



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: AIR CARRIER OPERATIONAL **Date:** 8/27/93 **AC No:** 120-55A
APPROVAL AND USE OF TCAS II **Initiated by:** AFS-450 **Change:**

1. **PURPOSE.** This Advisory Circular (AC) provides an acceptable means, but not the only means, to address Traffic Alert and Collision Avoidance System (TCAS) issues related to installation and use of TCAS II regarding compliance with Federal Aviation Regulations (FAR) Parts 121, 125, and 129 requirements for air carriers.

2. **CANCELLATION.** Advisory Circular 120-55, dated October 23, 1991, is hereby canceled.

3. **APPLICABILITY.** This AC applies to air carriers operating under FAR Part 121, other organizations conducting training approved in accordance with FAR Part 121 (e.g., training centers or aircraft manufacturers), operators under FAR Part 125, and foreign air carriers conducting operations in U.S. airspace under FAR Part 129. This AC describes the TCAS operational approval process, acceptable methods for TCAS training, acceptable programs for maintenance, operational policies for TCAS use, appropriate actions in the event of a TCAS occurrence, and criteria for foreign operator use of TCAS in U.S. airspace. In addition, this AC addresses commonly asked TCAS questions in order to facilitate timely and consistent application of FAR §§ 121.356, 125.224, and 129.18. While not specifically addressing FAR Part 135 operations, the principles described by this AC may also be applied to those air carriers operating under FAR Part 135 who choose to install TCAS II, as well as any aircraft operating under FAR Part 91.

4. **RELATED MATERIAL.**

a. FAR §§ 1.1, 1.2, 91.3, 91.123, 91.213, 91.215, 91.217, 91.219, 91.221, 91.413, 121.345, 121.356, 125.224, 129.11, and 129.18.

b. Advisory Circular 20-131, Airworthiness and Operational Approval of Traffic Alert and Collision Avoidance Systems (TCAS II) and Mode S Transponders, current edition.

c. Federal Aviation Administration (FAA)/Technical Standard Order (TSO) C112, Air Traffic Control Radar Beacon System (ATCRBS)/Mode S, and TSO-C119A, TCAS II Airborne Equipment. Copies may be obtained from the Department of Transportation, FAA, Aircraft Certification Service, Aircraft Engineering Division, AIR-120, 800 Independence Avenue, SW., Washington, D.C. 20591.

d. Radio Technical Commission for Aeronautics (RTCA), Document No. RTCA/DO-185, Minimum Operational Performance Standards for TCAS II Airborne Equipment, Volume II, Consolidated Edition. Copies may be purchased from the RTCA Secretariat, 1140 Connecticut Avenue, NW., Suite 1020, Washington, D.C. 20036.

5. HOW TO ORDER.

a. Copies of this AC and others mentioned herein may be obtained from:

Department of Transportation
General Services Section
M-443.2
Washington, DC 20590

b. Identify this publication in your order as:

FAA Advisory Circular 120-55A
Air Carrier Operational Approval
and Use of TCAS II

6. BACKGROUND AND DEFINITIONS.

a. TCAS Implementation. TCAS systems are now implemented in FAR Part 121 operations and other applications. Approval of TCAS for FAA Type Certification (TC) or Supplemental Type Certification (STC) is comprehensively addressed in AC 20-131, as amended. This AC provides information for U.S. air carriers, aircraft and TCAS manufacturers, various inspectors, foreign air carriers operating in U.S. airspace, and other aviation organizations regarding standard means acceptable to the FAA to establish and ensure continued compliance with FAR related to TCAS. This information is intended to facilitate TCAS system design and certification, promote timely and comprehensive program implementation, encourage development of standard practices for application of TCAS, and provide for suitable followup to TCAS events.

b. Definitions. For convenience, some definitions in this AC are repeated from other pertinent FAA references. Other definitions are unique to this AC and their application is limited to use with TCAS.

(1) Aircraft Certification Office (ACO). FAA offices responsible for determination of aircraft airworthiness regarding issuance of TC's, STC's, and other issues related to FAR Parts 21, 23, 25, 33, and other similar airworthiness rules. ACO's are also responsible for technical assessment of service difficulties including issuance of Airworthiness Directives.

(2) Aircraft Evaluation Group (AEG). FAA offices responsible for operational aspects of newly certificated, modified, or "in service" aircraft. AEG's establish FAA criteria for pilot qualification, minimum equipment lists (MEL), initial airworthiness, and other such requirements as they relate to FAR Parts 43, 61, 91, 121, 135, and other operationally related FAR.

(3) Altitude Limit (ALIM). ALIM is the specified amount of vertical separation that TCAS is designed to provide between aircraft. It is also the altitude threshold for the issuance of a corrective resolution advisory (RA). The value of ALIM varies with aircraft altitude.

(4) Altitude Threshold (ZTHR). The altitude threshold for the issuance of a preventive RA. The ZTHR varies with aircraft altitude.

(5) Certificate Holding District Office (CHDO). A Flight Standards office that is responsible for administration of a FAR Part 121 and FAR Part 135 operating certificate for a particular operator.

(6) Coordination (as related to TCAS). The process by which TCAS units in conflicting aircraft communicate with one another to select complementary resolution advisories to resolve an encounter (i.e., one unit selects a Climb, the other a Descend).

(7) Flight Standards District Office (FSDO). An FAA field office serving an assigned geographical area 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 carrier and general aviation aircraft.

(8) Flight Standardization Board (FSB). The FAA board responsible for establishing or revising crew qualification requirements (e.g., training, checking, currency, and type rating(s)) for specific aircraft. FSB's are established for each large turbojet, turboprop, and Special FAR Part 41 airplane type used in air transportation, as well as other FAR Part 25 airplanes, transport category multiengine helicopters, and large multiengine piston airplanes.

(9) Follow-on STC (As related to TCAS). A TCAS STC other than as described in item 6b(10) for an "Initial TC/STC." The following examples are considered to be "follow-on" STC's:

(i) A previously approved TCAS II installation which is installed in a subsequent type or model aircraft.

(ii) Changes of display configuration (weather radar/TCAS display), supporting system (Radar Altimeter) or other aircraft interface (i.e., ground proximity warning system (GPWS), etc.).

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

(NOTE: For previously approved TCAS 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).

(11) Intruder. A target which has satisfied the traffic advisory detection criteria.

(12) Limited Implementation Program (LIP). A TCAS evaluation program conducted by selected U.S. operators in conjunction with FAA prior to finalization of regulatory requirements for TCAS.

(13) Master Minimum Equipment List (MMEL). An FAA document listing stipulations in accordance with FAR § 121.627(c) and FAR § 135.179 that provides authorization for the continuation of flight beyond a terminal point with certain equipment inoperative. AEG's develop MMEL's in conjunction with a Flight Operation Evaluation Board (FOEB) established for each aircraft type. FAA MMEL's serve as the basis for an operator to develop specific MEL's applicable to its particular aircraft and operational requirements.

(14) Maintenance Review Board (MRB). An FAA 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. FAA CHDO's apply MRB requirements in reviewing and approving each carrier's proposed maintenance program.

(15) National Airspace System (NAS). The common network of U.S. 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.

(16) National Simulator Evaluation Team (NSET). Team of FAA operations specialists responsible for evaluating flight simulators to aid principal operations inspectors (POI) in approving those simulators in accordance with FAR requirements (e.g., NSET

evaluations support POI approval of a particular simulator for use in a specific FAR Part 121 program).

(17) Other Traffic. An intruder aircraft which is within the selected display range that is not proximate traffic and does not meet the threat criteria of a traffic advisory or resolution advisory.

