

# Honeywell

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May 13, 2015

Re: CEN14FA300, 1985 Piper Malibu PA-46-310P, S/N 46-8508088, N2428Q (JetPROP conversion SN 002)  
Autopilot equipment examination at Honeywell, 2/11, 2/12 & 3/23/2015 (Olathe, Kansas)  
Flight Computer crystal examination at Honeywell, 4/13/2015 (Phoenix, Arizona)

Dear Dr. Rodi,

The equipment detailed below from N2428Q was examined at our facility in Olathe, Kansas. Two boxes were shipped directly to Honeywell from Air Salvage of Dallas and remained in sealed containers until your arrival on 2/11/2015. A third box was shipped to Inspector Arno Boyle with the FAA Kansas City Flight Standards District Office for the inspection conducted on 3/23/2015. Mr. Boyle attended both inspections and was responsible for government oversight on 3/23/2015. Following the examination, the units were packaged for shipment in sealed containers and shipped from the Honeywell site as directed. A subsequent examination of the KC 192 Flight Computer crystal was conducted in Phoenix, Arizona, on 4/13/2015 with you in attendance.

1. KI 525 Pictorial Navigation Indicator, P/N 066-3046-01, S/N 10357
2. KC 192 Flight Computer, P/N 065-0042-03, S/N 50277
3. KS 271A Primary Servo (Yaw), P/N 065-0060-04, S/N unreadable
4. KS 270A Pitch Servo, P/N 065-0059-03, S/N 23328
5. KM 275 Servo Mount (Pitch), P/N 065-0030-27, S/N 23858
6. KS 271A Primary Servo (Roll), P/N 065-0060-05, S/N 31206
7. KM 275 Servo Mount (Roll), P/N 065-0030-27, S/N 24147
8. KG 102A Directional Gyro, P/N 060-0015-00, S/N 22481
9. KAS 297B Altitude Preselector/Alerter, P/N 065-0065-01, S/N 22037
10. KM 275 Servo Mount (Yaw), P/N 065-0030-33, S/N 23838
11. KI 256 Flight Command Indicator, P/N 060-0017-00, S/N 18735
12. KS 272A Trim Servo, P/N 065-0061-06, S/N 40620
13. KM 275 Trim Servo Mount, P/N 065-0030-36, S/N 23836
14. KC 296 Yaw Computer, P/N 065-0036-01, S/N 3318
15. KRG 331 Rate Gyro, P/N 060-0024-00, S/N 5495

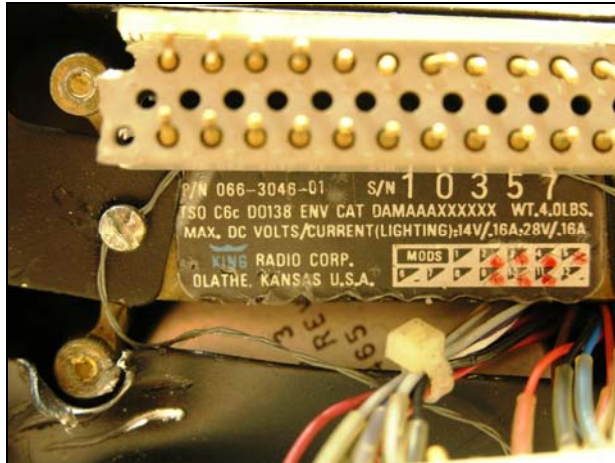


Equipment received in sealed boxes – good protective packaging

**1. KI 525A Pictorial Navigation Indicator, P/N 066-3046-01, S/N 10357**

The KI 525A Pictorial Nav Indicator is impact damaged which precludes functional testing. The damage, in part, includes broken connectors on the back of the unit, case/chassis deformation, loose parts, damaged circuit boards/components, and damaged stepper motor.

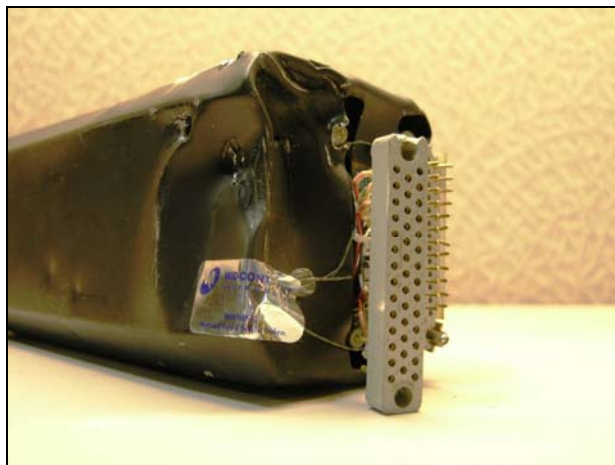
The displayed heading is approximately 200 degrees, a course setting of approximately 45 degrees, and the heading bug is set to approximately 193 degrees. The glideslope needle is in view on the left side and partially visible on the right side. The course deviation bar is offset from center about 2 degrees.



