Exhibit 1. Product Description

The distinguishing mechanical feature of the RTA-8XX unit is its one-piece mechanical design combining the receiver, transmitter and antenna into a single unit. The forward portion of this unit is the flat plate antenna. The flat plate antenna is available in either 12-, 14-, or 18-inch diameter models. The antenna size is the primary distinguishing feature between the RTA-800 and RTA-8X2 (12-inch antenna), the RTA-8X4 (14-inch antenna) and the RTA-8X8 (18-inch antenna). The RTA-800 is supplied only with a 12-inch antenna and does not provide turbulence detection.

The RF assembly is attached directly behind the antenna. The RF assembly consists of a transmitter, exciter and receiver. This design eliminates the need for waveguide.

The RTA-8XX assembly is mounted on the pedestal assembly and swings left and right as the system scans and up and down for tilt. The pedestal assembly is attached to the base assembly. The pedestal assembly contains the motors and gears for the scan and tilt functions.

The base assembly is cylindrical in shape, about 15-inches (38 cm) in diameter and slightly less than 2 inches (5.1 cm) in depth. It serves as the mounting base and contains the power supplies and signal processing portion of the RTA-8XX unit.

The complete RTA-8XX assembly must be mounted on a forward bulkhead or radar antenna mounting surface and enclosed by a radome. It is vital for proper performance of the system that the radome be at least 90% RF transparent.

The control functions include operating mode, gain, antenna tilt, and range selection knobs. Push buttons provide for ground clutter suppression (GCS), master/slave mode (SLV), and stabilization enable/disable (STB).

Purpose of Equipment

The RTA-8XX Receiver/Transmitter/Antenna combined with a weather radar control panel and an electronic flight instrument system provide the flight crew with a display of radar precipitation along and within 60 degrees of the flight path. Users must recognize that X-band weather radar can detect only wet precipitation. Precipitation like snow and some hail, which is typically dry, is generally not detectable by X-band radar.

In addition to wet precipitation detection, the RTA-8XX system features a turbulence detection capability (not available on the RTA-800 and RTA-84X systems) which alerts the crew to the location of turbulent conditions. This feature also depends on the liquid state of the precipitant. It is made possible by use of an extremely stable transmitter, which allows detection of very small shifts in frequency indicating a relative velocity of the detected precipitation particle.

Equipment Specifications

Table 1 is a listing of the units covered in this application. Table 2 is a listing of the RTA-8XX specifications.

Table 1. Equipment Covered

Equipment	Part Number	Description
RTA-800	822-1050-004	Receiver/Transmitter/Antenna with 12-inch antenna and no turbulence detection mode.
RTA-852L	622-9080-005	Receiver/Transmitter/Antenna with 12 inch antenna and turbulence detection mode. Allows for remote mounting of Base away from Pedestal/RF Section.
RTA-852L	622-9080-006	Receiver/Transmitter/Antenna with 12 inch antenna and turbulence detection mode. Same as –005 except has special kit for Saberliner model 40 and 65.
RTA-8X2	622-9301-004 (RTA-842) 622-8439-004 (RTA-852)	Receiver/Transmitter/Antenna with 12-inch antenna.
RTA-8X4	622-9302-004 (RTA-844) 622-8440-004 (RTA-854)	Receiver/Transmitter/Antenna with 14-inch antenna.
RTA-8X8	622-9303-004 (RTA-848) 622-8441-004 (RTA-858)	Receiver/Transmitter/Antenna with 18-inch antenna. A special extender block between the base and drive assembly is also included to provide clearance for antenna movement.