(18) Principal Inspector (PI). Refers to one of three FAA principal inspectors: principal avionics inspector, principal operations inspector, or principal maintenance inspector.

(19) Principal Avionics Inspector (PAI). The FAA inspector assigned responsibility for overseeing all avionics issues relative to a specific operator, to include input to training programs, operations specifications, MEL requests, etc.

(20) Principal Operations Inspector (POI). The FAA inspector assigned responsibility for overseeing all operational issues relative to a specific operator, including training programs, operations specifications approval, MEL approval requests, etc.

(21) Principal Maintenance Inspector (PMI). The FAA inspector assigned responsibility for overseeing all maintenance issues relative to a specific operator, to include input to training programs, operations specifications, MEL requests, etc.

(22) Proximate Traffic. An intruder aircraft which is within 6 nautical miles (nm) in range and within plus or minus 1,200 feet vertically, but does not meet the threat criteria of a traffic advisory or resolution advisory.

(23) Resolution Advisory (RA). Aural voice and display information provided by TCAS to a flightcrew, advising that a particular maneuver should, or should not, be performed to maintain safe separation from a threat aircraft.

(i) Corrective RA. A corrective RA is an advisory issued by TCAS that requires a pilot to modify the aircraft's existing vertical speed.

(ii) Crossing RA. An RA that directs a pilot to cross through the intruder aircraft's altitude in order to achieve safe vertical separation.

(iii) Increase RA. An RA that is issued after an initial Climb or Descend RA which indicates 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 feet per minute (fpm).

(iv) Preventive RA. A preventive RA is an advisory issued by TCAS that requires a pilot to maintain an existing vertical speed or avoid certain vertical speeds.

(v) Reversal RA. A reversal RA indicates a reverse in direction is required to achieve safe vertical separation (i.e., an initial descend RA reverses to a climb RA).

(vi) Weakened RA. An initial corrective RA that changes to an RA requiring less vertical speed because TCAS has determined that safe vertical separation is projected (i.e., a climb RA that softens to a do not descend advisory).

(24) Significant TCAS Events. Significant TCAS events are those which meet any one of the following guidelines:

(i) There is a loss of standard air traffic control (ATC) separation resulting from compliance with a TCAS-generated RA.

(ii) TCAS is suspected as not performing as desired.

(iii) A crewmember's use of the TCAS system appears to be improper.

(iv) There is an altitude excursion of more than 1,500 feet from an assigned level altitude.

(25) Tau. Greek symbol representing the time to closest point of approach.

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

(27) Traffic. Intruder aircraft with an operating transponder capable of being tracked by a TCAS-equipped aircraft.

(28) Traffic Advisory (TA). Aural and display information provided by TCAS to a flightcrew, identifying the location of nearby traffic meeting certain minimum separation criteria.

(29) TCAS. Traffic Alert and Collision Avoidance System. 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.

(i) TCAS I. A Traffic Alert and Collision Avoidance System providing only TA's to assist pilots in the visual acquisition of intruder traffic.

(ii) TCAS II. A Traffic Alert and Collision Avoidance System which provides TA's and RA's in the vertical plane (e.g., climb or descend).

(iii) TCAS III. A Traffic Alert and Collision Avoidance System providing TA's and RA's in both the horizontal and the vertical planes to avoid conflicting traffic.

(30) TCAS Academic Training (As applied within this AC). Training which exclusively addresses knowledge requirements (rather than skills), and is usually related to achieving satisfactory knowledge of TCAS concepts, systems, limitations, or procedures. TCAS 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 8b for an expanded explanation of what should be taught.

(31) TCAS Event. For the purpose of this AC, one or more of the following occurrences or situations related to TCAS:

(i) Issuance of any TCAS RA or TA as specified by a flightcrew (regardless of whether it is valid, unwanted, or nuisance),

(ii) Other TCAS-related in-flight traffic conflicts or potential conflicts as determined by a flightcrew,

(iii) Near mid-air collisions (NMAC) involving a TCAS-equipped aircraft,

(iv) TCAS system failures related to a traffic conflict, potential traffic conflict situation, or TCAS general system performance,

(v) ATC system error involving a TCAS-equipped aircraft, or

(vi) Other TCAS occurrences or situations related to potential TCAS or ATC system safety performance.

(32) TCAS Maneuver Training (As applied within this AC). Training which addresses both knowledge and skills and is usually related to achieving satisfactory performance of a particular TCAS procedure or maneuver, or series of procedures or maneuvers.

(33) TCAS Transition Program (TTP). A phased TCAS implementation and evaluation program established to assure timely and effective TCAS installation and use for U.S. air carrier aircraft and to assist in the integration of a large number of TCAS units in the NAS.

(34) Type Certificate (TC). An FAA certificate attesting to the fact that the respective aircraft, engines, or other components meet airworthiness requirements of the FAR.

(35) Supplemental Type Certificate (STC). An FAA certificate attesting to the fact that modifications to the respective aircraft, engines, or other components meet airworthiness requirements of the FAR.

7. APPROVAL TO USE TCAS IN FAR PART 121 OPERATIONS.

a. General.

(1) Use of TCAS in FAR Part 121 Operations Requires both FAA Airworthiness Certification and Operational Approval. Airworthiness certification of TCAS refers to an FAA approval of changes in an aircraft's type design by amendment to a TC or issuance of an STC. Operational approval pertains to changes to training and maintenance programs, manuals, operational procedures, MEL's, and other such areas necessary for safe and effective TCAS use. An airworthiness TC/STC of a TCAS system alone does not constitute operational approval for use of TCAS under provisions of FAR Part 121.

(2) Responsibilities of Various FAA Offices Regarding TCAS. FAA ACO's approve changes to a type design or issuance of STC's. FAA AEG's formulate operational criteria for specific aircraft types related to training, checking, maintenance, MMEL's or other operational issues, as necessary. FAA FSDO's use information developed by AEG's to review a particular operator's programs. FSDO's approve a particular operator's training and maintenance programs, operational procedures, MEL's, etc., if they are consistent with criteria specified in MMEL's, FSB, MRB reports and policy guidance from the Air Transportation Division, AFS-200, and the Flight Standards Aircraft Maintenance Division, AFS-300.

b. Airworthiness Approval.

Criteria for TCAS airworthiness approval (TC or STC) are addressed by AC 20-131, as revised. TCAS installations are to be made in accordance with a "Type Design" change, an aircraft manufacturer's FAA-approved "Service Bulletin," or by STC.

c. Operational Approval.

(1) Approval Criteria. Operational approvals are based on criteria in this AC and, if applicable, training, maintenance, MMEL, or other operationally related criteria formulated by AEG's. If criteria for training or checking are other than as specified in this AC, the criteria may be found in 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 by this AC, except as otherwise described by a MRB report for a specific aircraft type, or in FAA-approved maintenance instructions identified in conjunction with an STC or manufacturer's Service Bulletin.

(2) Approval Methods. TCAS operational approval is accomplished through FAA approval of pertinent training programs, checklists, operations manuals, training manuals, maintenance programs, MEL's, or other pertinent documents or document revisions applicable to the particular air carrier. Operators' TCAS programs are usually approved for each specific aircraft type. However, programs common to one or more types may be approved if TCAS program elements are common to different aircraft types (e.g., same TCAS systems, procedures, etc.).

(3) Approval Procedures.

(i) Approval to use TCAS is issued by an FAA PI.* Operators should make early contact with their respective PI's to permit timely FAA response. Usually such contact is initiated at the time preparations are being made for TCAS system selection or purchase, and generally not later than TCAS TC/STC application.