KI 525A dataplate: P/N 066-3046-01, S/N 10357



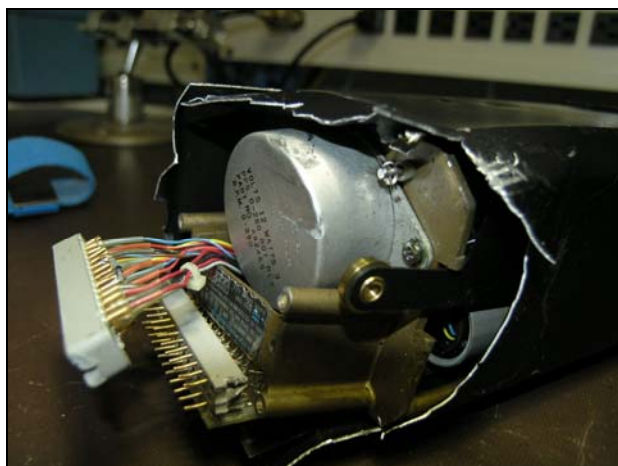
KI 525A front view



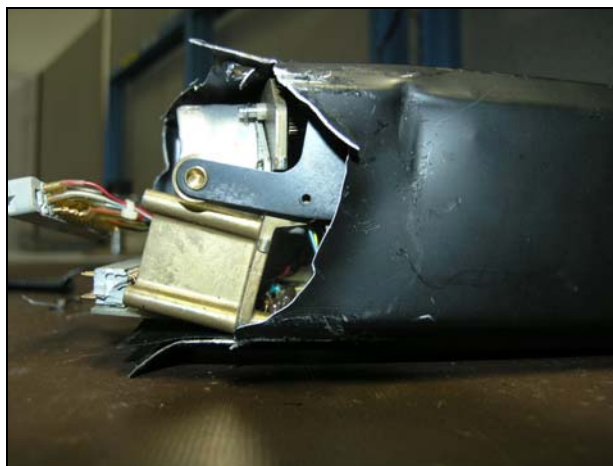
Connectors damaged; Midcontinent Instruments seal intact



KI 525A top view



Rear view – connectors, stepper motor and other internal damage



KI 525A internal structure/chassis bent/deformed

## 2. KC 192 Flight Computer, P/N 065-0042-03, S/N 50277

The bottom cover is dented inward – no other physical damage noted other than cosmetic (minor dents/scratches). The unit was opened to allow internal inspection – none detected. The unit was connected to a KC 192 test panel and power was applied. The test panel indicated “AP” invalid and the KC 192 would not preflight test. Trouble shooting revealed that the processor clock signal from Y101 crystal was bad -- replaced Y101. Unit then passed preflight test; however, many mode annunciators failed to illuminate (YD, FD, ALT, APR, AP – all have broken filaments, no coil stretching detected). None of the bulb filaments have the “snaking” or “spaghetti” appearance consistent with being on during impact. The KC 192 was subjected to functional testing – pitch and roll command, servo drive, and pitch trim are satisfactory. All modes engaged/disengaged satisfactorily except ALT hold – ALT will not engage. The ALT hold mode fault was traced to a bad output from I120 – I120 and/or circuit board fault/damage. No further troubleshooting was conducted.

The mode annunciator bulbs were removed to examine the filaments. Photos of each bulb filament with findings noted below.



