



# **ATTACHMENT 7**

**AIRWORTHINESS GROUP CHAIRMAN'S FACTUAL REPORT**

**MIA-08-MA-203**

**Avionics Test Results**

**FINAL REPORT FOR THE TECHNICAL  
EXAMINATION OF MARYLAND STATE POLICE  
AEROSPATIALE, SA365N-1 DAUPHIN II  
HELICOPTER, TAIL NUMBER: N92MD, Mfr S/No:  
#6311 ACCIDENT DATE 28 SEPTEMBER, CAPITAL  
HEIGHTS , MD**

TR2008-147  
Revision -  
11/24/2008

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**FINAL REPORT FOR THE TECHNICAL EXAMINATION OF  
MARYLAND STATE POLICE AEROSPATIALE, SA365N-1  
DAUPHIN II HELICOPTER, TAIL NUMBER: N92MD, Mfr S/No:  
#6311.**

**ACCIDENT DATE 28 SEPTEMBER, CAPITAL HEIGHTS , MD**

## **1.1 I. INTRODUCTION**

The purpose of this report is to provide the results of the Rockwell Collins, Inc. examination of 6 avionics system components for Ron Price of the NTSB at RCI's Melbourne facility.

Positive identification of the following Rockwell Collins avionics and their current Configurations:

<u>UNIT/Description</u>	<u>Part Number</u>	<u>Serial Number</u>	<u>Service Bulletin</u>
VIR-32 Navigation Receiver	622-6137-001	5647	1-17
VIR-32 Navigation Receiver	622-6137-001	8622	1-20, 27
ALT-55B Altimeter	622-2855-001	11786	1-5, 7
DME-42	622-6263-001	5016	1-4, 9, 11

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DISTANCE MEASURING EQUIPMENT

CTL-32	622-6521-016	9578	1-8, 10, 11, 14-17
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CONTROL, NAVIGATION

CTL-32	622-6521-016	9580	1-8, 10, 11, 14-17
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CONTROL, NAVIGATION

Information received from the NTSB indicated the chain of custody for these 6 components had originated with the Accident Investigation.

## TEAM MEMBERS

The examination was conducted at Rockwell Collins facilities, located in Melbourne, Florida, on November 11, 2008 through November 12, 2008. The primary team members are listed below. Additional Rockwell Collins Engineers and Technicians contributed according to their particular component specialization as necessary.

NTSB Representative:

**Ron Price,**

**Washington, DC**

Maryland State Police Representative

Dave Rosenberger,

Maryland State Police

US Eurocopter, Representative (invited):

Lindsay Cunningham,

Dallas, TX

Rockwell Collins Coordinator:

**Wayne Haug Senior Product Integrity Engineer, Certification  
Engineering, Cedar Rapids, IA**

Rockwell Collins Engineering Representatives and the equipment they represented:

Mike Hobbs	Quality Systems and Compliance Manager
<b>1.1.2.1.1.1</b>	<b>Steven Roederer</b> <b>CS Navigation Systems Hardware Manager</b>
Kevin Walters	Product Support Manager
Clay McCreary	DME-42
Russell Sylvester	VIR-32, CTL-32
Tarang Shah	ALT-55B

## **II. EXAMINATION**

### **1.2 A. Briefing, Initial Inspection and Documentation of Receipt**

#### **Briefing:**

The team members meet on November 11, 2008 to brief and discuss the plan for the examination. It was agreed that the components should be unpacked and their physical condition visually examined before attempting any testing. Copies of the relevant Rockwell Collins technical data and drawings were made available. Protective ESD gloves, and safety glasses were also made available for personnel handling the components.

#### **Packaging:**

The package contained the previously mentioned Units Under Test. The package had been opened by TSA in transport and resealed with TSA packing tape.

#### **Unpacking:**

The package was opened in the presence of above mentioned members (Lindsay Cunningham was not present.) The six Units Under Test were found in standard protective bubble wrap. There was sufficient packing materials used to prevent significant movement of the components within the package.

### **1.3 B. Visual Examination - As Received Condition**

The descriptions of the physical condition of the Units Under Test, and various photographs of the UUT's are included in the specific test results.

## 1.4 C. Test Plan

### General:

Remove equipment and inspect the chassis for damage. If the above is mechanically intact, check power input before testing. Based on the results of inspection and power input check a determination as to the best testing method to proceed with will be made.

**2. Below are the respective test plans that were used.**

Test Plan DME-42

Test Plan VIR-32

Test Plan ALT-55B

### 3. Test Plan for CTL-32

#### 3.1 Scope Summary:

The plan is to read the Frequencies from Non-Volatile Memory for the CTL-32's and execute a lab test to evaluate the condition of the UUT.