*NOTE: Each operator is assigned three FAA PI's as follows: A POI, a PMI, and a PAI. PI's are usually located in the CHDO.

(ii) Operations specifications normally are not required for U.S. operators. Installations, training, maintenance programs, MEL's, and other TCAS program elements are reviewed and accepted or approved by the FAA. TCAS operations specifications regarding FAR § 121.356 are not necessary. However, in the event of TCAS service difficulties, or in other special instances, the FAA may require certain operations specifications provisions.

8. FAR PART 121 FLIGHTCREW QUALIFICATION FOR USE OF TCAS.

a. General.

(1) TCAS Qualification Issues and Objectives. Air carriers should address the following issues and objectives to assure appropriate flightcrew TCAS qualification:

(i) Address necessary flightcrew knowledge of TCAS concepts, systems, and procedures (TCAS Academic Training).

(ii) Develop necessary flightcrew skills to properly respond to TCAS advisories (TCAS Maneuver Training).

(iii) Assess each pilot's ability to properly use TCAS (TCAS Initial Evaluation).

(iv) Maintain appropriate TCAS knowledge and skills (TCAS Recurrent Qualification).

(2) Acceptable Qualification Means. First time TCAS training and qualification should be addressed during initial, transition, upgrade, recurrent, differences, or stand-alone training and qualification programs, with TCAS topics addressed separately or integrated with other curriculum elements. For example, TCAS qualification may be keyed to specific aircraft during transition, upgrade, or differences courses (e.g., during DC-10 transition), may be addressed in conjunction with general training (e.g., during initial "new hire" indoctrination), or may be addressed in conjunction with recurrent training or checking events (e.g., in conjunction with recurrent proficiency check or proficiency training (PC/PT), or line-oriented flight training (LOFT)). TCAS qualification may also be addressed as a separate program (e.g., by completion of a standardized TCAS curriculum at an operator's training center, or at designated crew bases).

(3) Credit for Use of Other Programs. Each operator intending to receive credit for TCAS training when the program being proposed is based on LIP experience, or when the training is to be conducted by another operator, training center, or manufacturer, must be authorized to receive that FAR Part 121 credit from their respective POI. This is necessary even though the TCAS training may already be FAA-approved for the other operator, training center, or manufacturer conducting the training. POI's may permit credit for use of other operator or training center programs if those programs have been approved by FAA and if aircraft, TCAS systems, procedures, and other relevant factors or circumstances are the same or equivalent to those of the operator seeking credit. If a POI is uncertain about the suitability of a proposed program for a particular TCAS system or aircraft type, the POI should consult, through established organizational procedures, with the appropriate division of the Flight Standards Service, the NSET, or the assigned AEG, as applicable.

b. TCAS Academic Training. The following subjects should be addressed in an approved program of TCAS academic training during the initial introduction of a crewmember to TCAS. For subsequent programs, only the new, revised, or emphasis items need be addressed, as appropriate.

(1) General concepts of TCAS operation. TCAS academic training should cover, in general terms, TCAS system theory to the extent appropriate to ensure proper operational use. Aircrews should understand basic concepts of TCAS logic, closest point of approach, tau, altitude separation thresholds for the issuance of RA's, as well as the relationship between displayed traffic information and issuance of TA's and RA's. The training program should address the meaning of TA's and RA's; "increase," "reversal," "crossing," and "weakened" RA's; that TCAS II assures separation from Mode C-equipped aircraft; the detection provided by TCAS against altitude reporting and non-altitude reporting intruders; that the system detects multiple aircraft; TCAS-to-TCAS coordination; the potential impact of not following RA's; and the continued applicability of the "see and avoid" concept.

(2) Expected flightcrew response and level of protection provided by TCAS. Academic training should explain the normal, expected pilot response to TA's, to an RA, use of displayed traffic information to establish visual contact, and constraints on maneuvering based only on TA's.

(3) TCAS general limitations. There are several system limitations which apply to all aircraft types that should be understood as well as operational or performance limitations. System limitations include: the inability of TCAS to detect non-transponder-equipped aircraft, no RA's issued for traffic without an altitude reporting transponder, etc. Operational limitations include some RA's being inhibited at low altitudes, certain RA's being limited by aircraft performance constraints, and appropriate response to RA's in limiting performance conditions such as during heavy weight takeoff or while en route at maximum altitude for a particular weight.

(4) ATC Communication and Coordination. Training should discuss communication and coordination with ATC related to or following a TCAS event and when to contact ATC.

(5) TCAS equipment components, controls, displays, audio alerts, and annunciations. Academic training should include discussion of TCAS terminology, symbology, operation, and optional controls and display features including any items particular to an air carrier's implementation or unique to its system.

- (6) Interfaces and compatibility with other aircraft systems. Training should discuss the role of Mode S transponder (with a correct, discreet address installed), radar altimeter inputs to TCAS, weather radar/electronic flight instrument system interfaces, including any items particular to an air carrier's implementation or unique to its system.
- (7) Aircraft Flight Manual (AFM) information. AFM provisions should be addressed including information on TCAS modes of operation, normal and non-normal flightcrew operating procedures, and response to TA's, RA's, and any AFM limitations.
- (8) MEL operating provisions.
- (9) Appropriate pilot response to TCAS TA's, ATC clearance compliance, nuisance alerts, and other such issues.
- (10) The air carrier's TCAS event reporting policies for flightcrews.
- (11) Procedures by which aircrews report TCAS malfunction recording procedures for TCAS system irregularities, if not otherwise addressed by routine maintenance procedures of that operator.

c. TCAS Maneuver Training. In addition to the academic training described in paragraph 8b, appropriate maneuver training is required, to ensure use of proper procedures and response to TCAS advisories. As a minimum, TCAS maneuver training should expose the pilot to the encounter geometries involving two level aircraft; an intruder with a vertical rate; the TCAS aircraft with a vertical rate, parallel approach geometries, as well as multiple aircraft encounters; and should cover corrective, preventive, crossing, increase, reversal, and weakened RA's. In addition, training programs should cover the proper use of TCAS controls, procedures, and limitations; correct assessment of displays, aural advisories, and annunciations; timely and correct responses to TCAS RA's; appropriate interaction with ATC following an RA-induced deviation with return to an assigned ATC clearance unless given a subsequent change to clearance following a TCAS event; recognition of TCAS system failures; and TCAS issues unique to that air carrier, as necessary. Such training may be conducted using TCAS-equipped flight training devices or simulators, or by using suitable, computer-based instruction (CBI). Criteria for programs intending to address proper TCAS maneuvers through the use of simulators or training devices are listed in paragraph 8c(1). Criteria for programs intending to address proper TCAS maneuvers through CBI, and not using approved simulators or training devices, are listed in paragraph 8c(2). Operators may apply provisions of either paragraph 8c(1) or 8c(2), or combinations of these provisions to address necessary initial and recurrent TCAS maneuver training, as

approved by the FAA for that operator's specific TCAS systems, training devices, and simulators.

(1) Programs Addressing TCAS Maneuvers Through Use of Approved Simulators or Training Devices. Programs based on use of FAA-approved training devices or simulators should realistically depict relevant aspects of TCAS procedures, encounters, and pilot responses. This may be accomplished using one or more of a combination of training methods described in paragraph 8a. Any simulator or training device used should have the characteristics described in paragraph 8(m).