KC 192 dataplate: P/N 065-0042-03, S/N 50277, date code 0985



KC 192 front and top views: no damage detected



KC 192 self test: YD, FD, ALT, HDG, APR and AP lamps out



KC 192 rear and bottom views – no damage detected



KC 192 top board – no damage detected



KC 192 bottom board – no damage detected

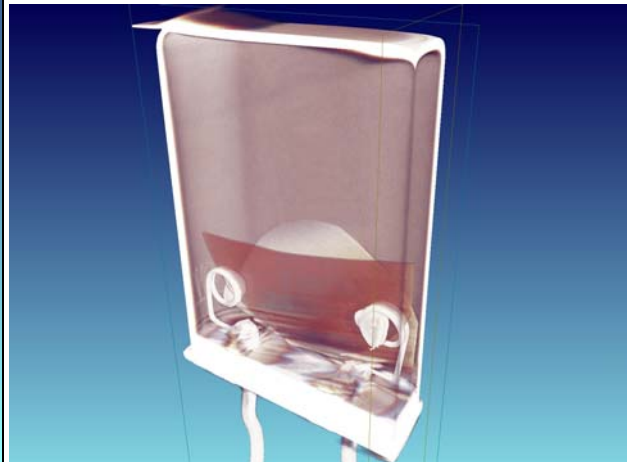


Top board adapter module: P/N 065-5028-42

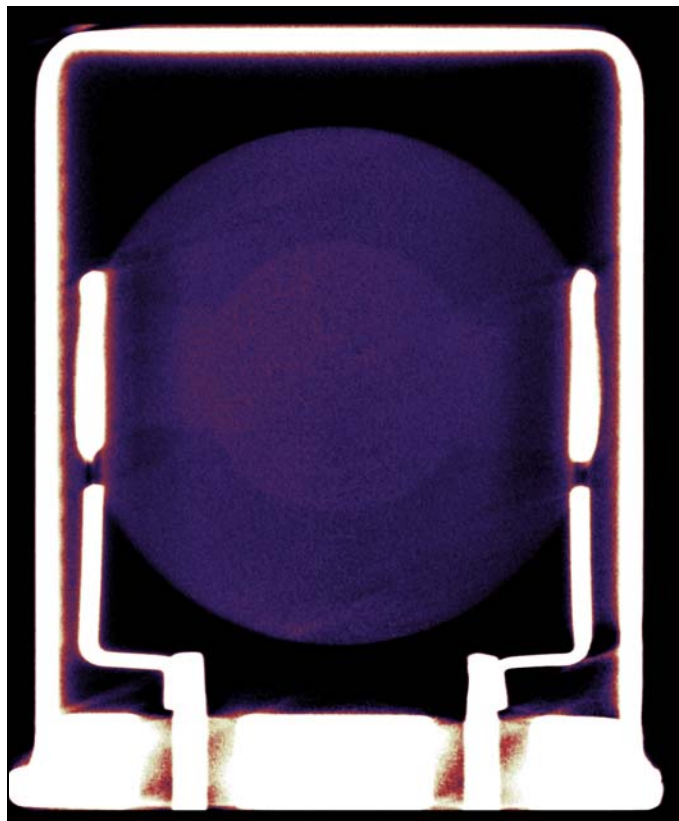


Bottom board adapter module: P/N 065-5025-65

The installed Adapter Modules are correct for the PA-46-310P installation, STC SA1778CE-D



KC 192: Y101 crystal CT scan images show that the piezoelectric disk is broken – consistent with impact forces (conducted in Phoenix, Arizona)



CT scan view of an exemplar Y101 crystal. The piezoelectric disk (crystal) is the purple colored disk attached to posts on the sides.



**YD lamp:** filament broken, no stretching (no spaghetti appearance)



**FD lamp:** filament broken, no stretching (no spaghetti appearance)



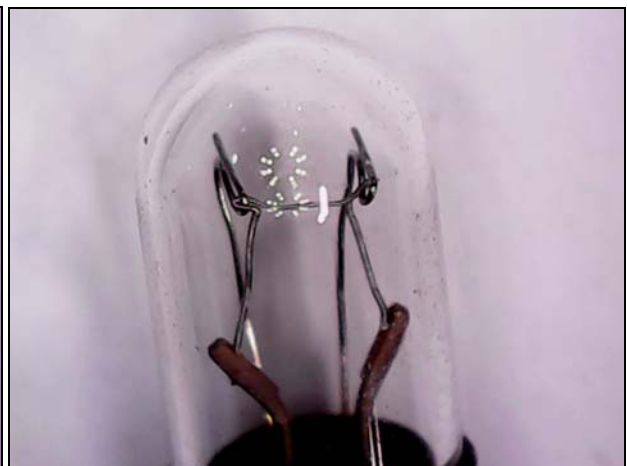
**ALT lamp:** filament broken, no stretching (no spaghetti appearance)



**HDG lamp:** filament broken, no stretching (no spaghetti appearance)



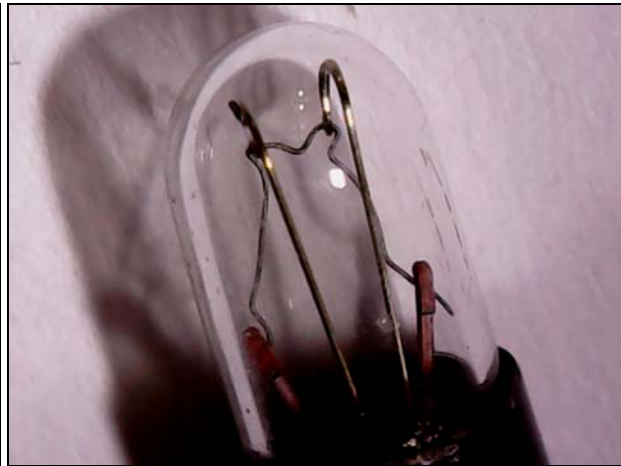
**GS lamp:** filament not broken, no stretching (no spaghetti appearance)



**NAV lamp:** filament not broken, no stretching (no spaghetti appearance)



APR lamp: filament broken, no stretching (no spaghetti appearance)



BC lamp: filament not broken, no stretching (no spaghetti appearance)



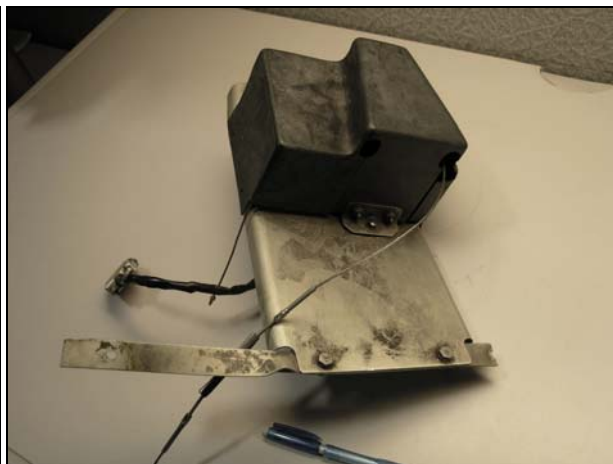
TRIM lamp: filament not broken, no stretching (no spaghetti appearance)



AP lamp: filament broken, no stretching (no spaghetti appearance)

### 3. KS 271A Primary Servo (Yaw), P/N 065-0060-04, S/N unreadable

The KS 271A Primary Servo (yaw) was received in a “not engaged” state and attached to aircraft mounting bracket. The dataplate is damaged which precludes part number and serial number identification. The correct part number for the yaw servo installation is 065-0060-04. The servo is impact damaged – cover broken and partially missing. The unit was subjected to final acceptance tests – no defects observed.