Table 2. RTA-8XX Equipment Specifications

Characteristic	Specification		
FAA TSO	-C63b dated August 1999		
Size	RTA-800/8X2	RTA-8X4	RTA-8X8
Diameter	381 mm (15.0 in)	381 mm (15.0 in)	477 mm (18.76 in)
Depth	220.14 mm (8.7 in)	220.14 mm (8.7 in)	292.74 mm (11.6 in)
Weight	7.93 kg (17.5 lb)	7.93 kg (17.5 lb)	8.47 kg (18.7 lb)
Power Requirement			
27.5 V dc	3.4 A standby 3.8 A operate		
115 V ac, 400 Hz	10 mA max		
Transmitted Output			
Power	28 Watts (+44.5 dBm) nominal		
Frequency	X-band, 9343 ± 2 MHz		
Pulse Length	1.7, 2.4, 4.8, 9.6, 19.2, or 28.3 microseconds		
Pulse Repetition Rate	208 to 324 pulses per second in WX modes 1456 pulses per second in turbulence mode.		
Duty Factor	0.0015 to 0.03		
Receiver			
IF Bandwidth	470 kHz, 167 kHz, 83 kHz, 42 kHz		
First IF	406 MHz		
Second IF	33.8 MHz		
MDS:	–125 dBm nominal		
STC (Dynamic)	optimized for range and pulse width		
Environmental			
Pressure Altitude	Cat F2 – Nonpressurized to 55,000 ft. (16.764 km), uncontrolled temperature environment.		
Temperature			
Test	20 ± 5 ºC		
Operate	Cat B - -55 to +70 ºC		
Humidity	Cat B – severe humidity environment, level 1		
Shock	Cat - - 6 g/11 ms, operational 15 g/11 ms, crash safety		
Vibration	Cat J – Turbojet, fuselage mounted		
Explosion	Cat E1 – capable of operation in a flammable or explosive environment but not intended for installation in that environment.		
Magnetic Effect	Cat A – 0.3 to 1.0 meters for 1 degree deflection		
Power Input	Cat BZ – Aircraft power with ac power generation with or without a battery floating on the dc bus, +18 to +29.5 V dc. Capable of surge operation at +40 V dc. Abnormal surges to +40 V dc for 100 mS.		
Voltage Spike	Cat A – Installations requiring very high tolerance to voltage spikes.		
Audio Frequency Susceptibility	Cat Z – Aircraft with AC power generation with or without a battery floating on the bus.		
Induced Susceptibility	Cat A – Interference free operation		
Radio Frequency Susceptibility	Cat Z – Interference free operation		
Electromagnetic Interference	Cat A – Interference free operation.		
Cooling	Convection		

Table 2. RTA-8XX Equipment Specifications

Characteristic	Specification		
Antenna	12-inch	14-inch	18-inch
Beamwidth	8º maximum	7º maximum	6º maximum
Gain	27.5 dB	28.9 dB	30.5 dB
Avoidance Range (calculations based on no waveguide loss)	Nmi	Nmi	Nmi
Performance Index (calculations based on no waveguide loss)			
Data Bus Format			
Data output Control data input External data input	ARINC 453 ARINC 429 RS-232		
Stabilization			
Analog Digital	2-wire gyro synchro 50 mV/degree or 200 mV/degree. Low speed ARINC 429		
Selectable Modes	All except RTA-800 OFF STBY (standby) TEST (test) TGT (target) MAP (ground mapping) WX (normal weather) WX+T (weather with turbulence detection) TURB (turbulence only)	RTA-800 OFF STBY (standby) TEST (test) MAP (ground mapping) WX (normal weather)	
Special Features	GCS (ground clutter suppression) M/S (master/slave) STB (stabilization enable/disable) HLD (display hold – freeze) SEC (sector scan) AUTO (automatic tilt correction	GCS (ground clutter suppression) STB (stabilization enable/disable)	
Gain Control	6 dB per step. CAL – Calibrated, +1, +2, +3, -1, -2, -3		
Tilt Control	-15 to +15 degrees.		
Selectable Ranges (nmi)	5, 10, 25, 50, 100, 200, 300		

Operating Controls

The RTA-8XX Weather Radar is designed to operate using one of several control heads and/or displays. For this reason, the following discussions will be focused on the possible operating modes of the RTA-8XX and not any specific controller/display.

The weather radar control panel/display provides data processing, mode control, range selection and other operating controls for the display of weather radar information on the aircraft multifunction display or navigation display. The display provides a five color weather display (green, yellow, red, magenta, and white, plus the black screen itself) with turbulence detection, “PAC Alert” (Path attenuation correction) with the PAC Alert bar appearing at the perimeter of the display, and GCS (ground clutter suppression) features. The controller also supplies master/slave switching for use when two indicators and two controllers are installed. Other controller/display features include auto-tilt, sector scan, and an in-flight stabilization/alignment mode of the radar as part of the post-installation test.

Mode Control

The MODE control is a rotary switch that selects the various operating modes of the weather radar system. The WX, MAP, and TEST position of the MODE switch are also used in the in-flight stabilization/alignment mode. A description of each mode follows.

OFF – removes power from the RTA-8XX Receiver/transmitter/antenna. OFF is displayed in the upper left of the MFD and at the left end of the range mark on the ND if weather radar is selected on the ND control panel along with a sector format.