#### D. Detailed Examination results

The detailed results of the equipment testing/inspections can be found in the various report (Links):

[Maryland State Police VIR-32 Serial #5647 Investigation Test Plan, Procedures, and Results](#)

[Maryland State Police VIR-32 Serial #8622 Investigation Test Plan, Procedures, and Results](#)

[Maryland State Police ALT-55B Serial #11786 Investigation Test Plan, Procedures, and Results](#)

[Maryland State Police DME-42 Serial #5016 Investigation Test Plan, Procedures, and Results](#)

[Maryland State Police CTL-32 Serial #9578 Investigation Test Plan, Procedures, and Results](#)

[Maryland State Police CTL-32 Serial #9580 Investigation Test Plan, Procedures, and Results](#)

## E. Individual Examination Result Summaries

Summaries of Individual Unit Under Test:

UUT:

Navigation Receiver VIR-32, P/N 622-6137-001, S/N 5647, SB's (1-17)

### Top Level Physical Appearance

Due to the obvious dent along the right front edge, it was decided to slide the dust cover back far enough to expose the assembly underneath.

### Top Level Power Application (Safe to Power Up)

P1-41 to ground >1.9 Mohm

P1-18 to ground >5.2 kohm

Power up current consumption = 0.813 amperes

### Top Level Basic Function (Working Unit)

Localizer Flag Threshold at 109.30 MHz = -117.8dBm

Glideslope Flag Threshold at 332.00 MHz = -107.8dBm

VOR Flag Threshold at 112.00 MHz = -116.6dBm

LOC Flag Threshold at 110.5 MHz (Andrews AFB 1R Localizer) = -117.4dBm

GLS Flag Threshold at 329.60 MHz (Andrews AFB 1R Glideslope) = -107.2dBm

### Top Level PTR (Summary below see Report for details)

The PTR (CPN 671-2166-001 Rev AF) was performed on the VIR-32 with the following results:

All tests passed except for a failure of test step 8.10 Monitor Bypass. Diagnostic Message (0.) This failure is possibly due to the absence of Service Bulletin 19, "Prevent Display of Nuisance Diagnostics". This service bulletin is applicable to serial numbers 5919 and below but is not required. In part this service bulletin is described as: This failure of the PTR step would not affect any of the navigation information displayed to the pilot. The annunciation of this condition would have only appeared during a functional test initiated on the CTL-32. The diagnostic code displayed would have been code 21 which identifies the 400 Hz supply as being bad.

Since this installation is digital only, the absence of a 400 Hz power source would not have been an issue. 400 Hz power is only used for analog display.

### **Sub-Level Investigation**

It was decided that since the unit checked out fully functional and that the dent did not cause any electrical problems, internal sub-level investigation was not warranted.

**Navigation Receiver VIR-32, P/N 622-6137-001, S/N 8622, SB's (1-20, 27)****Top Level Physical Appearance**

Due to the presence of fluid streaking on the sides and very small amounts of fluid on the bottom of the dust cover, it was decided that an internal visual inspection would be performed. Small amounts of a fluid had pooled along the bottom frame of the unit. As was explained, since the radios are mounted underneath the engine and hydraulic lines small amounts of hydraulic fluid can drip onto the radios.

**Top Level Power Application (Safe to Power Up)**

P1-41 to Ground >2.0 Mohms

P1-18 to Ground >4.8 kohms

Power up current consumption = 0.834 Amperes.

**Top Level Basic Function (Working Unit)**

Localizer Flag Threshold at 109.30 MHz = -117.7 dBm

Glideslope Flag Threshold at 332.00 MHz = -111.4 dBm

VOR Flag Threshold at 112.00 MHz = -114.8 dBm

Localizer Flag Threshold at 110.50 MHz (Andrews AFB 1R) = -117.7 dBm

Glideslope Flag Threshold at 329.60 MHz (Andrews AFB 1R) = -111.2 dBm

**Top Level PTR (Summary below see Report for details)**

The top level PTR was tested in building 308-100 in the VIR cell area. The ATE used was VIR-32 ATE . The PTR (CPN 671-2166-001 Rev AF) was performed on the VIR-32 with the following results: All tests pass except for failure of test step 8.5.2 "Glideslope Sensitivity -93dBm. Flag out of View @ 108.15 MHz." This failure is possibly due to the glideslope receiver front end being slightly out of alignment. The actual flag threshold was found to be -89dBm on a manual test station. The 4dB difference in flag threshold would only affect the acquisition distance from the ground station. This test failure would not have affected any of the navigation information displayed to the pilot as this frequency was not use during this flight.

**Sub-Level Investigation**

It was decided that since the unit checked out fully functional and that the fluid did not cause any electrical problems, internal sub-level investigation was not warranted.