KS 271A Primary Servo (Yaw): received attached to aircraft bracket



KS 271A Primary Servo (Yaw): cover damaged and partially broken away exposing internal parts/structure



KS 271A Yaw Servo: dataplate unreadable



KS 271A Yaw Servo with associated KM 275 mount, cover, and bracket

#### 4. KS 270A Pitch Servo, P/N 065-0059-03, S/N 23328

The Pitch Servo is impact damaged. The unit was visually and electrically inspected with the following observations noted:

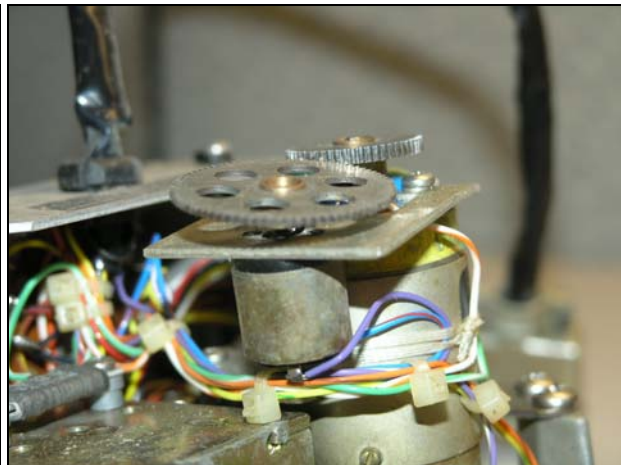
- Plastic cover for servo broken away – missing.
- Pitch Servo received attached to associated aircraft bracket and KM 275 Servo Mount. The servo was separated from the mount and bracket to allow inspection and testing.
- Pitch Servo received in a “not engaged” state.
- Tach motor mounting bracket bent causing tach motor gear to not mesh with the servo motor gear.
- Tach motor shaft is bent.
- Trim spring bars and micro switches intact – no damage observed.
- Servo baseplate partially broken away.
- The tach motor shaft and mounting bracket were straightened to allow testing.
- The Pitch Servo was subjected to final acceptance tests. No defects were noted.



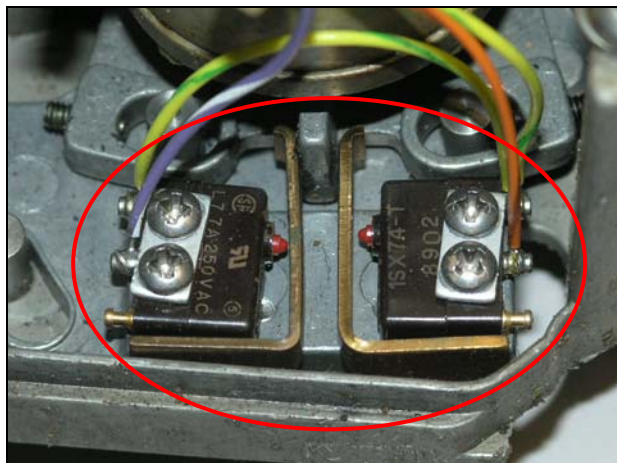
KS 271A Pitch Servo dataplate: P/N 065-0059-03, S/N 23328



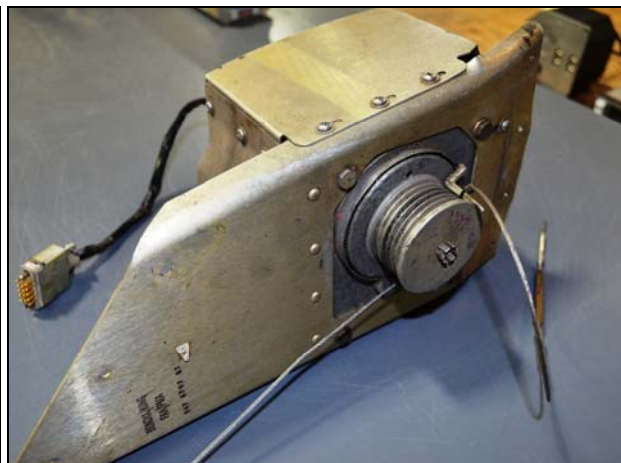
KS 271A Pitch Servo: cover missing



KS 271A Pitch Servo: tach motor shaft and mounting bracket bent – straightened later to allow gear engagement and testing



KS 271A Pitch Servo: micro switches and spring bars intact



KS 271A Pitch Servo received with associated mount and bracket

**5. KM 275 Servo Mount (Pitch), P/N 065-0030-27, S/N 23858**

The following observations were observed:

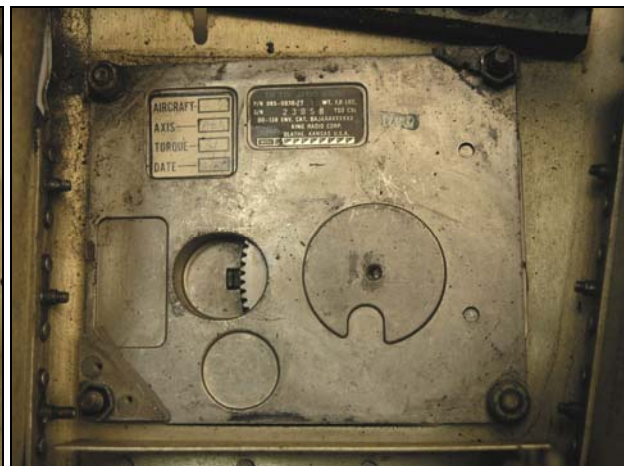
- The KM 275 Pitch Servo Mount was received attached to associated Pitch Servo – separated to allow visual inspection and testing.
- Capstan turns freely
- Cable guard damaged – one leg broken away.
- The slip clutch was tested – measured 30 in-lbs in the clockwise (CW) direction and 28 in-lbs in the counter-clockwise (CCW) direction. The specified limit is 22 +/- 2 in-lbs. The out-of-tolerance condition would not adversely affect proper function.



KM 275 Pitch Servo dataplate: P/N 065-0030-27, S/N 23858



KM 275 Servo Mount torque setting recording



KM 275 Pitch Servo Mount: front and back views with associated aircraft bracket attached

**6. KS 271A Primary Servo (Roll), P/N 065-0060-05, S/N 31206**

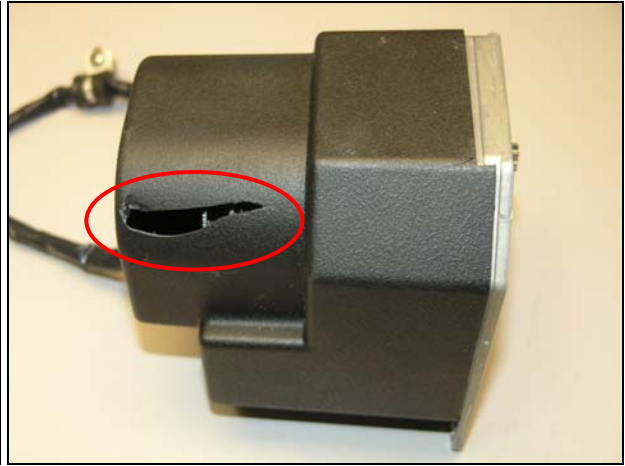
The Roll Servo is impact damaged. The unit was visually and electrically inspected with the following observations noted:

- Plastic cover for servo damaged.
- Roll Servo received in a "not engaged" state.
- Servo baseplate partially broken away – mounting ear.
- Midcontinent maintenance integrity seal intact.

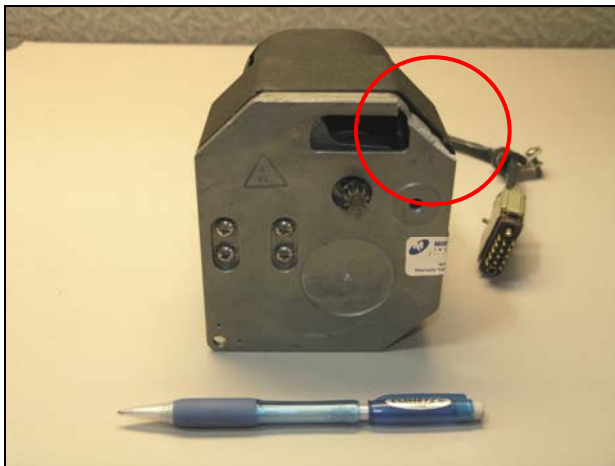
- During initial power-up, no motor drive/operation. Visual inspection revealed that one of the motor brush spring bars was displaced off the top of the brush -- consistent with impact forces. The spring bar was repositioned to the top of the motor brush.
- The Roll Servo was subjected to final acceptance testing -- no defects observed.