(2) Programs Addressing TCAS Maneuvers Through Use of CBI. TCAS programs may be approved which do not require using approved simulators or training devices if the proposed program meets certain criteria as described in 8c(2)(i)-(ii). These programs are based on CBI adequately depicting TCAS procedures, traffic encounters, desired pilot responses, and resulting maneuvers. Such programs may be approved if the program otherwise addresses the issues identified in 8c(1), and is consistent with the following criteria:

(i) TCAS systems, displays, and procedures must be consistent with accepted FAA and industry guidelines. There must not be any significant adverse training experience related to the particular TCAS system(s) to be used.

(ii) The program must realistically depict TCAS encounter scenarios. Scenarios must demonstrate proper TCAS procedures; depict "real time" (dynamic) traffic encounters; represent correct indications for TA's, RA's, displayed traffic and aural messages; and require proper pilot responses to RA's displayed on relevant vertical speed and pitch indicators.

d. Training Center Approval. Training centers conducting training (e.g., contract training, aircraft manufacturers, etc.) may have TCAS elements of those programs approved if:

(1) Provisions of 8b and 8c are shown to be met, or

(2) Equivalence to a previously approved program can be established. In this instance, circumstances, assumptions, and conditions for the program's use must also be equivalent to those applicable to the previously approved program.

e. Initial Evaluation of TCAS Knowledge and Procedures. Individual crewmember TCAS knowledge and procedures should be evaluated prior to TCAS use. Acceptable means of initial assessment include:

- (1) Evaluation by an authorized instructor or check airman using a simulator or a training device capable of depicting traffic encounters, or
- (2) Evaluation by an authorized instructor or check airman during line operations, training flights, PC/PT events, operating experience (OE), route checks, line checks, or
- (3) Computer-based testing in which TCAS scenarios and advisories are depicted, and for which a record documents acceptable pilot performance, or
- (4) Other alternate methods acceptable to the Administrator. Alternate methods must demonstrate the equivalent effectiveness of methods described in 8e(1)-(3).
- (5) If instructors are TCAS-qualified, they may be authorized to conduct the required initial TCAS crewmember evaluations.

f. TCAS Recurrent Training. TCAS recurrent training should be integrated into and/or conducted in conjunction with other established recurrent training programs. Recurrent training for TCAS should include maneuver training meeting the requirements of paragraph 8(c) and should address any significant issues identified by line operating experience, system changes, procedural changes, or unique characteristics.

g. TCAS Recurrent Evaluation. Recurrent TCAS checking should be incorporated as necessary as an element of routine proficiency training or proficiency check programs.

h. TCAS Currency (Recency of Experience). Once crews have completed initial TCAS training and as long as recurrent training is accomplished in accordance with paragraph 8f, specific TCAS currency requirements are not necessary.

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

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

k. Crew Resource Management (CRM). CRM programs should address effective teamwork in responding to TCAS events.

1. TCAS Academic Training Methods. Appropriate methods may be suited to each air carrier's program. No special methods related to academic training for TCAS are identified. Typically, a combination of ground instruction, manual information, flightcrew bulletins, and other such means is appropriate to address academic topics specified in paragraph 8b, Academic Training.

m. Characteristics of Simulated TCAS Systems for Maneuver Training.

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

(i) The ability to functionally represent TCAS displays, controls, indications, and annunciations.

(ii) Ability to depict selected traffic encounter scenarios including TCAS display and audio advisories.

(iii) Ability to show proper TCAS reaction to depicted scenarios and advisories.

(iv) Ability to interactively respond to pilot inputs regarding TCAS advisories including responses to RA's displayed on relevant vertical speed and pitch indicators.

(2) Simulator and TCAS System Fidelity. For a particular TCAS system, maneuver training may be accomplished in simulators or training devices which represent the specific aircraft or an aircraft that has similar characteristics. For the purposes of TCAS maneuver training, simulators or training devices may use simplified algorithms or displays. TCAS 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 FAA criteria are qualified by the NSET and approved for use by the POI. Any one or combination of the following devices or simulators which meet characteristics of paragraph 8m(1), Acceptable Characteristics, may be used:

(i) Level A through D Simulators,

(ii) Level 2 through 7 flight training devices, or

(iii) Dedicated TCAS training devices acceptable to the FAA (including those devices described in FAA Order 8400.10, Air Transportation Operations Inspector's Handbook, Volume 3, paragraph 443, "Aircraft Systems Integration Training" which are shown to be suitable for TCAS training).

***NOTE** - Training Device and Simulator Levels are as defined by AC 120-40B, Airplane Simulator Qualification; AC 120-54, Advanced Qualification Program; and FAA Order 8400.10.

9. OTHER OPERATIONAL ISSUES.

a. Manuals and Other Publications. Airplane flight manuals, operating manuals, maintenance manuals, general policy manuals, or other manuals, publications, or written materials (e.g., operating bulletins) that may relate to TCAS use must be appropriately amended to describe TCAS equipment, procedures, and operational policies according to the appropriate FAR.

b. MMEL/MEL.

(1) General. Operators formulate necessary TCAS revisions to their MEL(s) for each particular fleet (e.g., B727, DC10, etc.). MEL revisions must be consistent with the FAA 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 TCAS are provided in appendix 2.

(2) Inoperative TCAS During the TCAS Transition Program (TTP). During the TTP and prior to final TCAS FAR compliance dates, MEL provisions are as specified by FAA for the TTP. As TCAS compliance deadlines near, operators are generally expected to have resolved TCAS transition issues and have developed sufficient TCAS experience to properly apply MMEL and MEL requirements. From the time of the first TCAS installation, operators are encouraged to apply anticipated MMEL provisions to gain experience with TCAS inoperative component issues.

c. Aircraft with TCAS System Differences. Operators having aircraft with TCAS system differences in displays, controls, or procedures, or involved with interchange operations, must account for those TCAS system differences. This is accomplished as part of an approved differences training program in accordance with FAR Part 121, or as otherwise specified in applicable FAA FSB reports concerning crew qualification pertaining to a particular airplane type.

d. Issues Unique to a Particular Operator. Operators should address any TCAS issues that may be unique to their particular route environment, aircraft, procedures, or TCAS display and control features. Examples include the following:

(1) Example of a "Route Environment" Issue. Air carriers having takeoffs or landings outside of the reference TCAS performance envelope (e.g., 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) $\pm 50^{\circ}$ F should advise crews of appropriate procedures and precautions regarding RA compliance. To ensure proper response to TCAS in limiting performance conditions (e.g., TCAS RA during "takeoff climb" or in "final landing" configuration at high altitude airports such as Mexico City, La Paz, etc.), specific procedures or training may be needed unless these situations can be adequately addressed by bulletin or manual information.

(2) Example of a "Procedural" Issue. Air carriers should describe any TCAS precautions that may be appropriate when operating in countries where transponder, Mode S, or TCAS policies are uncertain. In those cases, carriers should conform to the laws and regulations that govern the airspace being used. This guidance should be reflected in company flight operations manuals.

(3) Example of a "Unique TCAS System" Issue. TCAS "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.

10. MAINTENANCE.

a. General. Maintenance procedures for TCAS are approved or accepted as part of an operator's initial maintenance manual approval or as a revision to that manual. TCAS maintenance procedures should be consistent with the TCAS manufacturer's maintenance procedures and/or aircraft manufacturer's maintenance procedures for TCAS.

b. Maintenance Training. An operator must provide adequate TCAS maintenance training in accordance with the appropriate FAR to ensure that its maintenance personnel or contract maintenance personnel at facilities not staffed by the operator are able to properly implement TCAS-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 TCAS systems. A method for

elimination of the potential for interfering with TCAS-equipped aircraft during transponder testing would be the use of shields for the transponder antennas.

c. TCAS System Software Updates. Operators should ensure that appropriate TCAS software updates are incorporated when necessary.