STBY – Power is applied to the RTA-8XX Receiver/transmitter/antenna and a short (approximately 3 second) initialization period is started. During initialization, the RTA-8XX drives the antenna to the boresight position (zero degrees azimuth and zero degrees tilt). The antenna remains in this position while STBY is selected. The weather display, radar transmitter, and antenna scan drive circuits are inhibited in STBY mode. Approximately 20 seconds after turning the MFD power switch on, one range mark, an airplane symbol, a white compass sector and the word STBY appear on the MFD. STBY appears at the left end of the range mark on the ND if weather radar is selected on the ND's control panel along with a sector format.

TEST – Starts the radar self-test function and causes the radar self-test display to appear. Any RANGE can be selected for the self-test function. "TEST" will be displayed in the upper left hand corner of the MFD and at the left end of the range mark on the ND if weather radar is selected on the ND's control panel along with a sector format.

TGT (target alert) – The TGT mode permits weather targets and turbulence areas to be detected and annunciated without the targets themselves appearing on the weather radar display. This mode is normally used when other data (such as checklists, remote data, etc.) is displayed on the MFD or when the ND's are in a non-weather format.

When TGT mode is selected, the radar transmitter is energized, the antenna begins to scan and a yellow box with the letter "T" inscribed will appear non-flashing to the right of the lubber line of the MFD. The "T" annunciation will also appear to the right of the lubber line on the ND if weather radar is selected on the ND control panel along with a sector format. "TGT will be displayed in the upper left hand corner of the MFD and at the left end of the range mark on the ND if weather radar is selected on the ND's control panel along with a sector format. The target alert mode notifies the pilot of the following:

a. When a weather target that is producing rainfall rates greater than 0.5 inch per hour is detected within 7 to 200 nautical miles and plus or minus 15 degrees of dead ahead, regardless of the range selected.

b. When an area of turbulence is detected with 7 to 50 nautical miles and plus or minus of 15 degrees of dead ahead, regardless of the range setting.

The "T" annunciation will flash when either of the preceding targets is detected within the target alert window. This flashing annunciation indicates to the pilot that weather and/or turbulence has been detected, and weather radar should be restored to the display and analyzed. One of the controller weather and/or turbulence detection modes (WX+T or TURB) should be selected and RDR should be selected on the MFD, or the ND's should be placed in a format that allows weather to be displayed.

MAP – Selecting MAP mode automatically disables the PAC Alert and ground clutter suppression features. MAP and range enunciators switch colors to indicate MAP mode. Ground targets appear in blue, cyan, yellow and magenta (least reflective to most reflective). MAP is displayed in the upper left hand corner of the MFD and at the left end of the range mark on the ND if weather radar is selected on the ND's control panel along with a sector format.

WX (weather only) – Selecting WX mode allows the weather radar system to operate in the weather detection mode. Detectable weather is color coded with the black screen representing no detectable moisture, while detectable weather will appear as one of four colors: green, yellow, red, and magenta (least reflective to most reflective).

The STC (sensitivity time control) circuit allows distant targets to appear with the same relative brightness of intensity as close-in targets. WX is displayed in the upper left hand corner of the MFD and at the left end of the range mark on the ND if weather radar is selected on the ND's control panel along with a sector format.

In WX mode, the PAC (path attenuation correction) feature is enabled. The purpose of PAC is to compensate for the radar beam absorption as it penetrates a given precipitation cell. This overcomes the tendency in non-compensated radar to underestimate the true image of a precipitation cell simply because the energy is absorbed as it penetrates the cell. When these radar targets are of sufficient magnitude (intensity and depth) to exhaust the full range of attenuation correction, a condition known as PAC Alert exists. PAC Alert highlights those sectors of uncertainty which are masked by intervening beam absorption. The bearing toward these areas is shown by a bar at the perimeter of the radar display. In a TWR-850 system using the RTA-8XX, a PAC alert bar will appear when the system can no longer detect a red level (Z4) target at a range where a yellow level (Z3) target would normally be detectable without intervening weather. The pilot can then recognize that, from his present position, any precipitation in the sector between the displayed weather and the PAC Alert bar may be underestimated and should be avoided.

NOTE: The PAC feature is intended for weather detection modes only. Using a weather detection mode and downward tilt to produce a ground map will probably produce an incorrect display because the PAC circuit will interpret the return signals from ground targets as intense storm targets and try to compensate for the attenuated signal. In MAP mode, the PAC alert feature is disabled.