KS 271A Primary Servo (Roll) dataplate: P/N 065-0060-05, S/N 31206



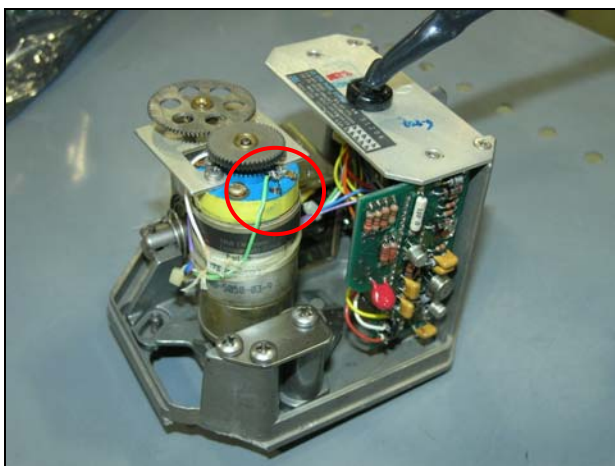
KS 271A Roll Servo: cover damaged



KS 271A Roll Servo mounting ear broken away



KS 271A Roll Servo: Midcontinent Instruments integrity seal intact



KS 271A Roll Servo: motor brush and spring bar location shown



KS 271A Roll Servo - cover removed

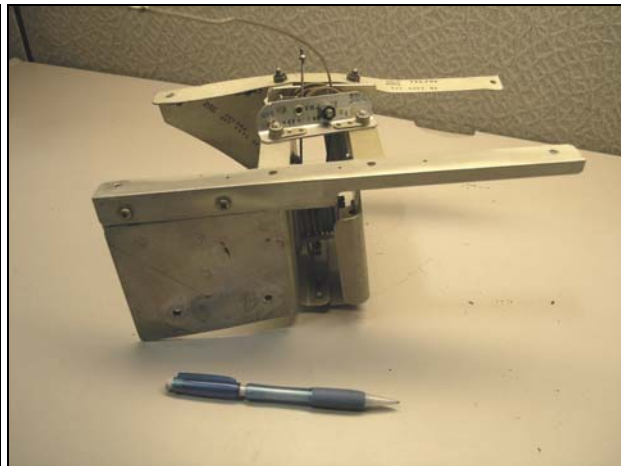
**7. KM 275 Servo Mount (Roll), P/N 065-0030-27, S/N 24147**

The following observations were observed:

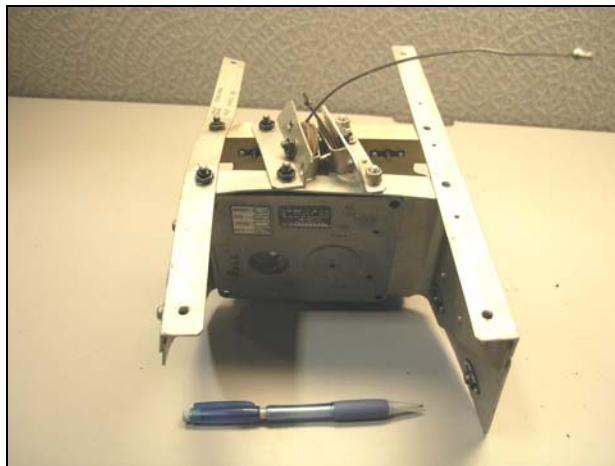
- The KM 275 Roll Servo Mount was received attached to the associated aircraft bracket – separated to allow visual inspection and testing.
- Capstan turns freely.
- Bridle cable attached to capstan.
- The slip clutch was tested – measured 21 in-lbs in the CW and CCW directions. The specified limit is 22 +/- 2 in-lbs.



KM 275 Roll Servo dataplate: P/N 065-0030-27, S/N 24147



KM 275 Roll Servo Mount with aircraft bracket attached



KM 275 Roll Servo Mount -- rear view of KM 275 with aircraft bracket



KM 275 Roll Servo Mount capstan with bridle cable

**8. KG 102A Directional Gyro, P/N 060-0015-00, S/N 22481**

The KG 102A Directional Gyro was visually inspected – no physical damage detected. The unit was subjected to functional testing – no defects observed. The unit was subjected to the specified drift test where it failed with an 8° drift after a 10 minute period. The drift limit is 4° maximum. The out-of-tolerance condition would not adversely affect proper function.



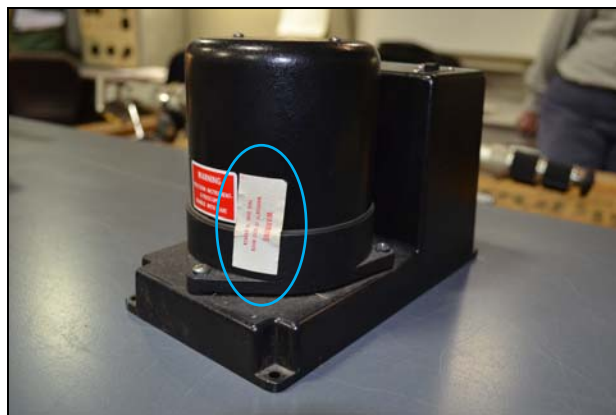
KG 102A Directional Gyro: P/N 060-0015-00, S/N 22481, D/C 5084



KG 102A rear view – no visible damage detected



KG 102A Directional Gyro – top and side views



KG 102A Directional Gyro: gyro can seal intact



KG 102A Directional Gyro – bottom view

9. **KAS 297B Altitude Preselector/Alerter, P/N 065-0065-01, S/N 22037**

The KAS 297B is impact damaged – bezel and rear connector damaged. The testing was limited to data recovery from the non-volatile memory (NVM). The KAS 297B stores the last altitude and vertical speed selected by the flight crew. The unit covers were removed to allow removal of the NVM device, I316. I316 was installed into an exemplar unit. Upon power-up, the last selected altitude of 27,000 feet with a vertical speed descent of 500 feet/minute was displayed.



