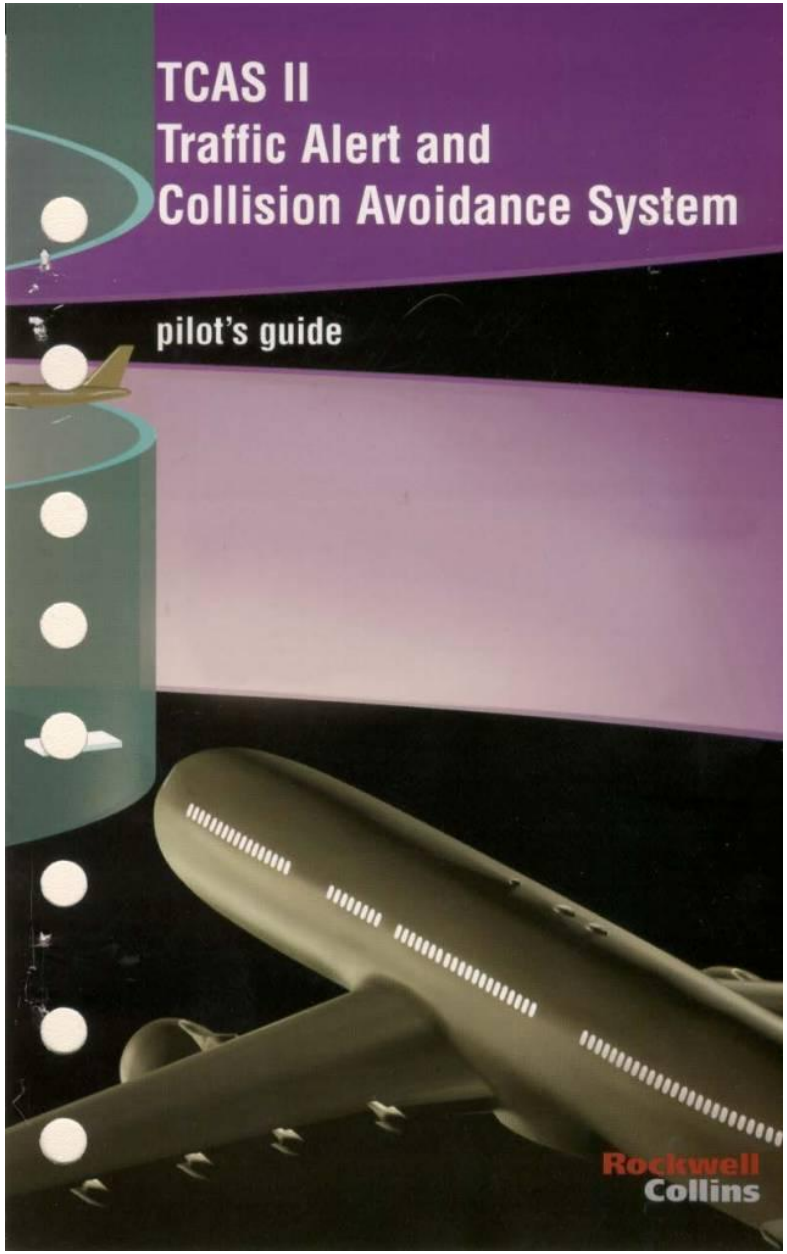
Exhibit H – User's Manual



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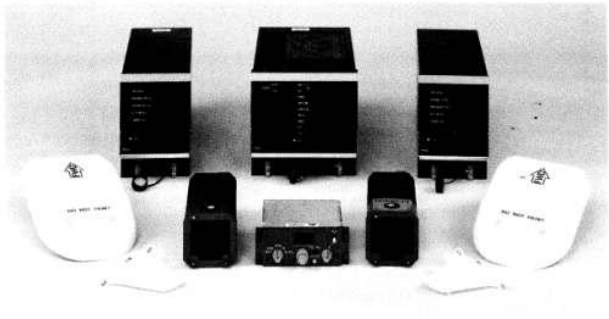
INTRODUCTION



TCAS II Traffic Alert and Collision Avoidance System

This publication is intended as a general pilot's guide to TCAS II operation. There are a variety of individualized operational features available through various control panel and display configurations. Refer to the Aircraft Flight Manual Supplement, Flight Operations Bulletins or other publications for each particular aircraft type for specific operating information.

WARNING: THE TCAS II SYSTEM IS TO BE USED AS A SUPPLEMENT TO THE FLIGHT CREW WHO, HAVE THE PRIMARY RESPONSIBILITY FOR AVOIDING MID-AIR COLLISIONS.

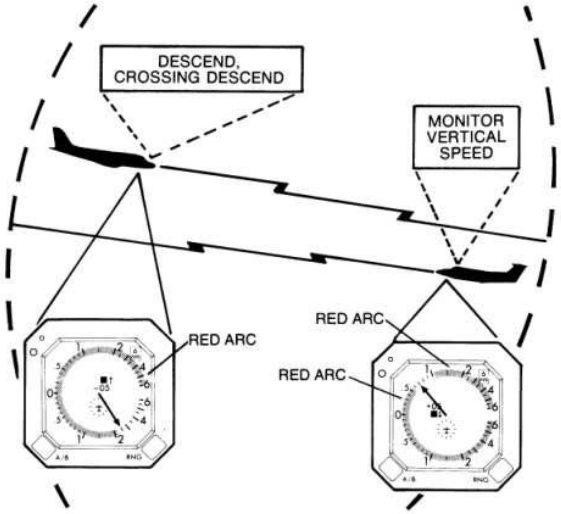
THE TCAS II SYSTEM DOES NOT PROVIDE ANY INDICATION OF AIRCRAFT THAT DO NOT HAVE OPERATING ALTITUDE-REPORTING TRANSPONDERS.

GLOSSARY

Advisory	A message presented to the flight crew containing information relevant to possible and actual conflicting traffic.
Alert	A message (aural or visual) that provides information to the flight crew in a timely manner about conflicting traffic.
CPA	Closest Point of Approach. The computed minimum separation between the TCAS-equipped aircraft and an intruder.
Corrective Resolution Advisory	A resolution advisory that advises the flight crew to change current vertical speed; eg, CLIMB when the aircraft is in level flight. Displayed as red and green arcs on vsi.
Data Tag	The numbers, sign, and arrow associated with an intruder display symbol representing the intruder altitude (absolute or relative to your aircraft) and its vertical movement, if greater than 500 fpm.
Full-time Display	A continuous traffic display on a TCAS indicator. (Compare to the "pop-up" display definition.)
Intruder	An aircraft being tracked by TCAS. Intruders are defined as Other, Proximate, TA, or RA.
Mode C Transponder	An airborne transponder that provides aircraft altitude information in the reply when interrogated by an SSR or TCAS.
Mode S Transponder	An airborne transponder that replies to discrete aircraft-address interrogations (Mode S) from TCAS-equipped aircraft and Mode C interrogations from ground SSR stations.
No-Bearing Target	A target for which the bearing cannot be determined by the TCAS. Altitude, climb/descend and distance information is shown in the display in a text message.
Other Traffic	An intruder more than 6 nmi away or greater than ±1200 ft from your aircraft and not currently a potential conflict. Displayed as an open cyan or white diamond.

Pop-up	A display operating mode in which all tracked intruders "pop up" on the display only when a TA or RA occurs.
Preventive Resolution Advisory	A resolution advisory that advises the flight crew of vertical speeds to avoid, to maintain safe separation from an intruder. Displayed as a red arc on the vsi.
Proximate Traffic	An intruder less than 6 nmi away and within ±1200 ft from your aircraft and not currently a potential conflict. Displayed as a solid cyan or white diamond.
RA (Resolution Advisory)	Aural and visual alert and maneuver guidance information. An RA is issued when a threat aircraft is 15 to 35 seconds from CPA, depending on altitude. Displayed as a solid red square.
Threat	A target that has satisfied the TCAS threat detection logic and produces a resolution advisory (RA), either corrective or preventive.
TA (Traffic Advisory)	A TA is an aural and visual alert and intruder position information issued when an intruder aircraft is 20 to 48 seconds from CPA, depending on altitude. Displayed as a solid yellow circle.
Traffic Display	A display of other Mode C or Mode S transponder-equipped aircraft relative to your own aircraft. This display provides altitude and vertical trend information for the associated targets.