11. TCAS OPERATIONAL USE.

a. General. Operationally, those skills addressed and the guidance provided in the TCAS training paragraph 8 will be followed and implemented by each operator electing to use TCAS II and apply the appropriate FAR.

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

(1) Respond to TA's 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 FAR and good operating practices.

(2) When an RA occurs, the pilot flying should respond immediately by direct attention to RA displays and should maneuver as indicated unless doing so would jeopardize the safe operation of the flight or unless the flightcrew has definitive visual acquisition of the aircraft causing the RA.

(3) Satisfy RA's, using prompt, positive control inputs in the direction and with the magnitude TCAS advises (normally 1,500 fpm climb or descent is all that is required). For TCAS 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 TCAS 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 nonflying pilot should advise the pilot flying when there is a deviation from the vertical flightpath indicated by TCAS. The nonflying pilot, and any onboard observers, also will assist in the visual search for the intruder and continue to cross-check the TCAS 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 (e.g., a climb RA downgrades 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 TCAS-to-TCAS resolution of encounters and not exacerbate or cause a "reversal" or "crossing" message.

(7) Excessive responses to TCAS RA's are inappropriate and may increase interference with other traffic.

(8) It may not be possible to respond to a TCAS RA and continue to satisfy a clearance at the same time. Even if a TCAS RA maneuver is inconsistent with the current clearance, respond appropriately to the RA. Since TCAS 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 11b(2). Exceptions noted in paragraph 11b(2) are meant to hold down obvious nuisance excursions and unsafe handling of the aircraft.

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

(10) If a TCAS RA response requires deviation from an ATC clearance, expeditiously return to the current ATC clearance when the traffic conflict is resolved or the TCAS message "clear of conflict"

is heard, or follow any subsequent change to clearance as advised by ATC. In responding to a TCAS 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 the amended clearance if one is issued. In addition, the flightcrew's discretionary use of other types of reports may be desired. See appendix 5 for suggested phraseology.

(11) If a TCAS RA maneuver is contrary to other critical cockpit warnings, then those other critical warnings are respected as defined by TCAS certification and training (i.e., responses to stall warning, windshear, and GPWS take precedence over a TCAS RA, particularly when the aircraft is less than 2,500 feet above ground level).

(12) Pilots should use TCAS 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 TCAS installations operating in conjunction with "track up" mode may require the pilot to make allowance for the difference between the aircraft heading and track when visually sighting nearby aircraft.

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

(14) When feasible, flightcrews should use the same altitude data source to provide altitude information to TCAS and the ATC transponders. Using a common altitude source precludes unnecessary RA's due to differences between altitude data sources.

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

(16) TCAS does not alter or diminish the pilot's basic authority and responsibility to ensure safe flight. Since TCAS does not respond to aircraft which are not transponder-equipped or aircraft with a transponder failure, TCAS alone does not ensure safe separation in every case. Other aircraft may not be able to maneuver due to equipment malfunctions. Further, TCAS RA's may, in some cases, conflict with flightpath 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 TCAS RA's. 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 TCAS is responding.

(2) It is difficult to visually determine the vertical displacement of other aircraft especially when ground reference information is unreliable or when 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; and

(3) ATC may not know when TCAS issues RA's. It is possible for ATC to unknowingly issue instructions that are contrary [opposite] to the TCAS RA indications. Safe vertical separation may be lost during TCAS coordination when one aircraft maneuvers opposite the vertical direction indicated by TCAS and the other aircraft maneuvers as indicated by TCAS. 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 on ATC instructions.

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

NOTE: See paragraph 11d(4)(i)-(vi) for appropriate conditions to operate TCAS in the TA only mode.

d. TCAS Good Operating Practices. The following TCAS "good operating practices" have been identified:

(1) To preclude unnecessary transponder interrogations and possible interference with ground radar surveillance systems, TCAS should not be activated until taking the active runway for departure.

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

(3) During flight, TCAS 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.

(4) It is appropriate to operate TCAS in the "TA Only" mode in circumstances where unnecessary RA's frequently occur and where such RA's are disruptive to the operation of 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 (e.g., 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 (e.g., 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 RA's.

(v) In the event of particular in-flight failures, as specified by the AFM or operator, or

(vi) During takeoffs or landings outside of the nominal "TCAS reference performance" envelope for RA's, as designated by the AFM or operator ("TCAS reference performance" for RA's is typically attainable during takeoffs and landings at airports within the envelope of ISA $\pm 50^{\circ}$ 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 "TCAS 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 (e.g., Mexico City, La Paz, etc.).

(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 RA's.

d. Operator Responsibilities. Operators have the following general responsibilities regarding TCAS:

(1) Assure followup and evaluation of unusual TCAS events,
and

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

e. ATC Responsibilities. ATC may not know when TCAS issues RA's. It is possible for ATC to unknowingly issue instructions that are contrary [opposite] to the TCAS RA indications. Safe vertical separation may be lost during TCAS coordination when one aircraft maneuvers opposite the vertical direction indicated by TCAS and the other aircraft maneuvers as indicated by TCAS. 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, the aircraft is not to maneuver contrary to the RA due to ATC instructions.

(1) When an aircraft deviates from its clearance in response to an RA, ATC is still responsible to provide 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 FAA Order 7110.65, Air Traffic Control.

(3) Controllers will not knowingly issue instructions that are contrary to RA guidance when they are aware that a TCAS maneuver is in progress.

(4) Maintain awareness of TCAS programs and program changes.

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

(6) When requested by the flightcrew, provide separation from TCAS-observed traffic and assistance in returning to the

assigned clearance, if appropriate. Issue additional clearance instructions when the situation so requires.

(7) Advise pertinent FAA offices via TCAS questionnaires about airspace or airports where excessive numbers of RA's occur. This facilitates initiation of corrective actions related to TCAS enhancements, TCAS procedures, and airspace adjustments.

(8) Advise FAA if aware of other hazardous conditions, situations, or events which may be related to TCAS.

12. TCAS EVENT REPORTING.

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

(1) Properly assess the importance of TCAS events,

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

(3) Keep the industry and FAA informed on the performance of TCAS in the NAS and in international operations.

b. Pilot Reports.

(1) "TCAS-Specific" report's. Pilots should make the following reports for TCAS TA's and RA's, as necessary.

(a) Upon query from ATC, or after a deviation from an ATC clearance, make radio communications as appropriate to report a response to a TCAS advisory. Refer to the Airman's Information Manual, Chapter 4, Section 4, ATC Clearance/Separations, paragraph 4-81C for guidance and appendix 5 of this AC for recommended phraseology,

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

(i) Pilot/Observer Questionnaire,

(ii) Logbook entry, aircraft communications addressing and reporting system (ACARS), etc., or

(iii) Other record used by that operator (e.g., "Captain's Report"). An example of a typical reporting form for TCAS event information is shown in appendix 1.

(2) Other reports incidental to TCAS.

(a) NMAC Reports. Flightcrews should continue to submit NMAC reports in accordance with existing policies and procedures. Crews should be aware that there is no requirement to submit an NMAC report solely due to a TCAS event.

(b) FAR § 91.123 Reports. Unless required due to other circumstances, reports in compliance with FAR § 91.123 regarding "emergency deviation from an ATC clearance" are not necessary solely as a result of a TCAS maneuver.