**Altimeter ALT-55B, P/N 622-2855-001, S/N 11786, SB's (1-5, 7)****Top Level Physical Appearance**

Radio Received with a broken connector (J2-RCVR)

**Top Level Power Application (Safe to Power Up)**

Using an ohmmeter, it was verified that no short exists between the power input contact (P1-1) and ground (P1-3). The DC resistance measured was 67 ohms.

**Top Level Basic Function (Working Unit)**

Due to the broken connector (J2) on the Receiver side, Receiver sensitivity readings were off by about 15 to 20 dB. However, the Radio was still locking on to the correct altitude by putting out a correct Analog altitude voltage.

Analog altitude output voltage at 0 feet: 0.376 volts

Analog altitude output voltage at 250 feet: 5.347 volts

Analog altitude output voltage at 2000 feet: 14.79 volts

**Top Level PTR (Summary below see Report for details)****Summary of Failures with a broken J2 connector**

Due to the broken J2 connector, a difficulty was experienced conducting the required testing. The broken J2 connector made it difficult to get accurate results, and therefore questioned the validity of the test results. As a result, with the investigators authorization, it was mutually decided to perform the PTR after fixing the broken connector.

**Summary of Failures after fixing J2 connector**

The PTR (CPN 669-4711-001) was performed on the ALT-55B with the following results. All tests pass except for Section 1.1.3 & Section 1.10.2

1. Center Frequency was out of spec by 15 MHz (Section 1.1.3)

Lower End Frequency 4.267 GHz

Higher End Frequency 4.373 GHz

Center(Average) 4.32 GHz

There was no realignment done to the unit after fixing broken J2 connector, and therefore the change in the metal piece may have affected the Center Frequency. The impact of this test is non-critical as the Center Frequency misalignment would not affect the altitude accuracy of the pilot's display. The Frequency band allocated for airborne radar altimeter is from 4.2 GHz to 4.4 GHz (MOPS). The ALT-55 is design to operate between 4.225 GHz and 4.375 GHz frequency range with 25 MHz margin.

## 2. Signal Presence Roll Off

Drop out Frequency out of spec by 4 KHz on the higher side. (Section 1.10.2 )

The impact of failing this test is non-critical as it would not affect the altitude accuracy. This test is conducted slightly differently than what the test procedure had called out. The audio signal in this test was injected directly into the ALT-55B instead of injecting into the test panel, and then from the test panel injected in to the ALT-55B.

## Sub-Level Investigation

None required, however, to fix the broken connector, the ALT-55B was disassembled, and the (J2) connector was replaced before re-running a full final PTR.

**Distance Measuring Equipment DME-42, P/N 622-6263-001, S/N 5016, SB's (1-4, 9, 11)****Top Level Physical Appearance**

Residue on the top of the unit indicated that some fluid had splattered onto the unit. The dust cover was removed to reveal internal contamination. There were no large puddles of fluid, and coupled with the resistance measurement, it was deemed safe to apply power to the unit.

**Top Level Power Application (Safe to Power Up)**

Using an ohmmeter, it was verified that no short exists between the power input contact (P1-60) and ground. Power was applied and no excessive current was observed using the current meter on the DC power supply.

**Top Level Basic Function (Working Unit)**

The DME was tuned to 111.90MHz (56X). The DME reported accurate distance with clear and unambiguous audio ident in accordance with the MOPS (test passed.) The DME was retuned to 113.10MHz (VORTAC frequency for Andrews AFB). The DME reported accurate distance with clear and unambiguous audio ident in accordance with the MOPS (test passed.)

**Top Level PTR (Summary below see Report for details)****Summary of Failures**

The PTR (CPN 671-2237-001 Rev AF) was performed on the DME with the following results:

Failure for low transmitter power output section 10.2.2 and 10.2.3 for stations 64X (133.70MHz) and 126X (117.90MHz), respectively

- o Low limit is 350W
- o 64X measured ~340W
- o 126X measured ~318W
- o Failure repeated on retest

The FAA requirement as stated in DO-151 for DME (MOPS) is 250W. Therefore, although this DME failed the Collins internal standard, it still meets the power output requirements of the FAA.

Failure for section 10.4.1 analog distance output side 1

- o Low limit is 4.833V
- o Measured 4.83273V
- o This is 0.0075nmi

Test passed twice upon retest. The installation in the helicopter involved in the accident did not utilize the analog distance output. This fact, coupled with the unit passing upon retest makes this failure insignificant.

Failure for section 10.9.1 frequency control, parallel, test condition 3, Ch. 2

- o Expected value "invalid" (0.0)
- o Measured 1.0

Test passed upon retest. The installation in the helicopter involved in the accident did not utilize 2X5 parallel tuning. This fact, coupled with the unit passing the retest makes this failure insignificant.

### **Sub-Level Investigation**

It was decided that since the unit checked out fully functional and that the dents/fluids did not cause any electrical problems, internal sub-level investigation was not warranted.