SYSTEM OVERVIEW



The Traffic Alert and Collision Avoidance System (TCAS) is an airborne system that interrogates Mode C and Mode S transponders in other aircraft. From the replies received, the system analyzes the intruding aircraft's altitude, closure rate, and projected flight path to predict a penetration of the airspace about your aircraft. The system then displays the other aircraft visually and aurally to alert you to any potential threats of airspace conflict. These advisories aid in assuring adequate separation when a potential flight path conflict is predicted.

The TCAS-protected airspace about your aircraft is defined in terms of time to closest point of approach (CPA) of an intruding aircraft. Using the changes in elapsed times for the intruding aircraft's transponder replies to your TCAS interrogations (range rate), the difference between the reported Mode C altitude of the intruding aircraft and your own aircraft, the TCAS calculates a predicted straight-line flight path for both your and the intruding aircraft. From this, both your and the intruding aircraft. From this, the TCAS continuously computes the time to CPA and uses this value as a criterion for issuing traffic and resolution advisories. (Time to CPA is based on the slant range between the aircraft and the effective closure rate along this slant range.) Traffic advisories (TA) are issued when the time to CPA is 20 to 48 seconds. Resolution advisories (RA) are issued when the time to CPA is 15 to 35 seconds.

The traffic display is an information-only display which shows the location of intruder aircraft in relation to your own aircraft. Associated with the intruder symbol is a data tag showing altitude and vertical speed trend. Displayed traffic symbols are divided into four categories indicating different threat levels: Other, Proximate, TA, and RA.

Other intruder symbols are shown on the TA display (in the normal, non-pop-up, mode) as open, cyan (blue-like) or white diamonds and associated data tag. An Other intruder has a range greater than 6 nmi or, if within 6 nmi, at a relative altitude of more than ±1200 ft from your altitude, and is not a threat.

When an Other intruder moves to within 6 nmi and/or ±1200 feet of your altitude, the open-diamond (displayed in the normal, non-pop-up, mode) turns solid. This indicates a Proximate intruder. These are not yet considered threats but are displayed to assist the flight crew in visually acquiring the traffic.

A Proximate intruder whose flight path brings it to within 20 to 48 seconds of CPA will cause a TA to be issued. If operating in the pop-up mode, the symbol pops up on the display and is a solid yellow circle with its associated data tag. The aural alert message, **"Traffic, Traffic"** is annunciated. If the TA target continues to close on your flight path, an RA will be issued when it is 15 to 35 seconds from CPA.

An RA display symbol is a solid red square with an associated data tag. At the same time the RA is displayed, the vertical speed range and/or pitch necessary to assure maximum vertical separation at the CPA, with the least impact on current vertical trend, is displayed on the RA indicator (vsi, or EFIS or IDS in ADI/PFD mode). Simultaneously, an aural alert message advising vertical speed or pitch action is annunciated. (Refer to the table of aural annunciator messages in the next section of this guide.) TCAS II RA algorithms are based on the flight crew initiating the maneuver within 5 seconds of the RA.

The RA may be either corrective or preventive. Corrective RAs advise the pilot to change vertical speed or pitch to increase separation between aircraft at the CPA. Preventive RAs advise the pilot to monitor vertical speed to ensure the aircraft is not flown into a range which would reduce separation between aircraft.

If the threat aircraft changes its vertical speed, your TCAS may annunciate an advisory to increase your rate of climb or descent, or to reverse your vertical speed or pitch direction. When any of these messages are annunciated, it is expected that the pilot will act to comply within 2½ seconds.

When the threat situation has cleared, the RA target will downgrade to a TA and the advised vertical speed range (red or possibly green arcs) will no longer be displayed. An aural **"Clear of conflict"** message will be annunciated, when the intruder no longer meets the RA and TA threat parameters.

The TCAS is designed to issue advisories in sufficient time to avoid abrupt vertical speed changes. Often the altitude change will be only in the 300- to 600-foot range. When the **"Clear of conflict"** message is issued, the pilot should return to normal flight.

The system has the capability to track up to 30 intruders. It is designed to provide collision avoidance protection between aircraft with a horizontal closure rate of up to 1200-kts. and vertical closure rate of up to 10,000 feet per minute.

At the time of installation, the TCAS is programmed to inhibit the issuance of advisories which could be outside the performance limits of the aircraft, or could cause an unsafe condition of flight. For example, all RAs and the **"Traffic, traffic"** annunciation are inhibited when the aircraft is below 400 ft. AGL when descending or 600 ft. when climbing (below 900 ft. AGL when descending or 1100 ft. for version 6.04A), to avoid distractions on approach or departure. The climb and increase climb advisories may be inhibited when the aircraft is in certain flight configurations or altitudes. Refer to the System Inhibits section of this guide for a more complete discussion of these.

The TCAS system generates resolution advisories only for threat aircraft equipped with operating Mode C or Mode S transponders. Only traffic advisories can be generated for aircraft with operating Mode C or Mode S transponders but which are not providing altitude information. Resolution advisories require altitude information. No information is provided about aircraft without an operating transponder.

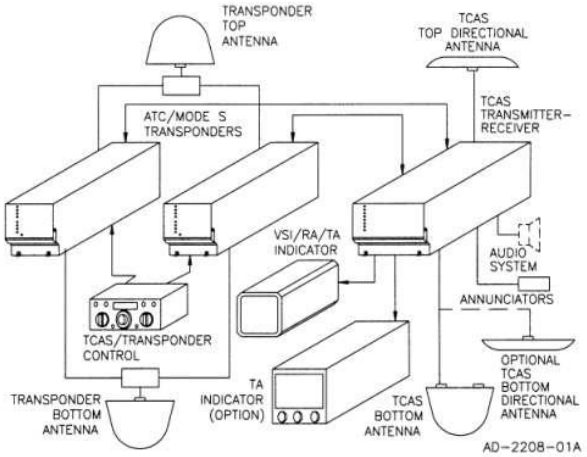
The TCAS system hardware consists of:

- a TCAS transmitter/receiver unit
- two TCAS antennas
- two transponders (one must be Mode S)
- two transponder antennas
- two display units (one must display RAs)
- a transponder/TCAS control unit

The block diagram in the illustration below shows a typical TCAS system.

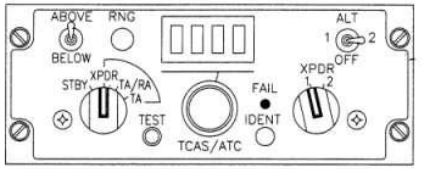
The transmitter/receiver unit transmits interrogations to nearby aircraft and receives their replies. From the received information, the computer section of the unit calculates the intruder aircraft's range, bearing, relative speed and altitude, and outputs the data to the TCAS display. If the computed CPA predicts a threat, the intruder display will become an RA. An aural alert will also be output over the cockpit audio system.

If the intruding aircraft is also TCAS-equipped, maneuver-coordination messages are transmitted between aircraft via the Mode S transponders. This allows both aircraft to coordinate RAs to prevent each TCAS from commanding the same maneuver; climb, for example. (The RA is based on the predicted straight-line flight path of both the intruding aircraft and your own aircraft.)