(c) Aviation Safety Reporting System (ASRS) Reports. ASRS reports may be filed at the discretion of the flightcrew.

c. Maintenance Personnel Reports. Maintenance personnel should report TCAS problems that relate to system performance, manufacturers, and/or vendors to the PAI.

d. FAA ATC. Report the following:

(1) TCAS events to FSDO's as necessary,

(2) Any significant TCAS-related events regarding NAS performance to the Air Traffic Procedures Division, ATP-100.

e. TCAS Manufacturer Reports. TCAS avionics manufacturers report problems found with specific TCAS 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 Aircraft Engineering Division, AIR-100.

13. FAA RESPONSE TO TCAS EVENTS.

a. Regulatory Compliance Issues. Under current policy, the FAA will not initiate enforcement action solely on the basis of a TCAS event. Letters of investigation will not be sent to pilots involved in a TCAS-related deviation provided:

(1) The aircraft was equipped with TCAS, the system was operable, and the equipment was turned on at the time of the event.

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(2) The pilots have properly operated their aircraft in compliance with ATC clearances prior to the TCAS-related deviation; and

(3) The pilots have successfully completed the carrier's FAA-approved TCAS training program.

14. FOREIGN AIR CARRIERS.

a. General. FAR § 129.18 requires TCAS II installation and use by certain foreign air carriers when operating in U.S. airspace. Foreign air carriers are not required to install and use TCAS for any aircraft or operations taking place outside of the U.S. 12 nm territorial limit (FAR § 71.9) even though separation services may be provided by a U.S. ATC facility (e.g., in oceanic airspace).

b. TCAS Approval for Foreign Air Carriers. FAA does not approve TCAS installation, training programs, MEL's, or maintenance programs for foreign operators operating non-U.S. registered aircraft. Such authorizations are addressed as specified by the State of the operator or by the International Civil Aviation Organization (ICAO). However, since compatibility of TCAS and Mode S transponders with other aircraft and NAS facilities within U.S. airspace is essential, FAR Part 129 operations guidelines for TCAS are issued by FAA to all foreign air carriers operating within U.S. airspace. Compliance with these TCAS provisions ensures both TCAS system and procedural compatibility. The issuance of operations specifications or an amendment to existing operations specifications for TCAS must take place prior to a foreign air carrier operating a TCAS-equipped aircraft in U.S. airspace, and not later than the final FAR § 129.18 compliance deadline for foreign operators. Standard provisions for foreign air carriers for TCAS are shown in appendix 3.

c. Application and Approval. Foreign air carriers should contact their FAA POI to obtain application information for FAR Part 129 TCAS operations specifications. When a foreign air carrier submits the necessary information to the respective PI showing that its aircraft comply, the PI approves those operations specifications or an amendment. Standard operations specifications provisions regarding TCAS for foreign air carriers are shown in appendix 3. Although not mandatory, foreign operator compliance with the provisions of this AC, or equivalent provisions specified by the State of the operator or specified by ICAO, is expected.


William J. White
Deputy Director, Flight Standards Service

APPENDIX 1. SAMPLE TCAS EVENT REPORTING INFORMATION

Name: _____ Phone: (W) _____ (H) _____
(Optional for Aircrew)

DATE/TIME of EVENT _____ AIRLINE/FLT # _____ ORIG _____

Phase of Flight _____ Submitted due to: ATC INQUIRY _____ RA _____ OTHER _____

TA Data: Intruder Relative Altitude _____ Feet Position _____ o'clock

Own Aircraft: Altitude _____ Feet Position: _____ / _____
(VOR) (RADIAL) (DME)

RA Data: Intruder Relative Altitude _____ Feet Position _____ o'clock

Type RA Issued _____ Did RA: _____ STRENGTHEN _____ REVERSE

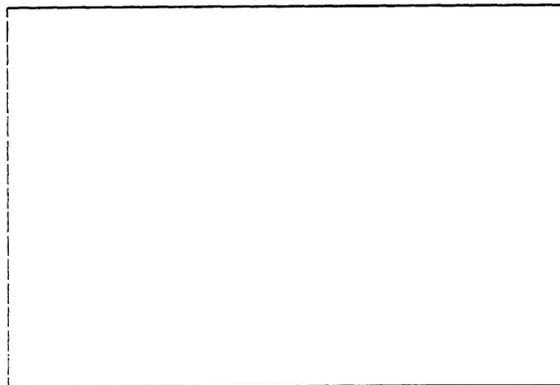
For the encounter please indicate the sequence of events below (i.e., first event = 1, second event = 2, etc.):

ATC Advisory _____ TA _____ RA _____ Visual Contact _____

Please diagram the sequence of events for any TCAS events. Use the following codes to denote the sequence:

Location of Target

- TA = Traffic Advisory
- RA = Resolution Advisory
- V = Visual Contact
- C = Clear of Conflict



NOTE: Size of the TCAS display will be adjusted to provide space for additional questions for those airlines desiring additional data on TCAS implementation.

Was the RA: Proper for the situation? YES NO Followed? YES NO

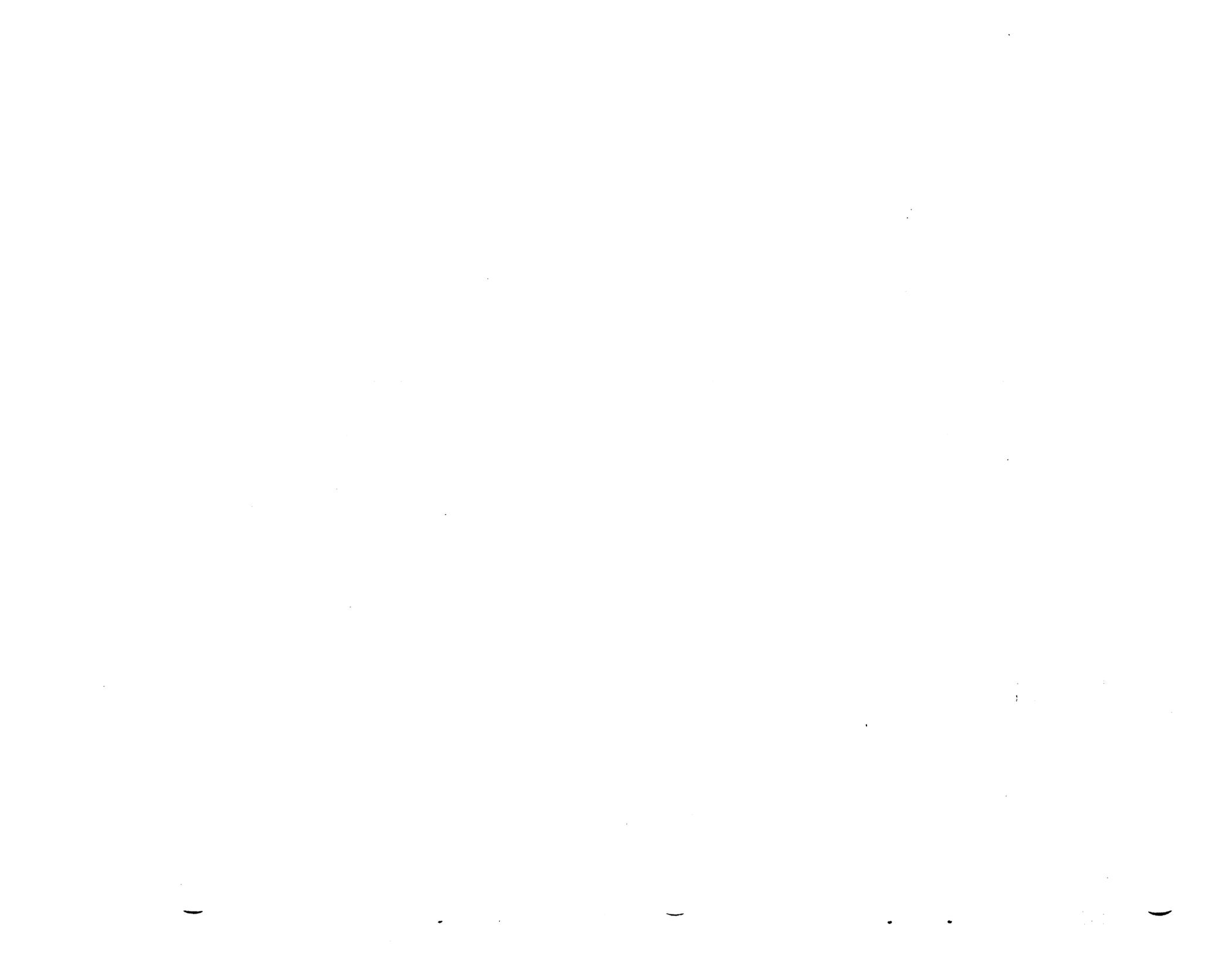
Necessary for the situation? YES NO Conflict with ATC instructions? YES NO