WX+T (weather plus turbulence) – Same as WX mode except that turbulence is detected and displayed on the 5, 10, 25, and 50 nmi RANGE positions. Turbulence cannot be detected at ranges greater than 50 nmi. Detectable weather is color coded with black representing no detectable moisture, while detectable weather appears as one of five colors: green, yellow, red, magenta, and white (least reflective through turbulence). Reflectivity levels (represented by Z1, Z2, etc.) are used to relate precipitation rate to return signal strength.

In WX+T MODE and with the RANGE switch positioned to one of the TURB positions, the weather radar indicator displays detected turbulence. Detected turbulence is displayed in white, and consists of precipitation areas where wind velocity shifts in excess of 5 meters/second (16.4 feet/second or about 11 miles/hour) are detected. For reference, the US National Weather Service defines light turbulence as 0 to 19 feet/second (0 to 5.8 meters/second) and moderate turbulence as 19 to 35 feet/second (5.8 to 10.7 meters/second.

NOTE: Doppler turbulence detection techniques such as those used in the TWR-850 system rely on the presence of at least light precipitation. It is not *capable of detecting clear air turbulence.*

"WX+T" is displayed in the upper left corner of the MFD and the left end of the range mark on the ND (if weather radar is selected on the ND's control panel along with a sector format.

TURB (turbulence only) – TURB mode removes all weather radar targets from the display except for areas of turbulence that appear in white. This position of the MODE switch is spring loaded requiring the operator to hold the MODE switch in the TURB position. Releasing the MODE switch returns the control to the WX+T position and restores the full weather radar display. TURB mode is useful for closely analyzing areas of turbulence that have been detected while in the WX-T mode. By removing the green, yellow, red and magenta targets from the display, the area of turbulence can be observed alone. As in the WX+T mode, the TURB mode can only display turbulence in the 5, 10, 25 and 50 nmi RANGE positions. "TURB" is displayed in the upper left-hand corner of the MFD and at the left end of the range mark on the ND if weather radar is selected on the ND's control panel along with a sector format.

GAIN Control

The GAIN control is a seven position switch for manual gain control of the radar receiver. When placed in the CAL position, the gain is preset to a value that allows the radar receiver to calibrate its operation to the Z4 (red) return level. Each of the minus settings (-1, -2, -3) reduces receiver sensitivity below the CAL level by 6 dB for a total reduction of 18 dB in the –3 position. Adjusting the GAIN control switch clockwise, in the + direction, has the effect of increasing the system sensitivity by appropriating sensitivity factors from other features. For example: within the STC range, the normal receiver sensitivity reduction for STC is partially or wholly cancelled in order to effect an increase in receiver sensitivity. At ranges beyond STC, the various rainfall-rate threshold levels are reduced or narrowed to give the appearance of an increase in sensitivity.

The GAIN control can be used in the MAP, WX, WX+T and TURB modes. The ability of a target to be displayed is dependant on the particular GAIN setting used. All detectable targets are shown in one of four distinct colors: green, yellow, red, magenta (least reflective to most reflective) for WX mode; one of five distinct colors: green, yellow, red, magenta, white (least reflective to turbulence) for WX+T and TURB modes, or four distinct colors: blue, cyan, yellow, magenta (least reflective to most reflective) for MAP mode plus the black indicator screen itself.

If any GAIN position except CAL is selected (CAL is not annunciated), the selected GAIN is displayed (G-1, G+3, etc.) in the upper left-hand corner of the MFD and at the left end of the range mark on the ND, if weather radar format is selected on the ND's control panel along with a sector format.

TILT Control

The radar antenna is fully stabilized to compensate for aircraft pitch and roll attitude changes. The TILT control allows adjusting the pitch of the stabilized radar antenna form approximately +15 to –15 degrees to allow the best target presentation. When stabilization (STAB) is on, the combined TILT and stabilization control range is 30 degrees tilt down to 30 degrees tilt up.

The tilt angle in tenths of a degree is displayed at the right end of the range mark on both the MFD and ND (if weather radar is selected on the ND's control panel along with a sector format).