TCAS COCKPIT CONTROLS, INDICATORS, AND ANNUNCIATORS

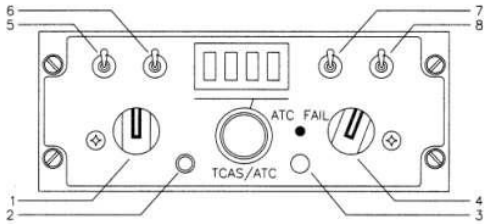
TTC-920 Transponder/TCAS Control



The TTC-920 Transponder/TCAS Control controls operation of the TCAS and associated transponders. If the system's vertical speed/TCAS indicator has the optional mode and range switches on it, those functions would not be provided on the TTC-920 control. The TTC-920A control is available for installations in which the side 2 (or right) transponder is a Mode C-only type. In this case, when the side 2 (or R) transponder is selected, the TCAS automatically goes to standby.

Controls, control legends, and positions of switches on the panel vary to accommodate the uniqueness of different installations. The following illustration shows all the possible switch locations. The accompanying table lists the different legends and functions for each switch.

Refer to the Operating Procedures section for instructions for operating the transponder/TCAS control.



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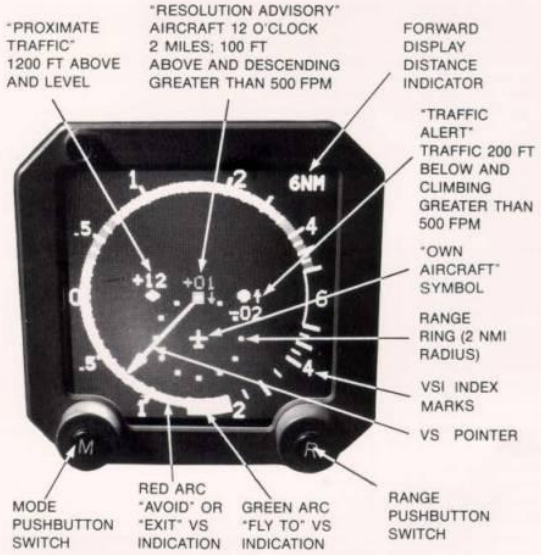
SWITCH	LEGENDS	FUNCTION
S1	TEST, STBY, XPDR, TA/RA, TA ONLY	Selects indicated functions (TEST and STBY apply to both the TCAS and transponder. XPDR turns on transponder and leaves TCAS in standby. Other positions enable TCAS and transponder. TA ONLY position inhibits RAs.)
	TEST, STBY, XPDR, TA, TA/RA	Same as above. (TA=TA ONLY).
	STBY, TA/RA, TA XPDR	Does not select TEST function: done by S2.
	STBY, XPDR, TA/RA, TA	Same as above.
	STBY, AUTO, TA ONLY	Same as above. (AUTO=TA/RA)
S2	Not present	Functions are on S1 or S3 switches
	TEST	Selects self-test for both TCAS and transponder
	IDENT	Enables transponder IDENT if not on S3

SWITCH	LEGENDS	FUNCTION
S3	Not present	Function is on S2 switch.
	IDENT	Enables transponder IDENT if not on S2.
S4	1 - 2 L - R	Enables #1 or #2, or left or right transponder.
	1 - STBY - 2 L - STBY - R	Enables #1 or #2, or left or right transponder; or places both transponders and TCAS in standby.
		CAUTION: IN THE TTC-920A CONTROL PANEL THE #2 OR "R" TRANSPONDER IS NON-MODE S AND NOT COMPATIBLE WITH TCAS. IN THIS SYSTEM CONFIGURATION, SELECTING "2" OR "R" WILL PLACE THE TCAS SYSTEM IN STANDBY.
S5	Not present	Functions are not available.
	TFC	Enables full-time (vs pop-up) display of TCAS traffic on VSI.
	ABOVE - N - BELOW	Selects display of traffic (relative to own-aircraft altitude) from +9900 ft to -2700 ft (ABOVE), +2700 ft to -2700 ft (N), or +2700 ft to -9900 ft (BELOW).
S6	Not present	Functions are not available.
	RNG	Selects traffic display range (3, 5, 6, 10, 12, 20, or 40 nmi, depending on indicator).
	ABS - REL, or REL - ABS	Selects whether altitude shown in data tag is absolute or relative altitude.

SWITCH	LEGENDS	FUNCTION
S7	Not present.	Functions are not available.
	ABOVE - N - BELOW	Selects display of traffic (relative to aircraft altitude) from +9900 ft to -2700 ft (ABOVE), +2700 ft to -2700 ft (N), or +2700 ft to -9900 ft (BELOW).
	FL, or ABS - REL	Selects whether altitude shown in data tag is absolute or relative altitude.
S8	ALT - OFF	Enables altitude reporting on transponder. CAUTION: TCAS REQUIRES OWN-AIRCRAFT ALTITUDE. SETTING SWITCH TO "OFF" WILL PLACE THE TCAS SYSTEM IN STANDBY.
	1 - OFF - 2 L - OFF - R	Selects source of altitude information and turns altitude reporting on for transponder system. CAUTION: TCAS REQUIRES OWN-AIRCRAFT ALTITUDE. SETTING SWITCH TO "OFF" WILL PLACE THE TCAS SYSTEM IN STANDBY.
	ABS - REL	Selects whether altitude shown in data tag is absolute or relative altitude.
Code select	0000 through 7777, as selected	Selects transponder code (displayed in window). NOTE: Codes 7500, 7600, and 7700 are for emergency use only. Do not select for non-emergency situations.

SWITCH	LEGENDS	FUNCTION
FAIL indicator	FAIL (if present)	Indicates failure in transponder, control panel, antennas, or air data system when lamp remains lit. Indicator lights momentarily when in test mode to verify operation of indicator and enabling of test mode in transponder.

TVI-920 Vertical Speed/TCAS Indicator



The TVI-920 is the primary TCAS display instrument. It incorporates the TCAS display with the standard vertical speed display. Some versions of the TVI-920 have mode (M) and range (R) pushbutton switches. The mode and range switches may be included on certain versions of the TTC-920 control panel for use with TVI-920 not having these switches. The particular indicator/control panel combination used depends on the individual aircraft installation.

The previous illustration shows a representative display on the TVI-920 indicator. The following table describes the various symbols that may be displayed on the indicator. Range and mode switch positions are also described in the table.

The indicator has eight slots in which various flags, and messages may be displayed. In the figure on the following page, messages are shown in slots 1, 3, and 5. Areas for slots 2, 4, 6, 7, and 8 are highlighted on the display.

Refer to the System Operation section for displays and an interpretation of each.

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SYMBOL	INTERPRETATION
Vertical Speed Display	
Vertical speed scale (Always displayed) (White)	100-ft. index marks from 0 to ±1000 fpm; 500-ft. index marks from ±1000 to ±6000 fpm.
Pointer (White)	Indicates present vertical speed. Pointer displayed when vertical speed is valid.
VERT SPEED X 1000 FPM (Cyan)	Legend displayed on indicator when in pop-up mode and traffic is not displayed, and in some failure modes.
Resolution Advisory Display	
Red arc(s)	Preventive RA: Current Vertical Speed is outside of the red arc and should be maintained outside the red arc. Corrective RA: Current Vertical Speed is within the red arc and should be increased or decreased to outside the red arc.
Green arc	Recommended vertical speed to resolve corrective resolution advisory.

SYMBOL	INTERPRETATION
Traffic Display	
Aircraft (White)	"Own aircraft" symbol. If in pop-up mode, displayed only when TA or RA is present; if in full-time mode, displayed continuously.
Range ring (White)	2-mile radius range about aircraft. If no-bearing message is displayed, only forward half of ring displayed.
Solid square (Red)	Threat-level intruder; RA generated; range and bearing relative to own aircraft.
Solid circle (Yellow)	Potential threat-level intruder; TA generated; range and bearing relative to own aircraft.
Solid diamond (Cyan)	Proximate traffic within ±1200 ft. and 6 nmi of own aircraft.
Open diamond (Cyan)	Other traffic; beyond 6 nmi and/or greater than ±1200 ft. from own aircraft.
Traffic altitude tag (Same color as associated traffic symbol)	Relative or absolute (flight level) altitude of intruder. If altitude is not available, data tag is not displayed.
Vert speed trend arrow (Same color as associated traffic symbol)	Arrow indicating direction of vertical speed change (>500 fpm) of intruder.
Partial traffic symbol (Same color as fully displayed symbol)	Off scale or out of range RA or TA intruder; symbol at periphery of display at bearing to intruder.
Mode/Warning Flags and Messages	
V/S (message slot 5) (Black on yellow)	Vertical speed is unreliable, or system is in test mode.
RA (message slot 1) (Black on yellow)	Resolution advisory or vertical speed is unreliable.
TCAS(message slot 1) (Black on yellow)	TCAS functions have failed.
ALT or **FL**(message slot 8)	Absolute altitude is selected.