Result in a Clearance Deviation? YES NO

If YES, what was the deviation? _____

WEATHER: IMC VMC DAY NIGHT GEAR: UP DWN FLAPS _____

REMARKS: (Please provide comments/concerns you have regarding TCAS for this OR any previous encounter. Include items such as: use of TA only, ATC conflicts, TCAS procedures, ATC procedures (i.e., noise abatement, parallel approaches), display symbology, cockpit workload, etc.).



APPENDIX 2. TCAS "MINIMUM EQUIPMENT LIST" (MEL) AND
"MASTER MINIMUM EQUIPMENT LIST" (MMEL) PROVISIONS

1. Each operator intending to have authority to dispatch an aircraft with a TCAS system or component temporarily inoperative must do so in accordance with provisions of a MEL. MEL's are approved for each operator and type aircraft, within provisions of the FAA MMEL for that type. When proposed MEL provisions are consistent with the FAA MMEL, POI's may approve the MEL. If a less restrictive MEL or different MEL provisions are requested, a proposal for consideration of an FAA MMEL change must be forwarded to the AEG assigned for that aircraft type. No relief will be granted for the voice command portion of the TCAS 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 TCAS 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. EXAMPLE OF A TCAS MMEL PROVISION*

*NOTE - The provisos and repair category intervals are intended to grant the operator sufficient relief, especially during the early stage of the TCAS TTP. This is intended to promote the installation process, as well as support the use of a partial system. Both equipment reliability and operational experience will dictate if any revision to this MMEL relief should be considered after the installation phase is completed.

APPENDIX 2. TCAS "MINIMUM EQUIPMENT LIST" (MEL) AND
"MASTER MINIMUM EQUIPMENT LIST" (MMEL) PROVISIONS (continued)

CHAPTER 34 NAVIGATION

Traffic Alert Collision
Avoidance System (TCAS)

- | | | | | |
|---|---|---|---|--|
| 1) TCAS System | C | - | 0 | *(M) May be inoperative provided the system is deactivated and secured. |
| 2) Combined TA and RA
***Dual Displays | C | 2 | 1 | *(O) May be inoperative on the nonflying pilot side provided:

a) TA and RA elements and audio functions are operative on flying pilot side, and

b) TA and RA display indications are visible to the nonflying pilot. |
| 3) RA Display Systems | C | 2 | 1 | *(O) One may be inoperative on nonflying pilot side.

or |
| | C | - | 0 | *(O) May be inoperative provided:

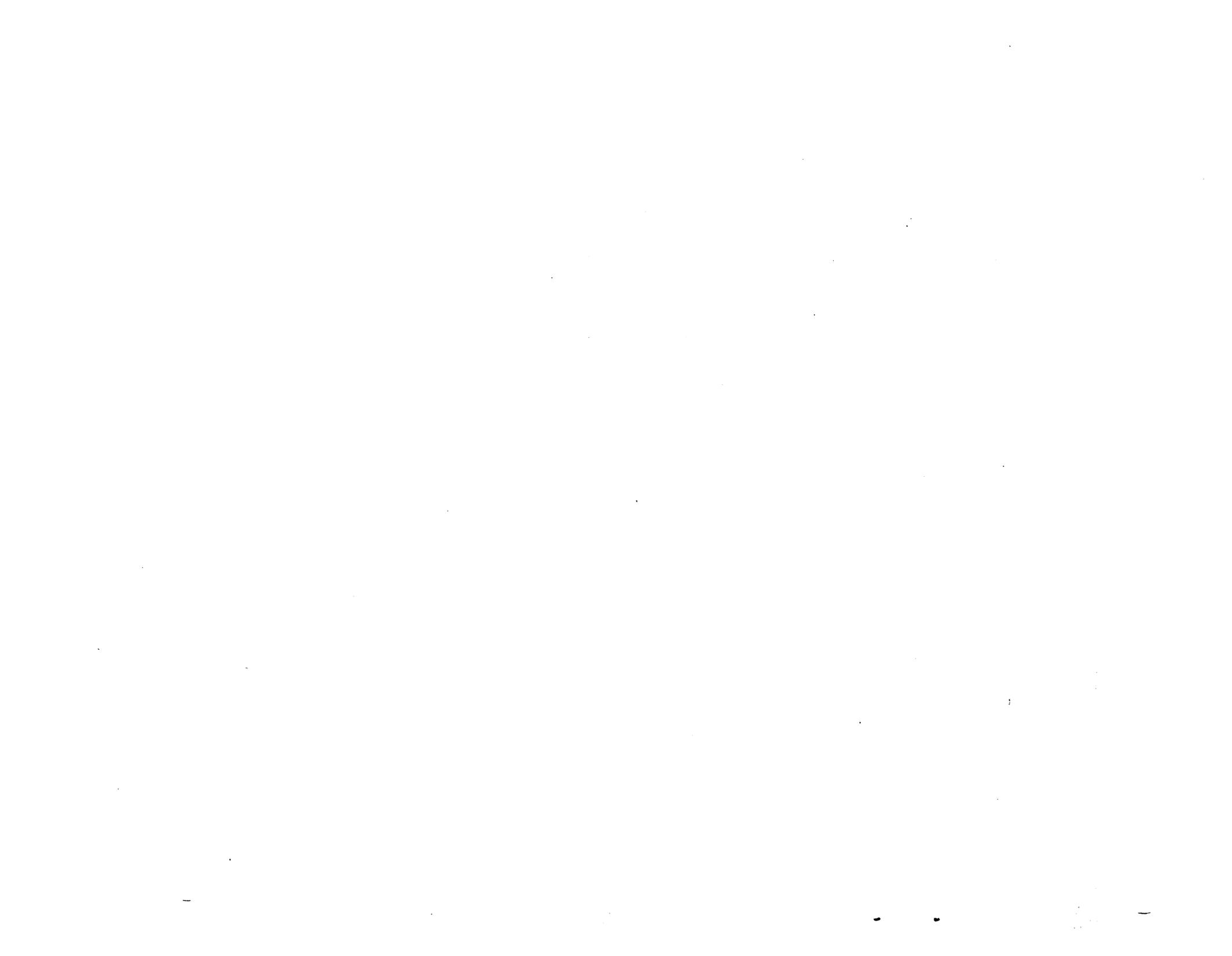
a) All TA display elements and voice command audio functions are operative, and

b) "TA Only" mode is selected by the crew. |
| 4) TA Display System(s) | C | - | 0 | *(O) May be inoperative provided all installed RA display and audio functions are operative. |

* Item must be placarded.
*** If installed.