RANGE Control

The RANGE control is a rotary switch that is used to select the maximum display range of the radar system. All of the selectable ranges provide one range mark in the center of the MFD and ND (if weather radar is selected on the ND's control panel along with a sector format) with half scale range annunciation at the right end of the range mark. As the lettering on the control panel shows, turbulence (TURB) can only be detected on the 5, 10, 25 and 50 nmi ranges. The selectable ranges and range mark annunciations are shown in Table 1

Table 1. Selected Range and Range Mark Annunciation

Selected Maximum Range (nmi)	Range Mark Annunciation
5	2.5
10	5
25	12.5
50	25
100	50
200	100
300	150

GCS (Ground Clutter Suppression) Pushbutton

The ground clutter suppression feature is enabled by pressing the GCS button. GCS is operable only in the WX and WX+T modes. When selected, GCS causes the radar to eliminate all targets detected as ground returns. Any MODE or RANGE change automatically disables GCS, and the system turns on without GCS selected. GCS should only be used to identify ground targets (clutter), and then switched off for normal operation. Continuous GCS operation is not recommended because some precipitation returns may also be reduced in intensity or completely eliminated.

“GCS” will be displayed in the upper left corner of the MFD and at the left end of the range mark on the ND (if weather radar is selected on the ND’s control panel along with a sector format).

SLV (Slave) Pushbutton (Not available on systems using RTA-800)

The slave mode is enabled by pressing the latching push-on/push-off SLV button so the mode is on (button in). The SLV mode is used only in those installations that have dual weather radar control panels. The system powers up with SLV not selected. In dual control panel installations, momentarily pressing SLV on one control panel causes the associated ND to display the MODE, RANGE, TILT, and GAIN selected by the other control panel. (Weather radar must be selected on the ND’s control panel along with a sector format). The other control panel then becomes the master and controls the radar system. Selecting SLV on both control panels presses the radar system in standby mode and STBY is annunciated on the displays. Momentarily pressing SLV on the slaved control panel returns the system to normal operation. SLV is annunciated by all annunciations except the range mark becoming yellow.

STB (Stabilization) Pushbutton

The latching push-on/push-off STB button enables or disables the radar antenna pitch and roll stabilization circuits. The STB button is normally pushed in to the on position. The STB button is out to the off position in case of attitude input signal failure to the radar antenna.

If stabilization is not selected, “USTB” is displayed at the right end of the range mark on the MFD and at the right end of the range mark on the ND (if weather radar is selected on the ND’s control panel along with a sector format). If stabilization is selected the annunciation will be blank, and if there is an attitude fault, USTB will flash.

HLD (Hold) Pushbutton

Pressing the non-latching momentary action HLD button (located concentric with the GAIN control on WXP-850A), inhibits updating of the weather display on the MFD and ND (if weather radar is selected on the ND’s control panel along with a sector format). Updating is resumed when the HLD button is pressed again, or when a MODE, RANGE, GAIN, GCS, SLV, or SEC change occurs, or when power is removed from the system. The system powers up with HLD mode not selected.

In HLD mode, the weather radar annunciator in the upper left hand corner of the MFD and at the left end of the range mark on the ND alternates between ‘HOLD’ and the selected mode (HOLD-WX-HOLD-WX’ etc.). The alternating words serve to remind the pilot that the system is in the HLD mode and the weather radar display is not being updated.

AUTO (Auto Tilt) Switch

Auto tilt is selected by pulling outward on the AUTO switch (located concentric with the TILT control on the WXP-850A). Auto tilt is designed to be used as a pilot workload reducer. When auto tilt is selected, the radar system tilts the antenna to an estimate of optimum antenna tilt angles for the current mode and range. Changing MODE or RANGE causes the system to estimate a new optimum tilt angle. When in auto tilt mode, antenna tilt commands from the TILT control and from the stabilization circuits are used as offsets to the estimated optimum tilt angle. Pushing the AUTO switch to the in position turns off the auto tilt feature. The system powers up with auto tilt not selected.

Auto tilt is annunciated with an “A” preceding the tilt angle in tenths of a degree (for example A+10.7, A-5.3, etc.). This annunciation is at the right end of the range mark on the MFD and at the right end of the range mark on the ND (if weather radar is selected on the ND’s control panel along with a sector format).

SEC (Sector) Pushbutton

Sector scan is selected by pressing in on the non-latching momentary action SEC button (located concentric with the RANGE control on the WXP-850A). When SEC is selected, the antenna azimuth scan range is reduced from ±60º on either side of the aircraft’s nose to ±30º. By reducing the antenna scan, the weather radar display update rate is increased. In a dual installation, either control panel can select or cancel the reduced sector scan function. The radar system powers up with SEC not selected.

SEC mode is annunciated by decreasing the range mark to the new reduced sector scan area on both the MFD and the ND’s (if weather radar is selected on the ND’s control panel along with a sector format).