SYMBOL	INTERPRETATION
Flags and Messages (Cont)	
ONLY TA (message slots 1 and 2) (White on black in white border)	TCAS set to TA-only mode, either manually or automatically. If a TA occurs, message and box border change to yellow.
TCAS OFF (message slots 3 and 4) (White on black in white border)	TCAS set to standby, either manually or automatically.
TEST (message slot 6) (White on black in white border)	TCAS set to test mode.
ABV (message slot 4) (White on black)	Traffic displayed in altitudes from +9900 ft. to -2700 ft., relative to own aircraft. (If no message is displayed (ABV or BLW not selected), traffic display is from +2700 ft. to -2700 ft., relative to own aircraft.)
BLW (message slot 4) (White on black)	Traffic displayed in altitudes from +2700 ft. to -9900 ft., relative to own aircraft. (If no message is displayed (ABV or BLW not selected), traffic display is from +2700 ft. to -2700 ft., relative to own aircraft.)
6 NM or **12 NM**, or other (message slot 3) (White on black)	Selected forward range of traffic display. (Available ranges depend on individual installation.)
No-bearing message (message slots 6 and 7) (Red if RA; yellow if TA)	Range and altitude of RA or TA intruders for which no bearing information is available.
Mode, Altitude Scan, and Range Switches (Not on all indicators)	
M (mode) or **A/B** (above/below) switch	Selects pop-up or full-time display of traffic. Selects ABV, normal, or BLW altitude scan. (Refer to slot 4 symbol, above.)
R (range) switch	Allows selection of forward-direction display range.

Aural Annunciator Messages
(TCAS II, MOPS Change 6.04A)

MESSAGE	INTERPRETATION
Traffic Advisory Annunciation	
TRAFFIC; TRAFFIC	Traffic has entered 20 to 48-second envelope. (Symbol has changed to solid yellow circle.)
Resolution Advisory Annunciations (Maneuver should begin within 5 seconds)	
CLIMB; CLIMB; CLIMB	Climb at rate shown on vertical speed indicator.
CLIMB-CROSSING CLIMB; CLIMB-CROSSING CLIMB	Climb at rate shown on vertical speed indicator. Flight path will cross intruder's flight path.
REDUCE CLIMB; REDUCE CLIMB	Reduce rate of climb to that shown on vertical speed indicator.
DESCEND; DESCEND; DESCEND	Descend at rate shown on vertical speed indicator.
DESCEND, CROSSING DESCEND; DESCEND, CROSSING DESCEND	Descend at rate shown on vertical speed indicator. Flight path will cross through intruder's flight path.
REDUCE DESCENT; REDUCE DESCENT	Reduce rate of descent to that shown on vertical speed indicator.
MONITOR VERTICAL SPEED; MONITOR VERTICAL SPEED	Monitor present vertical speed to prevent entering restricted (red arc) vertical speed.
Increased Action Resolution Advisory Annunciations (Maneuver should begin within 2½ seconds)	
INCREASE CLIMB; INCREASE CLIMB	Follows "climb" advisory due to intruding aircraft's maneuvering. Rate of climb of own aircraft should be increased.
INCREASE DESCENT; INCREASE DESCENT	Follows "descend" advisory due to intruding aircraft's maneuvering. Rate of descent of own aircraft should be increased.

MESSAGE	INTERPRETATION
Increased Action Resolution Advisory Annunciations (Cont)	
CLIMB-CLIMB NOW; CLIMB-CLIMB NOW	Follows "descend" advisory when reversal of vertical speed is required due to maneuvering of intruding aircraft.
DESCEND, DESCEND NOW; DESCEND, DESCEND NOW	Follows "climb" advisory when reversal of vertical speed is required due to maneuvering of the intruding aircraft.
Threat Situation Resolved	
CLEAR OF CONFLICT	Intruding aircraft is no longer a threat.

Aural Annunciator Messages
(TCAS II With Change 7.0 and ACAS II)

MESSAGE	INTERPRETATION
Traffic Advisory Annunciation	
TRAFFIC; TRAFFIC	Gain visual contact of traffic. Check TCAS display for traffic bearing and range if necessary. Assess the threat and prepare to execute the evasive maneuver TCAS issues.
Resolution Advisory Annunciations (Maneuver should begin within 5 seconds)	
MONITOR VERTICAL SPEED	Be alert for approaching traffic. Ensure that the VSI needle does not enter the area of the red-lighted scale segments on the TCAS VSI/RA/TA display.
MAINTAIN VERTICAL SPEED, MAINTAIN	Maintain present vertical speed. Ensure that the VSI needle stays within the green arc and does not enter the area of the red-lighted scale segments on the TCAS VSI/RA/TA display.
MAINTAIN VERTICAL SPEED; CROSSING, MAINTAIN	A flight path crossing is predicted, but being monitored by TCAS. Maintain present vertical speed. Ensure that the VSI needle stays within the green arc and does not enter the area of the red-lighted scale segments on the TCAS VSI/RA/TA display.
ADJUST VERTICAL SPEED, ADJUST	Indicates a weakening of the RA. Reduce vertical speed (climbing or descending) to that shown on the TCAS VSI/RA/TA display by a green arc.
CLIMB; CLIMB;	Change vertical speed to 1500 ft/min climbing, as indicated on the TCAS VSI/RA/TA display.

MESSAGE	INTERPRETATION
Resolution Advisory Annunciations (Maneuver should begin within 5 seconds) (cont)	
CLIMB-CROSSING CLIMB; CLIMB-CROSSING CLIMB	Same as CLIMB except that it further indicates that flight paths will cross at some altitude.
DESCEND, DESCEND	Change vertical speed to 1500 ft/min descending, as indicated on the TCAS VSI/RA/TA display.
DESCEND, CROSSING DESCEND; DESCEND, CROSSING DESCEND	Same as DESCEND except that it further indicates that flight paths will cross at some altitude.
Increased Action Resolution Advisory Annunciations (Maneuver should begin within 2½ seconds)	
INCREASE CLIMB; INCREASE CLIMB	Follows "climb" advisory. The climb vertical speed should be increased, typically to 2500 ft/min, as shown on the TCAS VSI/RA/TA display.
INCREASE DESCENT; INCREASE DESCENT	Follows "descend" advisory. The descent vertical speed should be increased, typically to 2500 ft/min, as shown on the TCAS VSI/RA/TA display.
CLIMB-CLIMB NOW; CLIMB-CLIMB NOW	Follows "descend" advisory when reversal of vertical speed from descent to climb is required to provide adequate separation.
DESCEND, DESCEND NOW; DESCEND, DESCEND NOW	Follows "climb" advisory when reversal of vertical speed from climb to descent is required to provide adequate separation.
Threat Situation Resolved	
CLEAR OF CONFLICT	Resume normal flight, apparent conflict of airspace has been resolved.

ADDENDUM 1
TO
ROCKWELL COLLINS TCAS II TRAFFIC ALERT and COLLISION AVOIDANCE SYSTEM
PILOT'S GUIDE

Part Number 523-0776233-202117, 2nd Edition Dated 13 Oct 99

Notice

INFORMATION SUBJECT TO EXPORT LAWS

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Export Control Classification Notice (ECCN) for this document is 6E991.