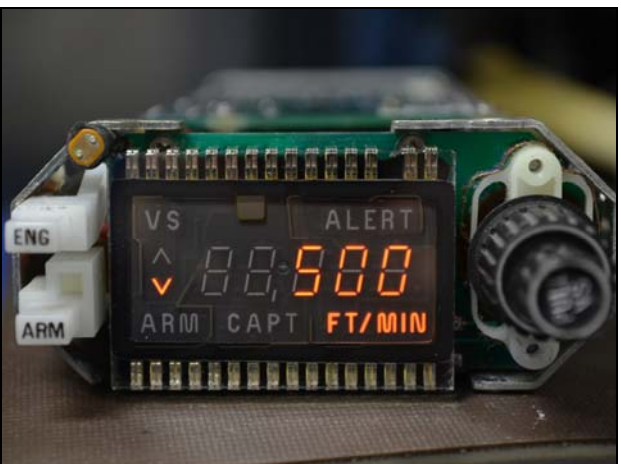
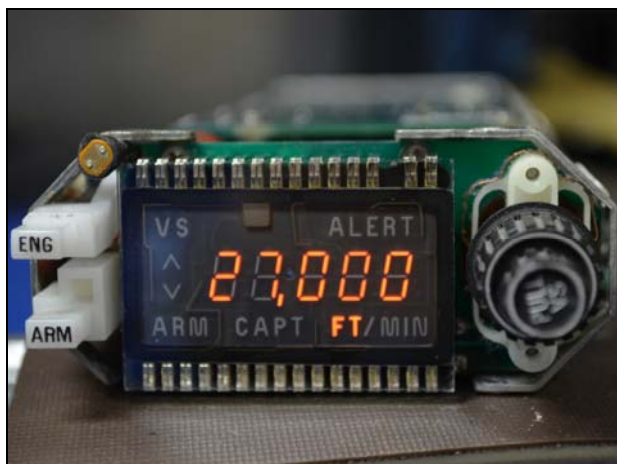
KAS 297B dataplate: P/N 065-0065-01, S/N 22037



KAS 297B rear connector damaged



KAS 297B Altitude/VS Selector: cover, connector, bezel, and chassis damage/deformation



KAS 297B Altitude/VS Selector: last altitude and vertical speed selected by flight crew – 27,000 feet and 500 feet/minute descent, respectively

**10. KM 275 Servo Mount (Yaw), P/N 065-0030-33, S/N 23838**

The following observations were observed:

- Capstan turns freely.
- Bridle cable attached to capstan.
- Foreign substance consistent with oil on servo mount.
- The slip clutch was tested – measured 45 in-lbs in the CW and CCW directions. The specified limit is 40 +/- 4 in-lbs. The out-of-tolerance condition would not adversely affect proper function.



KM 275 Yaw Servo Mount dataplate: P/N 065-0030-33, S/N 23838



KM 275 Yaw Servo Mount – rear view



KM 275 Yaw Servo Mount – rear view

# 11. KI 256 Flight Command Indicator, P/N 060-0017-00, S/N 18735

The KI 256 was impact damaged and could not be tested. The following observations were observed:

- The cover was removed to allow visual inspection. The Outer Gimbal shaft is bent downward and will not move freely -- consistent with impact forces.
- The fast erect vanes were dislodged from impact forces.
- The gyro assembly was removed for visual inspection. The rotor turns freely. No rotational scoring observed on the rotor or rotor housing.