**Control Navigation CTL-32, P/N 622-6521-016, S/N 9578, SB's (1-8, 10, 11, 14-17)****Top Level Physical Appearance**

Obvious excessive damage to the overall unit as well as visible internal damage (see Photos) Caused the investigations to move directly to internal assembly inspection.

**Top Level Power Application (Safe to Power Up)**

Due to the obvious excessive damage to the overall unit as well as visible internal damage, Top level power application testing was canceled. Investigations moved directly to internal assembly inspection.

**Top Level Basic Function (Working Unit)**

Due to the obvious excessive damage to the overall unit as well as visible internal damage, top level basic function tests were canceled. Investigations moved directly to internal assembly inspection.

**Top Level PTR (Summary below see Report for details)**

Due to the extent of the damage and the fact that a known good unit was needed to install the processor assembly, performance of the PTR was not warranted.

**Sub-Level Investigation**

Due to the excessive amount of damage, it was not possible to remove the dust cover in the normal fashion. It was decided that the least damaging method was to break the spot welds along the cover seam. This was performed with no additional damage to the internal assemblies. After examination of each of the assemblies it was determined that the application of power to the CTL itself was not going to be possible. Therefore, it was decided to concentrate on the processor assembly so that it could be installed in a known working unit for memory retrieval. The audio potentiometer was measured to determine the audio level setting. As seen from the rear of the potentiometer, the center pin was given the label of pin 1, the outer pin below and to the left of pin 1 was labeled pin 2, and the outer pin below and to the right was labeled pin 3.

The measurements were as follows.

- Pin 1 to Pin 2 232 ohms
- Pin 1 to Pin 3 352 ohms
- Pin 2 to Pin 3 578 ohms.

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Once the processor assembly was installed in the known good CTL-32, a current limited power supply (1.0A) was connected and power applied. The unit powered up and the stored frequencies were recorded as follows.

- Active Frequency 111.50 MHz
- Stored Frequency #1 113.10 MHz
- Stored Frequency #2 115.10 MHz
- Stored Frequency #3 110.50 MHz
- Stored Frequency #4 117.60 MHz

These frequencies are consistent with those that would be expected at Andrews AFB.

**Control Navigation CTL-32, P/N 622-6521-016, S/N 9580, SB's (1-8, 10, 11, 14-17)****Top Level Physical Appearance**

Obvious excessive damage to the overall unit as well as visible internal damage (see Photos,) Caused the investigations to move directly to internal assembly inspection.

**Top Level Power Application (Safe to Power Up)**

Due to the obvious excessive damage to the overall unit as well as visible internal damage, Top level power application testing was canceled. Investigations moved directly to internal assembly inspection.

**Top Level Basic Function (Working Unit)**

Due to the obvious excessive damage to the overall unit as well as visible internal damage, top level basic function tests were canceled. Investigations moved directly to internal assembly inspection.

**Top Level PTR (Summary below see Report for details)**

Due to the extent of the damage and the fact that a known good unit was needed to install the processor assembly, performance of the PTR was not warranted.

**Sub-Level Investigation**

Due to the excessive amount of damage, it was not possible to remove the dust cover in the normal fashion. It was decided that the least damaging method was to break the spot welds along the cover seam. This was performed with no additional damage to the internal assemblies. After examination of each of the assemblies it was determined that the application of power to the CTL itself was not going to be possible without repair. The audio potentiometer was measured to determine the audio level setting. As seen from the rear of the potentiometer, the center pin was given the label of pin 1, the outer pin below and to the left of pin 1 was labeled pin 2, and the outer pin below and to the right was labeled pin 3.

The measurements were as follows:

- Pin 1 to Pin 2 538 ohms
- Pin 1 to Pin 3 8.05 ohms

- Pin 2 to Pin 3 543 ohms.

Once the display (cpn 262-2859-070) was replaced, a current limited power supply (1.0A) was connected and power applied. The unit powered up and the stored frequencies were recorded as follows:

- Active Frequency 110.50 MHz
- Stored Frequency #1 111.00 MHz
- Stored Frequency #2 115.10 MHz
- Stored Frequency #3 111.50 MHz
- Stored Frequency #4 109.00 MHz

It should be noted that the "HOLD" indication was illuminated. The rear interconnect assembly was partially pulled away from the rest of the assembly at an angle of roughly 5-10 degrees. The plastic hold tab at the top of the rear interconnect was also broken.

- Stored Frequency #4 117.60 MHz

These frequencies are consistent with those that would be expected at Andrews AFB.

## F. Final Summary

Based on the individual exam results, no contributory failures were found in the RCI equipment. Additionally, we were able to provide information related to the tuned frequencies, which were consistent with those that would be expected at Andrews AFB.