Insert these Addendum sheets after page 22 and before page 23

The TCAS system gives an aural RA over the aircraft flight deck audio system or an independent speaker system in addition to the RA that shows on the flight display. If the TCAS senses that the other aircraft is not responding in the planned manner, it will issue opposite corrective commands. For example, if the TCAS issues a descent but the other aircraft also descends, the TCAS will issue a corrective climb command. The following table lists the TCAS II v7.1 aurals and gives a brief description of each.

TCAS II v7.1 Aurals

ADVISORY	AURAL	RESPONSE
Clear	CLEAR OF CONFLICT	Resume normal flight, apparent conflict of airspace has been resolved.
Traffic	TRAFFIC, TRAFFIC	Gain visual contact of traffic. Check TCAS display for traffic bearing and range, if necessary. Assess the threat and prepare to execute the evasive maneuver TCAS issues.
Preventive RA	MONITOR VERTICAL SPEED	Be alert for approaching traffic. Ensure that the aircraft pitch attitude or vertical speed does not enter the red zone on the attitude display or vertical speed scale.
	MAINTAIN VERTICAL SPEED MAINTAIN	Maintain present pitch or vertical speed and direction.

ADDENDUM 1
TO
ROCKWELL COLLINS TCAS II TRAFFIC ALERT and COLLISION AVOIDANCE SYSTEM
PILOT'S GUIDE

Part Number 523-0776233-202117, 2nd Edition Dated 13 Oct 99

ADVISORY	AURAL	RESPONSE
		Ensure that the aircraft pitch or vertical speed does not enter the red zone on the attitude display or vertical speed scale.
Preventive RA (cont)	MAINTAIN VERTICAL SPEED CROSSING MAINTAIN	A flight path crossing is predicted, but being monitored by TCAS. Maintain present pitch or vertical speed and direction. Ensure that the aircraft pitch or vertical speed does not enter the red zone on the attitude display or vertical speed scale.
	LEVEL OFF, LEVEL OFF	Reduce vertical speed to zero feet per minute. A green arc will illuminate beginning at zero feet per minute.
Corrective RA	CLIMB, CLIMB	Change vertical speed to 1500 ft/min climbing or as indicated on attitude display or vertical speed scale.
	CLIMB, CROSSING CLIMB CLIMB, CROSSING CLIMB	Same as previous except that it further indicates that flight paths will cross at some altitude.
	DESCEND, DESCEND	Same as CLIMB except that a descending vertical speed is indicated.
	DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Same as previous except that it further indicates that flight paths will cross at some altitude.
	LEVEL OFF, LEVEL OFF	Reduce vertical speed to zero feet per minute. A green arc will be illuminated beginning at zero feet per

ADDENDUM 1
TO
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ADVISORY	AURAL	RESPONSE
		minute.
Corrective RA (Cont.)	INCREASE CLIMB INCREASE CLIMB	This follows a CLIMB advisory. The climb pitch or vertical speed should be increased, typically to 2500 ft/min, as shown on the attitude display or vertical speed scale.
	INCREASE DESCENT INCREASE DESCENT	This follows a DESCEND advisory. The descent pitch or vertical speed should be increased, typically to 2500 ft/min, as shown on the attitude display or vertical speed scale.
	CLIMB, CLIMB NOW CLIMB, CLIMB NOW	This follows a DESCEND advisory. This advisory indicates that a reversal of vertical speed from descent to climb is needed to provide adequate separation.
	DESCEND, DESCEND NOW DESCEND, DESCEND NOW	This follows a CLIMB advisory. This advisory indicates that a reversal of vertical speed from climb to descent is needed to provide adequate separation.

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SYSTEM OPERATION

Displays and Aural Messages

Traffic Display

Four types of symbols, differentiated by both shape and color, are used to display intruders around your own aircraft. The different symbols represent: Other traffic, Proximate traffic, traffic advisories (TA), and resolution advisories (RA). All Intruders, Other, Proximate, TA and RA intruders are commonly displayed on VSI/TA/RA displays and EFIS or IDS indicators operating in the HSI or navigation display mode. RA commands are commonly displayed on VSI/TA/RA displays, weather radar/TCAS indicators and EFIS or IDS indicators operating in the ADI or primary flight display (PFD) mode. Other TA and RA indicators may be used, depending on the individual installation.

The following discussions use the Collins TVI-920 vertical speed/TCAS indicator to show the displays. Traffic symbols will be similar on an EFIS or IDS indicator. RA advisories are displayed as red, wedge-shaped pitch commands on the PFD indicators.

- *Off-Scale and No-Bearing Traffic*

If an intruder is outside the indicator display range, the symbol associated with it will be a partial one shown at the periphery of the display at the relative bearing to the target. As the aircraft moves into the display range, the symbol will move into the display area and become a full symbol.

RA or TA intruders for which the TCAS cannot compute bearing information will be shown as a text message (RA 1.4 -10↑, for example; resolution advisory due to an aircraft 1.4 miles distant, 1000 feet below your aircraft, and climbing) in the indicator display. The text for an RA will be red and that for a TA will be yellow.

- *Other Traffic*

An Other traffic intruder is displayed as a **cyan or white open diamond**. It represents an aircraft greater than 6 nmi away, and/or greater than ±1200-ft. altitude relative to your aircraft. Other traffic is not displayed on indicators operating in the pop-up mode unless a TA or RA is simultaneously present.

- *Proximate Traffic*

A Proximate traffic intruder is displayed as a **cyan or white solid diamond**. It represents an aircraft within 6 nmi and ±1200-ft. relative altitude. These aircraft are not considered a threat but are displayed to assist the flight crew in visually acquiring the intruders. (In the pop-up mode these intruders will not be displayed unless a TA or RA is simultaneously present.)

- *Traffic Advisory (TA) Traffic*

These aircraft are displayed as a **yellow solid circle**. At the time an intruder is upgraded to a TA, the aural alert, **"Traffic, Traffic."** is annunciated. TAs represent aircraft that are within the times from CPA listed below. This gives the flight crew time to visually acquire the intruding aircraft; however, no maneuvers are commanded by the TCAS during this time. Traffic advisory traffic may be upgraded to resolution advisory traffic, depending upon its continued flight path.

ALTITUDE (FEET)	SECONDS TO CPA
Up to 1000 AGL	20
1000 - 2350 AGL	25
2350 AGL - 5000 BARO	30
5000 - 10000 BARO	40
10000 - 20000 BARO	45
20000 - Above BARO	48

- *Resolution Advisory (RA) Traffic*

This traffic is displayed as a **solid red square**. At the time an intruder is upgraded to an RA, an aural alert advising flight action is annunciated. This message varies, depending on the action required to achieve maximum vertical separation between your aircraft and the intruder. Typical messages are: **"Climb, Climb."** (**"Climb, Climb, Climb."** for change 6.04A) **"Descend, Descend."** (**"Descend, Descend, Descend."** for change 6.04A) **"Monitor vertical speed."** (**"Monitor vertical speed. Monitor vertical speed."** for change 6.04A). (Refer to the Aural Annunciator Messages list in the previous section for a complete list of messages and their interpretation.)

Intruders become a threat and RAs are issued when the following criteria are met.

ALTITUDE (FEET)	SECONDS TO CPA
Below 900 AGL	RAs not issued if descending
Below 1100 AGL	RAs not issued if climbing
1000 - 2350 AGL	15
2350 AGL - 5000 BARO	20
5000 - 10000 BARO	25
10000 - 20000 BARO	30
20000 - Above BARO	35

Resolution Advisory Display

RA maneuver guidance symbols are red and green arcs superimposed on the vertical speed scale of the vertical speed/TCAS indicator. On the EFIS/IDS PFD indicator, a red-outlined wedge gives the pitch command. (This is equivalent to the red arc on the vertical speed/TCAS indicator.)

Two types of RAs may be displayed — a preventive and a corrective. A preventive advisory indicates a vertical speed range or pitch that is to be avoided while maintaining your present flight path. A corrective advisory indicates a necessary change in flight path by displaying a vertical speed range or pitch to be flown to. Either advisory serves to ensure that the maximum separation between your aircraft and the threat aircraft, is achieved.