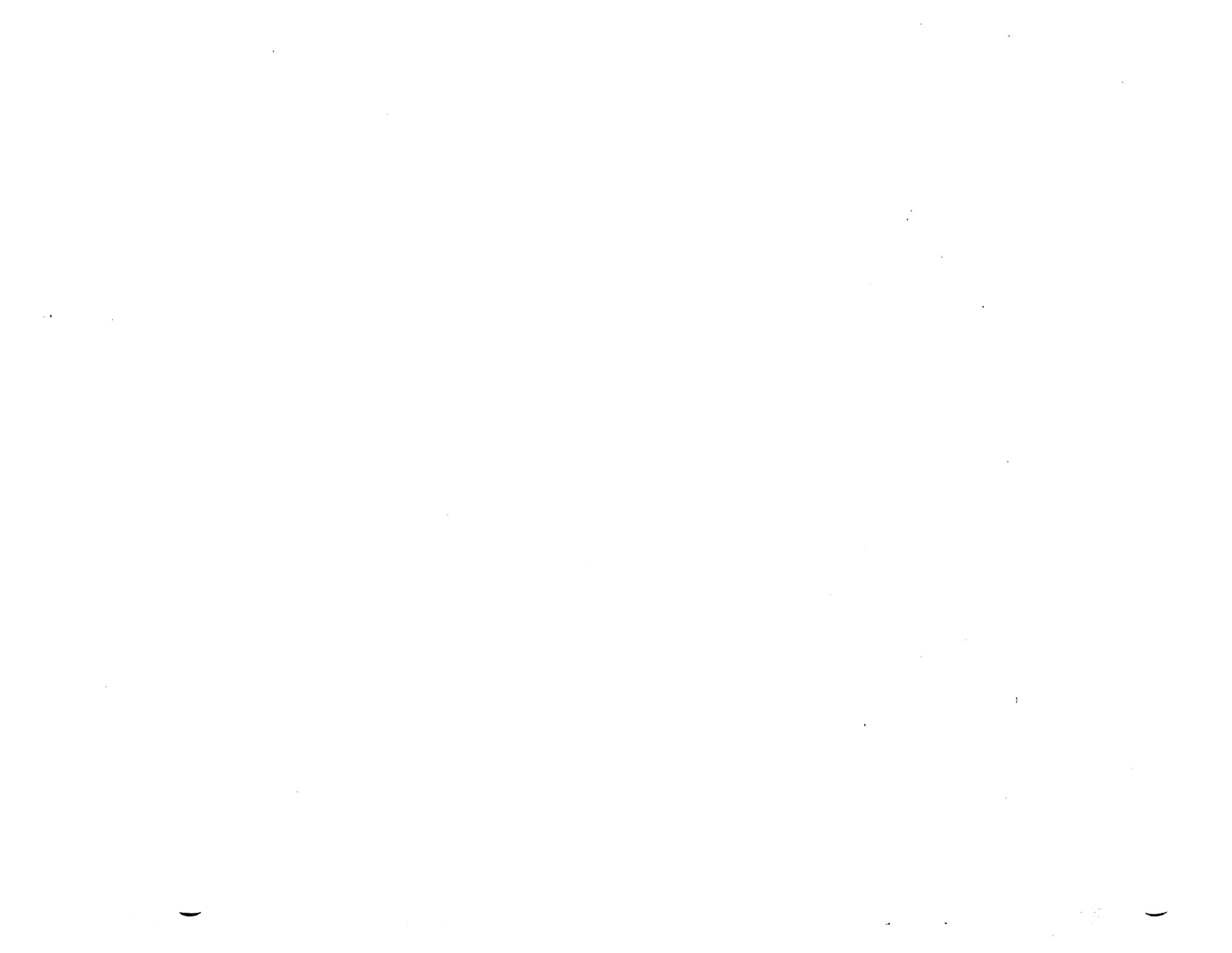
APPENDIX 3. FAR 129 PROVISIONS FOR USE OF TCAS IN U.S. AIRSPACE

1. An appropriate Mode S transponder must be installed and operated on a suitable code specified by ATC during flight in U.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 TCAS safety functions (e.g., must not be set to all "ones" or all "zeros," or the country address must not be set without the unique aircraft specific address.
2. A TCAS II capable of coordinating with TCAS units meeting TSO C-119A must be installed. Except as provided for by MEL provisions acceptable to the State of the operator, the TCAS system must be operated in an appropriate TCAS mode during flight in U.S. airspace.
3. Training and procedures for use of TCAS as specified by ICAO, this AC, or other equivalent criteria acceptable to FAA, must be used when operating in U.S. airspace.
4. Unsafe conditions or performance related to TCAS operation which potentially could affect continued safe operations in the U.S. NAS must be reported to the FAA POI within 10 days of the time that such a hazard is identified.



APPENDIX 4. ACRONYMS AND ABBREVIATIONS

ACARS	Aircraft Reporting and Communications System
ACO	Aircraft Certification Office
AEG	Aircraft Evaluation Group
AFM	Airplane Flight Manual
AFS	Flight Standards Service (FAA)
AGL	Above Ground Level
AIR	Aircraft Certification Service (FAA)
ARD	Research and Development Service (FAA)
ASRS	Aviation Safety Reporting System
ATCRBS	ATC Radar Beacon System
ATC	Air Traffic Control
ATP	Air Traffic Procedures Division (FAA)
CBI	Computer-Based Instruction
CHDO	Certificate Holding District Office
CPA	Closest Point of Approach
EFIS	Electronic Flight Instrument System
FAR	Federal Aviation Regulations
FOEB	Flight Operation Evaluation Board
FSB	Flight Standards Board
FSDO	Flight Standards District Office
GPWS	Ground Proximity Warning System
ICAO	International Civil Aviation Organization
ISA	International Standard Atmosphere
LIP	Limited Implementation Program
LOFT	Line-Oriented Flight Training
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
MRB	Maintenance Review Board
MSL	Mean Sea Level
NAS	National Airspace System
NMAC	Near Mid-air Collision
NSET	National Simulator Evaluation Team
NTSB	National Transportation Safety Board
OE	Operating Experience
PAI	Principal Avionics Inspector
PC	Proficiency Check
PI	Principal Inspector
PMI	Principal Maintenance Inspector
POI	Principal Operations Inspector
PT	Proficiency Training
QFE	Altimeter Reference to Zero Feet at Field Elevation
RA	Resolution Advisory
STC	Supplemental Type Certificate
TA	Traffic Advisory
TC	Type Certificate
TCAS	Traffic Alert and Collision Avoidance System
TSO	Technical Standard Order
TTP	TCAS Transition Program



APPENDIX 5. PHRASEOLOGY FOR TCAS EVENTS:

In order to keep everyone informed during a TCAS maneuver, radio communication should be in terminology common to all parties on the frequency regarding a TCAS RA. The following phraseology is suggested and should contain: (1) name of the ATC facility, (2) aircraft identification (ID), and (3) nature of the TCAS deviation.

When a flightcrew receives a TCAS 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), TCAS Climb/Descent"

Example:

"New York Center, Quantum 321, TCAS Climb"

"Cleveland Center, Universal 602, TCAS Descent"

Following such a communication, the designated air traffic facility is not required to provide approved standard separation to the TCAS maneuvering aircraft until the TCAS encounter is cleared and standard ATC separation is achieved. If workload permits, traffic information should be provided in accordance with Order 7110.65.

When the RA is clear, the flightcrew should advise ATC that they are returning to their previously assigned clearance or subsequent amended clearance.

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

Example:

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

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 Order 7110.65.

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

