to interactively respond to pilot inputs regarding ACAS advisories, including responses to RAs displayed on relevant vertical speed and pitch indicators.

(2) *Simulator and ACAS Fidelity*. For a particular ACAS, maneuver training may be accomplished in simulators or training devices that represent the specific aircraft or an aircraft that has similar characteristics. For the purposes of ACAS maneuver training, simulators or training devices may use simplified ACAS algorithms or displays and do not require ACAS logic or a ACAS processor. ACAS displays do not have to be identical, but must be functionally equivalent to the air carrier operator's specific aircraft in use.

(3) *Training Device or Simulator Approval*. Training devices or simulators meeting UAEAC criteria are qualified by the UAEAC and approved for use by the POI. Any one or combination of the following devices or simulators which meet characteristics of paragraph m (1) may be used:

(i) Level A through D simulators;

(ii) Level 2 through 7 FTDs; or

(iii) Dedicated ACAS training devices acceptable to the UAEAC, and approved by the POI.

NOTE: Flight Training Devices and Simulators are as defined and qualified in accordance with RAC 24 and approved by the POI.

APPENDIX 7

DEFINITIONS

For convenience, some definitions are repeated from other pertinent references. Other definitions are unique to this TB and their application is limited to use with ACAS.

1. **Altitude Limit (ALIM).** ALIM is the specified projected amount of vertical separation that ACAS is designed to provide between aircraft. It is also the altitude threshold (ZTHR) for the issuance of a corrective RA. The value of ALIM varies with aircraft barometric altitude.

2. **Altitude Threshold (ZTHR).** The projected minimum ZTHR for the issuance of a preventive RA. The ZTHR varies with aircraft altitude.

3. **Closest Point of Approach (CPA).** The occurrence of minimum range between your own ACAS aircraft and the intruder.

4. **Coordination (as related to ACAS).** The process by which ACAS units in conflicting aircraft communicate with one another to select complementary RAs to resolve an encounter (for example, one unit selects a "climb" command and the other a "descend" command).

5. **Flight Standards Office.** An UAEAC office serving and staffed with Flight Standards personnel who serve the aviation industry and the general public on matters relating to the certification and operation of air carriers and general aviation aircraft.

6. **Follow-on STC (As related to ACAS).** A ACAS STC other than as described in paragraph 8. The following examples are considered to be follow-on STCs:

   a. A previously approved ACAS II installation, which is installed in a subsequent type or model aircraft; and
   b. Changes of display configuration (weather radar/ACAS display), supporting system (Radar Altimeter), or other aircraft interface (GPWS, etc.).

7. **Initial TC/STC (As related to ACAS).** The first UAEAC ACAS airworthiness approval in accordance with a TC or STC of any one or combination of the following components: a ACAS processor (computer), ACAS directional antenna, and/or Mode S transponder.

NOTE: For previously approved ACAS systems, if the part number of any of the above components changes due to a significant modification, the system change requires an initial TC/STC.

8. **Intruder.** An aircraft which has satisfied the ACAS traffic advisory detection criteria.

9. Master Minimum Equipment List (MMEL). A document listing stipulations in accordance with those rules and regulations that provide authorization for the continuation of flight beyond a terminal point with certain inoperative equipment. MMELs serve as the basis for an operator to develop specific MELs applicable to its particular aircraft and operational requirements.

10. Maintenance Review Board (MRB). A board responsible for establishing maintenance requirements for a specific aircraft type. MRB requirements are usually formulated in conjunction with information provided by the manufacturer and prospective operators through industry working groups. Civil Aviation Authorities apply MRB requirements in reviewing and approving each carrier's proposed maintenance program.

11. Colombian Airspace System. The common network of colombian airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information, and services; rules, regulations, and procedures; technical information, manpower, and material; and system components shared jointly with the military.

12. Other Traffic. Aircraft ±1,200 feet vertical and 6nm from own aircraft, which are neither an RA nor a TA.

13. Principal Inspector (PI). Refers to one of the following three UAEAC inspectors who is selected as primary for ACAS for an air carrier (normally the POI):

a. *Principal Avionics Inspector (PAI).* The UAEAC inspector responsible for overseeing all avionics issues relative to a specific operator, to include input on training programs, OpSpecs, MEL requests, etc.
b. *Principal Operations Inspector (POI).* The UAEAC inspector responsible for overseeing all operational issues relative to a specific operator, including training programs, OpSpecs approval, MEL approval requests, etc.
c. *Principal Maintenance Inspector (PMI).* The UAEAC inspector responsible for overseeing all maintenance issues relative to a specific operator, to include input on training programs, OpSpecs, MEL requests, etc.