CAUTION: WHEN THE TCAS IS OPERATING IN THE TA-ONLY MODE, NO RAs WILL BE DISPLAYED, BUT TRAFFIC SYMBOLS FOR AIRCRAFT WHICH WOULD OTHERWISE CAUSE AN RA WILL BE DISPLAYED.

- *Preventive Advisory*

The preventive advisory is an RA that occurs when the TCAS has determined that a threat exists but that the current vertical speed or pitch will result in sufficient separation from the intruder to avoid the threat.

The general conditions necessary for this advisory occur when the intruder is within 300 to 800 feet (relative altitude), the range separation is decreasing, and there is approximately 25 seconds to the CPA. The RA display will show a red vertical-speed arc, or pitch-command wedge indicating speeds or pitches to avoid. The flight crew should monitor their own vertical speed or pitch; no other action is advised.

- *Corrective Advisory*

This is an RA that occurs when the TCAS has determined that the flight crew should take action to change vertical speed or pitch to avoid a conflict.

The general conditions necessary for this advisory occur when the threat aircraft is within 300 feet relative altitude, the range separation is decreasing, and there is approximately 25 seconds to the CPA. The TCAS will provide the flight crew with a recommended vertical speed or pitch, either climb or descend, that will provide maximum aircraft separation at CPA.

The corrective advisory may consist of one or two red arcs or pitch-command wedges and a green arc. (Some EFIS/IDS displays will show a green cap on the narrow end of the red pitch-command wedge.) As with the preventive advisory, the red represents vertical speed or pitch ranges that are to be avoided or flown out of.

The pilot should act on the corrective advisory command within approximately 5 seconds after it is issued. Strengthened (Increase Climb or Increase Descent) RAs or reversals represent more urgent situations and should be acted on within not more than 2½ seconds.

The RA (either preventive or corrective) may downgrade to a TA when the threat aircraft begins diverging from your own aircraft. When the RA changes to a TA, the RA vertical speed maneuver guidance arcs are removed and the aural message, **"Clear of conflict,"** is annunciated.

Operational Situations

Normal Operation

- *Pop-up or Full-time Traffic*

In the pop-up mode, the display would be as shown above for a climb when no TA or RA situation exists. When an RA or TA is issued, a display of all intruders within range pops up on the indicator and continues to be displayed until all TAs and RAs clear. Once clear, the display reverts to showing the VERT SPEED X1000 FPM legend.

If the full-time mode is selected, the VERT SPEED X1000 FPM legend is removed and the own-aircraft symbol, range ring, and range legend are continually displayed, regardless of the traffic situation. The display would look like that shown at the top of the next page if that traffic were present and the 6 nmi range and "below" altitude sector were selected. If no traffic were present, the display would be the same except for absence of the traffic symbols.

- *TA Only*

If the TA-only mode is selected (manually on the transponder/TCAS control panel, or automatically in certain situations such as when below 1000 ft AGL), the display will show the ONLY TA flag in message slots 1 and 2. The display below shows this situation. This display also shows that the 6-nmi range has been selected.

CAUTION: THE TA-ONLY MODE DOES NOT IDENTIFY RA INTRUDERS AND WILL NOT GENERATE CORRECTIVE OR PREVENTIVE RA DISPLAYS. IF AN RA THREAT LEVEL AIRCRAFT IS PRESENT, THE DISPLAY WILL SHOW IT AS A TA TARGET WHEN THE TA-ONLY MODE IS SELECTED.

- *Corrective RA*

The display on the following page shows a corrective RA display advising immediate action to provide maximum aircraft separation at CPA. This is a "snap shot" view of the indicator showing the flight path correction having been started. Your aircraft is descending through 650 fpm to exit the vertical speeds indicated by the red arc. Desired vertical speed is indicated by the green arc — 1500 to 2000 fpm, down.

The maneuver is being performed to avoid the threat traffic, indicated by the solid red square. That traffic is at $^1/_2$ mile and 12 o'clock, 200 feet above your altitude and level.

Simultaneous with the time this traffic was upgraded from a TA to an RA display, the aural alert **"Descend, Descend"** (**"Descend, Descend, Descend."** for version 6.04A) would have been annunciated.

Proximate traffic is also shown in this display. The solid diamond at 11:00 o'clock and 3.5 miles is 300 feet above your own altitude and descending. It poses no present threat, but is within the 6-mile, ±1200-ft. relative altitude range. The other proximate traffic is at 2:00 o'clock and 4 miles, 500 feet below your altitude and climbing. It, too, does not pose a present threat.

Two additional corrective commands may be issued if the initial corrective command does not provide the desired aircraft separation. These occur when the threat aircraft maneuvers in a direction that results in a conflict if your own aircraft continues with the previously recommended maneuver.

An increase advisory, either climb or descend at 2500 fpm to 3000 fpm, will occur if the previous 1500-fpm to 2000-fpm rate of climb or descent is no longer adequate. This display will be accompanied by an aural annunciation of, **"Increase climb. Increase climb"** or **"Increase descent. Increase descent."** as appropriate for the advisory.

Alternately a reversal advisory - a climb advisory after a descend advisory, or a descend advisory after a climb advisory — will occur if the TCAS determines that the initial advisory should be reversed. This would occur if, for example, the intruder causing the initial climb advisory was above you descending into your aircraft's flight path, then altered its flight path to present a new conflict if your aircraft were to continue to climb.

Reversal advisory displays are accompanied by an aural annunciation of **"Climb-Climb Now; Climb-Climb Now"** or **"Descend-Descend Now; Descend-Descend Now,"** as appropriate for the advisory.

- *Preventive RA*

The display below shows a preventive RA display. Your aircraft is descending at 1700 fpm, well outside the restricted vertical speed indicated by the red arc. The red arc advises that you should not climb at any vertical speed to avoid the threat aircraft at 12 o'clock and 600 feet above you. Simultaneous with the time this traffic was upgraded from a TA to an RA display, an aural alert message would have annunciated, **"Monitor vertical speed."** (**"Monitor vertical speed. Monitor vertical speed."** for version 6.04A).

Proximate traffic is also shown in this display. The solid diamond at 11:00 o'clock and 3.5 miles is 700 feet above your own altitude and descending. The other proximate traffic is at 2:00 o'clock and 4 miles, 100 feet below your altitude and climbing. Neither of these intruders poses a present threat.

If the threat aircraft maneuvers to cause a new conflict before the RA clears, a corrective RA may be issued, overriding the preventive RA.

- *No-Bearing Messages*

When an intruder is detected but no bearing can be determined for the aircraft, a no-bearing message is displayed in slot 6 (and slot 7 if two, or more, aircraft produce this situation; highest priority will be displayed first). The message provides range, altitude, and trend in vertical speed of the RA or TA intruder(s). If altitude of the no-bearing target cannot be determined, no message is issued for that target. Message color is red if the intruder is causing an RA, or yellow if causing a TA.

In the message shown in the photo above, the yellow "TA" indicates that the intruder is causing a traffic alert. The "1.2" indicates a distance to the intruder of 1.2 miles. The "00" indicates that the intruder is level at your own altitude. An RA no-bearing message, displayed in red, would be interpreted similarly.

- *Clear of Conflict*

When the range of an intruder responsible for causing an RA begins to increase, its conflict is considered to be resolved. If more than one intruder is involved in an RA, all conflicts must be resolved before the clear-of-conflict message will be issued. When this occurs, **"Clear of conflict"** is annunciated.

If track or altitude of an intruder is lost during an RA, the RA may terminate without the **"Clear of conflict"** annunciation.

Failure Indications

The display above shows a TCAS flag, indicating failure of the TCAS. Note, also, that there is no range ring. Normal vertical speed operation is not affected, however.

If this display is the result of a self-test being completed, the aural message **"TCAS system test fail."** will be annunciated once at the end of the test.

The display below shows an RA and a V/S flag, indicating failure of the vertical speed indicator. If the vertical speed function of the indicator (or its associated system units) has failed, it can display no vertical speed commands, thus no RA maneuvers can be commanded. Because of this, the RA flag is also displayed. Failure of vertical speed indicators used as the primary TCAS RA indicator will cause a TCAS failure (with the corresponding TCAS flag display in the upper left message slot).

If the failed vertical speed indicator is used as a secondary RA indicator, Other and Proximate traffic and TA displays will not be affected, however. This indicator will continue to display this traffic when it is detected.

TCAS System Test

The TCAS may be self-tested by selecting TEST on the transponder/TCAS control panel. If an EFIS or IDS indicator is used for the TCAS display, self-testing must not be performed until the EFIS is fully operational and the inertial reference units (IRUs) are aligned. While in self-test mode, normal operation of the TCAS is suspended. In many installations, self-test is inhibited when the aircraft is airborne.

The self-test display, above, will be shown on the vertical speed/TCAS indicator for a few moments. Since the TEST switch also activates transponder self-test, that system also causes transponder self-test indications on the control panel. (The squawk code digits display all 8s, FAIL lights momentarily, etc.) If the TCAS system passes the internal self-test, the message, **"TCAS system test okay."** is annunciated. If the TCAS system fails, the message, **"TCAS system test fail."** is annunciated and the TCAS flag will be in view.

OPERATING PROCEDURES

NOTE: The average RF output power of the TCAS is below the minimum allowable for human exposure, as noted in FAA Advisory Circular, number 20-68B, dated 8 August 1980. The system may be operated normally on the ground without danger to personnel in the vicinity.

Preflight

There are no particular preflight procedures to be performed on the TCAS. The only warm-up time required is about 10 seconds after application of primary power for the unit power supplies to come to full voltage and the computer circuits to be reset to initial operating conditions.

When executing takeoff and climbout, it is suggested that the 6 nautical mile, or shorter, range and ABOVE scan be used. This will eliminate the display of intruders more than 2700 ft. below you and allow intruders at altitudes up to 9900 feet above you to be detected during climbout. This range will keep distant intruders from cluttering the display at the time your aircraft is in areas of high traffic density, such as airport traffic areas. Any available range and altitude selection may be used, however.

CAUTION: TCAS REQUIRES OWN-AIRCRAFT ALTITUDE DATA. SETTING THE ALTITUDE SWITCH TO "OFF" (STEP c) WILL PUT TCAS IN STANDBY OPERATION.

CAUTION: ON TTC-920A CONTROL PANEL, "2" OR "R" TRANSPONDER IS NON-MODE S AND DOES NOT FILL REQUIREMENTS FOR TCAS. WITH TTC-920A, SELECTING "2" OR "R" (STEP d) WILL PUT TCAS IN STANDBY OPERATION.

The following steps may be performed any time before system operation is required. (Switch functions are explained on pages 10 through 13.)

a. Select **STBY** on transponder/TCAS control. Power is applied to the transponder and TCAS any time the related primary power circuit breaker is closed. There is no "OFF" position.

b. Set **assigned ATC squawk code** for transponder on transponder/TCAS control.

c. Select **ALT**, or altitude source **1** or **2**, or **L** or **R**, depending on version of control panel in use. *See CAUTION on previous page.*

d. Select transponder **1** or **2**, or **L** or **R** (if switch is not also used for STBY). *See CAUTION above.*

e. Select **6 nmi** (or other short) range, depending on version of control panel or indicator in use.

f. Select **ABOVE** (if available on control panel).

g. Select **REL** (if available on control panel). (This displays the relative altitude between your aircraft and any intruder reporting altitude.)

Self-Test

CAUTION: DO NOT PERFORM A SELF-TEST ON AIRCRAFT USING EFIS OR IDS DISPLAYS FOR TCAS UNTIL THE EFIS/IDS IS FULLY OPERATIONAL AND THE IRUs ARE ALIGNED.

If the installation permits, the TCAS may be self-tested at any time from the TCAS/transponder control panel. (Some installations inhibit self-test while the aircraft is airborne.) During self-test, the system suspends normal operation, generates internal test signals, and compares the results with preset values to determine if the system is operating

within specifications. After completing self-testing, the system returns to the selected operating mode.

To initiate self-test, perform the following:

a. Select or press and release **TEST**, as applicable, on transponder/TCAS control. Then select **STBY**.

(Holding TEST engaged for longer than 9 seconds will cause later versions of the TCAS computer unit to go into an extended test (maintenance) mode.)

b. Vertical speed/TCAS indicator will remove operating TCAS display from indicator and show traffic test pattern and TEST on indicator.

EFIS ADI/PFD indicator will show white TCAS TEST/OFF and IDS ADI/PFD indicator will show cyan TCAS TEST in middle of left side of display. Either system will show test pitch command and traffic pattern on HSI/ND indicator.

c. At end of test sequence, message of either **"TCAS system test okay"** or **"TCAS system test fail"** is annunciated, as appropriate.

If the FAIL light (on the control panel) stays on, this indicates a failure in the transponder or units monitored by the transponder. FAIL illuminates for one second when the test mode is selected to verify operation of the light and test mode in the transponder. Transponder code digits will display 8888 for one second for verifying that all digit segments will illuminate.

If test fails, refer to Alternate Operating Procedures in next section. Otherwise, continue.

Normal/In-flight Operation

When flying in close proximity to other aircraft (as when in airport traffic areas), it may be desirable to inhibit RAs. This can be done by selecting **TA** or **TA ONLY** (depending on the version of control panel in use). With TA/RA mode selected the system automatically inhibits RA displays when the aircraft is below 400 ft. AGL when descending or 600 ft. when climbing (below 900 ft. AGL when descending or 1100 ft. for version 6.04A).

Perform the following procedures, as applicable, during takeoff, cruise, and landing.

Takeoff and Climbout

CAUTION: **ON TTC-920A CONTROL PANEL, "2" OR "R" TRANSPONDER IS NON-MODE S AND DOES NOT FILL REQUIREMENTS FOR TCAS. WITH TTC-920A, SELECTING "2" OR "R" WILL PUT TCAS IN STANDBY OPERATION.**

a. Immediately before beginning takeoff, select **TA/RA**, or **AUTO** and **1** or **2**, or **L** or **R** (depending on version of control panel in use).

b. If desired, and not selected earlier, select **ABOVE** (if available on control panel) and short range (eg, 6 nmi) to reduce clutter.

Cruise

a. Select desired display range.

b. Select normal or pop-up mode, as desired, if available.

c. If desired, select **N** (if available on control panel). (This selects a ±2700-ft. altitude sector about your aircraft.)

d. Select **ABS** or **FL,** if available on control panel, if display of intruder's absolute altitude (flight level) instead of relative altitude is desired.

NOTE: In some installations the display may revert to relative altitude (from abs or fl) if your own aircraft altitude is below 18,000 ft..

Descent and Landing

a. If desired, select **BELOW**, if available on control panel.

b. Select **REL**, if available on control panel, if not already selected.

c. Select short display range.

d. Optional step. Refer to TA ONLY definition (*Operational Situations* section of this guide, page 29) and related caution. Select **TA** or **TA ONLY** (depending on version of control panel in use). This eliminates RA displays caused by other aircraft in close proximity such as on parallel runways. Otherwise, leave **TA/RA** or **AUTO** selected. Note, however, that the system automatically inhibits RAs when the aircraft is below 900 ft. AGL on approach.

Post Flight

TCAS left in operation after landing, causes unnecessary intruder clutter in other TCAS-equipped aircraft in the area. It is strongly recommended that TCAS be placed in **STBY** mode as soon as practical after a landing is completed.

ALTERNATE OPERATING PROCEDURES

The following are suggested alternate operating procedures for use in the event a V/S, RA, or TCAS flag is displayed on the vertical speed indicator, or the FAIL or ATC FAIL indicator on the transponder/TCAS control panel is lit.