14. Proximate Traffic. An aircraft which is within 6 nm in range and ±1,200 feet vertically, but does not meet the ACAS thresholds of a TA or RA.

15. Resolution Advisory (RA). Aural voice and display information provided by ACAS to a flightcrew, advising that a particular maneuver should or should not be performed to attain or maintain minimum safe vertical separation from an intruder:

a. *Corrective RA.* An RA that advises the pilot to either deviate from current vertical speed, such as climb when the aircraft is level or to maintain an existing climb or descent rate.
b. *Altitude Crossing RA.* An RA that directs a pilot to cross through the intruder aircraft's altitude to achieve safe vertical separation.
c. *Coordinated Crossing RA.* Initial RAs that are coordinated between ACAS-equipped aircraft and that direct the aircraft to cross in altitude.

d. *Increase Rate RA*. An RA that is issued after an initial climb or descend RA, which indicates that additional climb or descent rate is required to achieve safe vertical separation. An increase rate RA requires a climb or descent rate of 2,500 fpm.
e. *Preventive RA*. An RA that requires a pilot to avoid certain deviations from current vertical rate, such as a Don't Climb RA when the aircraft is level.
f. *Reversal RA*. An RA that indicates a change in the direction previously issued by ACAS and is required to achieve safe vertical separation. For example, an Initial Descend RA that reverses to a climb RA.
g. *Turn Around RA*. An initial corrective RA issued to a ACAS aircraft with an established vertical rate that directs the aircraft in the opposite direction. For example, a -1,500 fpm Descend RA issued while climbing at +2,000 fpm.
h. *Weakened RA*. An initial corrective RA that changes to an RA requiring less vertical speed because ACAS has determined that safe vertical separation is projected. For example, a Climb RA that weakens to a Do-Not-Descend advisory.

16. Significant ACAS Events. Significant ACAS events are those which meet any one of the following guidelines:

a. There is a loss of standard ATC separation resulting from compliance with a ACAS-generated RA;
b. ACAS is suspected of not performing as designed;
c. ACAS issues a descent RA when own aircraft is below 1,000 feet AGL;
d. There is an altitude excursion of more than 1,000 feet from an assigned level altitude;
e. ACAS issues a turn around RA; or
f. ACAS issues a coordinated crossing RA.

17. STC. An certificate attesting to the fact that modifications to the respective aircraft, engines, or other components meet airworthiness requirements.

18. Tau. Greek symbol representing the time to CPA.

19. Threat. An intruder which has satisfied the threat detection criteria and thus requires an RA.

20. Traffic. Aircraft with an operating transponder capable of being tracked and displayed by a ACAS-equipped aircraft.

21. Traffic Advisory (TA). Aural voice and display information provided by ACAS to a flightcrew, identifying the location of nearby traffic that meets certain minimum separation criteria.

22. Traffic Alert and Collision Avoidance System (ACAS). A family of airborne devices meeting specified TSO and RTCA/DO-185 requirements, as amended, which function independently of the ground-based ATC system to provide collision avoidance information.

a. **ACAS I.** A ACAS providing only TAs to assist pilots in the visual acquisition of intruder traffic.
b. **ACAS II.** A ACAS which provides TAs and RAs in the vertical plane, such as climb or descend.

22. ACAS Academic Training (as applied herein). Part of ground training which exclusively addresses acquiring the required ACAS concepts, systems, limitations, or procedures knowledge (rather than skills), and demonstration of that knowledge. ACAS academic training generally is accomplished using a combination of classroom methods (standup instruction, slide/tapes, computer based instruction, tutorial, etc.), flight manual information bulletins, or self-study. See paragraph 9b for an expanded explanation of what should be taught.

23. ACAS Event. For the purpose of this TB, one or more of the following occurrences or situations are related to ACAS:

a. Issuance of any ACAS RA or TA as specified by a flightcrew, regardless of whether it is valid, unwarranted, or a nuisance;
b. Other ACAS-related in-flight traffic conflicts or potential conflicts as determined by a flightcrew;
c. Near midair collisions (NMAC) involving a ACAS-equipped aircraft;
d. ACAS system failures related to a traffic conflict, potential traffic conflict situation, or ACAS general system performance;
e. ATC system error involving a ACAS-equipped aircraft; or
f. Other ACAS occurrences or situations related to potential ACAS or ATC system safety performance.

24. ACAS Maneuver Training. Part of flight training that includes the integration of ACAS knowledge with the specific skills required to demonstrate satisfactory performance of a particular ACAS procedure or maneuver, or series of procedures or maneuvers.

25. Type Certificate (TC). A certificate attesting to the fact that the respective aircraft, engines, or other components meet airworthiness requirements.