V/S and RA Flags Displayed

Appearance of these flags indicates failure of the related vertical speed information. RAs cannot be displayed on the affected vertical speed indicator; thus, the RA flag will also be display.

The EFIS does not have a V/S flag, but the TCAS FAIL flag will appear in the event of failure of vertical speed information. The IDS has a V/S flag and it will be displayed when vertical speed information fails.

TCAS operation requires that one vertical speed indicator be operational. If one is operational, continue normal TCAS operation.

If both indicators are displaying the V/S and RA flags, proceed with the following.

a. Select **TA** or **TA ONLY** (depending on version of control panel in use).

WARNING: DO NOT MANEUVER THE AIRCRAFT SOLELY WITH REFERENCE TO INFORMATION ON THE TRAFFIC DISPLAY.

b. Traffic display will provide information, including TAs, relative to intruders in your area.

RA Flag Displayed

Appearance of this flag on the vertical speed indicator indicates failure of the RA functions of the TCAS. The EFIS and IDS do not have this flag.

Follow the same procedures given above.

TCAS Flag Displayed

Appearance of this flag indicates failure of some part of the TCAS system. This includes the associated display systems as well as the units generating the major TCAS functions and signals.

a. Verify that FAIL or ATC FAIL indicator is not lit. If lit, refer to FAIL/ATC FAIL Indicator Lit procedures. If not, continue with following procedures.

b. Select **TA** or **TA ONLY** (depending on version of control panel in use.)

WARNING: DO NOT MANEUVER THE AIRCRAFT SOLELY WITH REFERENCE TO INFORMATION ON THE TRAFFIC DISPLAY.

c. If **TCAS** flag is replaced by **ONLY TA** message, continue TCAS operation in TA mode.

d. If failure flag remains (**TCAS** flag on VSI, or **TCAS FAIL** flag on the EFIS or IDS) select **XPDR** or (TCAS) **STBY**, depending on version of control panel in use. TCAS is no longer available.

FAIL or ATC/FAIL Indicator Lit

This indicator annunciates a failure of the transponder, transponder/TCAS control (in some installations), altitude source, or transponder upper or lower antenna.

CAUTION: ON TTC-920A CONTROL PANEL, "2" OR "R" TRANSPONDER IS NON-MODE S AND DOES NOT FILL REQUIREMENTS FOR TCAS. WITH TTC-920A, SELECTING "2" OR "R" WILL PUT TCAS IN STANDBY OPERATION.

Transponder Failure

If indicator is lit, proceed with the following.

a. Select alternate transponder system by selecting **2** or **1**, or **R** or **L**.

b. If indicator is not lit for this selection, previously selected transponder system has failed. Continue normal operation; however, refer to caution above for possible change in TCAS operation.

c. If indicator remains lit, refer to Altitude Source Failure procedures and check for failure of transponder altitude source.

Altitude Source Failure

To determine if altitude source failure has occurred, perform the following.

a. Select alternate altitude source, if available, by setting transponder/TCAS control panel altitude control switch to **2** or **1**, or **R** or **L** (depending on version of control panel in use).

b. If indicator lights again, select original transponder system by setting transponder/TCAS control panel transponder select switch to **1** or **2**, or **L** or **R** (depending on version of control panel in use).

c. If indicator turns off, previously selected altitude source has failed and alternate source restores normal transponder operation. Continue normal operation.

Transponder Antenna Failure

If the **FAIL** or **ATC FAIL** indicator is lit and the **TCAS** flag is not displayed, one or both transponder antennas may have failed. TCAS response to this condition depends on the individual aircraft installation.

SYSTEM INHIBITS

Several inhibits (limitations) have been programmed into the system at the time of installation in the aircraft. They are not operator-controllable since they are dependent on such parameters as maximum aircraft climb rate, gear and flap position, etc. Some do, however, affect the TA and RA displays at times. Because of this, the inhibits are listed and discussed from the operator's viewpoint.

INHIBIT	PARAMETERS
Increase descent RA	Inhibited below 1450 ft. AGL in descent; Inhibited below 1650 ft. AGL in climb.
Descend RA	Inhibited below 1000 ft. AGL in descent and below 1200 ft. AGL in climb.
Resolution advisories	Inhibited below 900 ft. AGL in descent and below 1100 ft. AGL in climb. (TCAS automatically reverts to TA ONLY).
TA aural alert (effective MOPS Change 6.04A)	Inhibited below 900 ft. AGL in descent and below 1100 ft. AGL in climb.
TA aural alert (effective with Change 7.0 and ACAS II)	Inhibited below 400 ft. AGL in descent and below 600 ft. AGL in climb.
Climb command	1500 fpm can be inhibited, based on aircraft flight configuration.
Increase climb command	2500 fpm can be inhibited, based on aircraft flight configuration.
Self-test	Can be inhibited when airborne.
Advisory priority	Can revert to TA ONLY or STBY when higher priority advisories (eg, GPWS, windshear) occur.
Altitude climb limit	Inhibited in accordance with aircraft performance limitations.

Air Transport Systems
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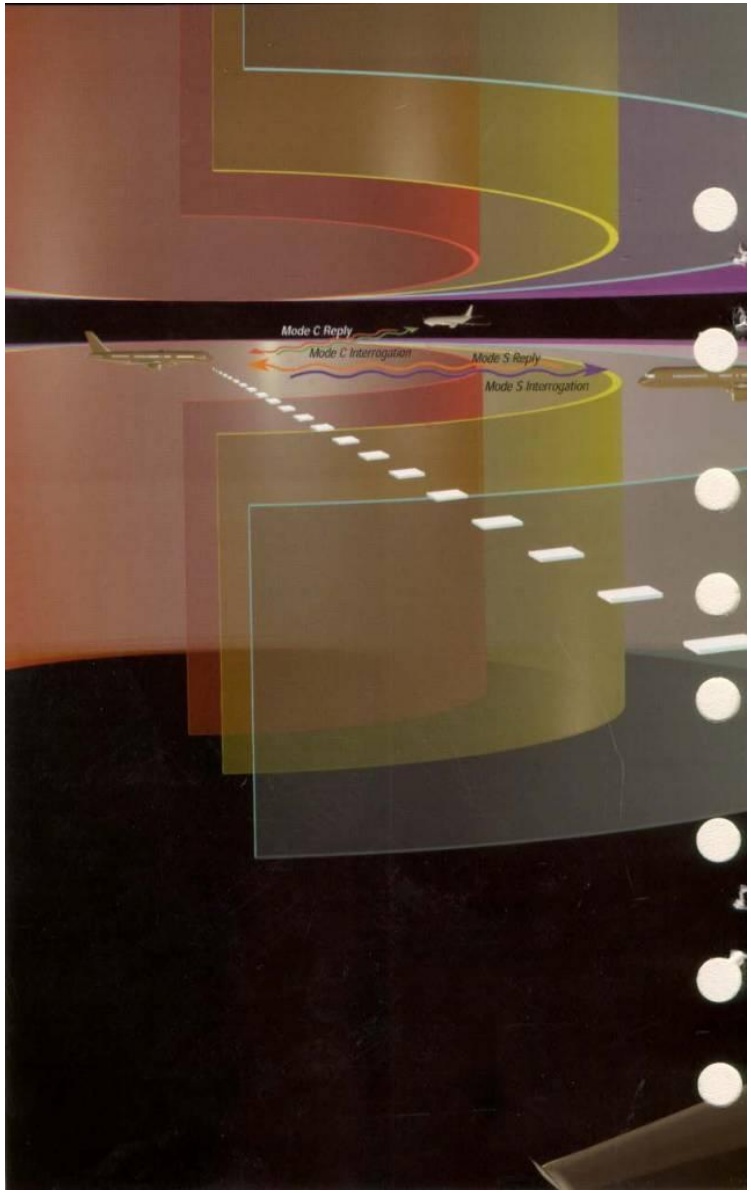
Mode C Reply
Mode C Interrogation
Mode S Reply
Mode S Interrogation