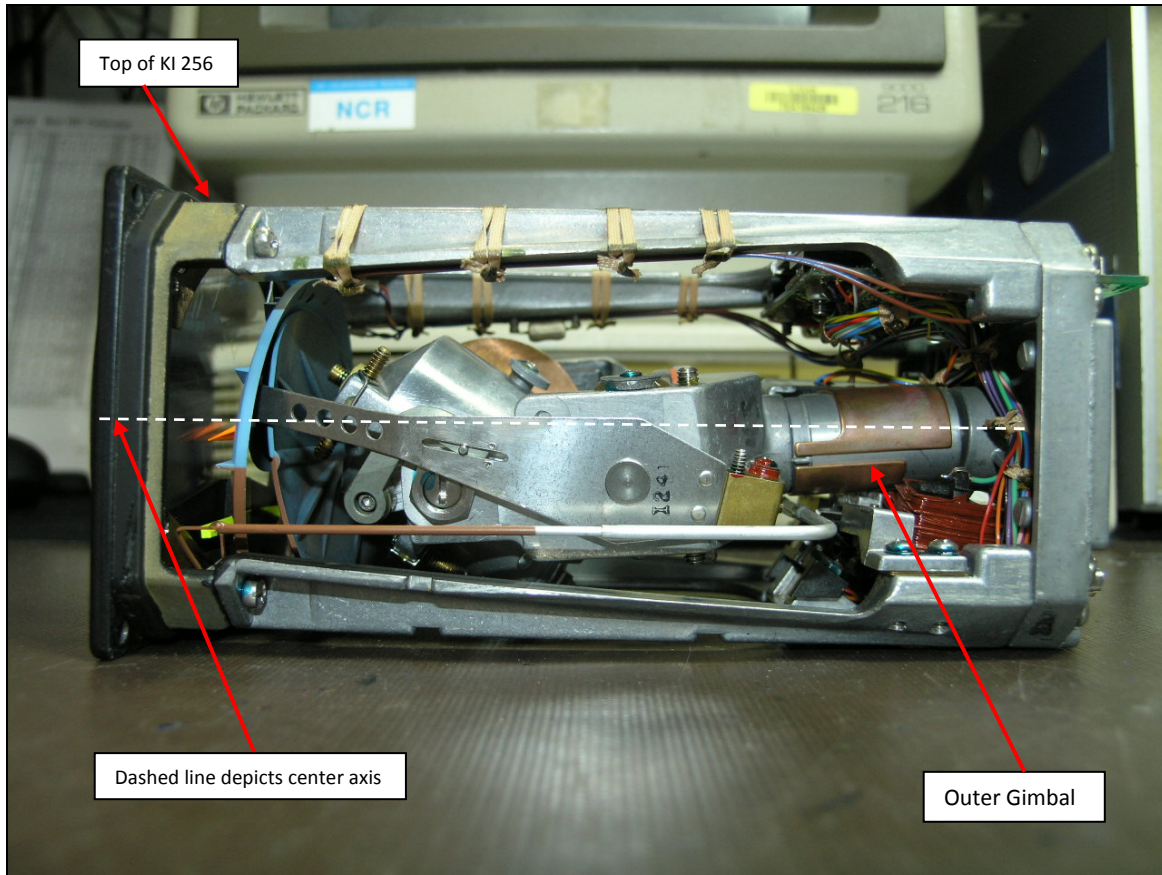
KI 256 FCI dataplate: P/N 060-0017-00, S/N 18735



KI 256 Flight Command Indicator: front view



KI 256 – no apparent physical damage observed in this view



KI 256 right side view with cover removed: outer gimbal shaft bent downward in direction of impact

#### 12. KS 272A Trim Servo, P/N 065-0061-06, S/N 40620

The Trim Servo is impact damaged. The unit was visually and electrically inspected with the following observations noted:

- Plastic cover for servo damaged.
- Trim Servo received in a “not engaged” state.
- Removed cover to allow visual inspection. Found the engage plate, P/N 073-00513-0003, broken. Relay K201, P/N 032-00029-0001, displaced (mounting bracket/tab bent).
- Unit was subjected to functional testing – solenoid engages/disengages, motor runs in both directions; Manual trim CW inop, autotrim inop – found K201 bad (consistent with impact forces).



KS 272A Trim Servo dataplate: P/N 065-0061-06, S/N 40620



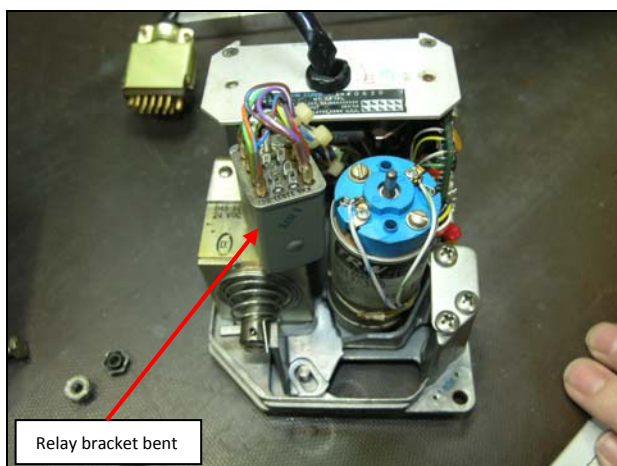
KS 272A Trim Servo: received with KM 275 mount and aircraft bracket



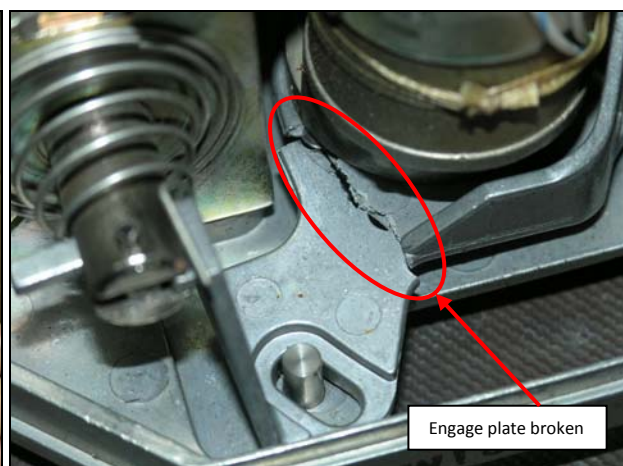
KS 272A Trim Servo and KM 275 mount: mount twisted



KS 272A Trim Servo: cover cracked



KS 272A Trim Servo impact damaged: removed cover to allow inspection – clutch engage plate broken and relay displaced (bracket bent)



### 13. KM 275 Trim Servo Mount, P/N 065-0030-36, S/N 23836

The following observations were observed:

- Received attached to KS 272A Trim Servo and aircraft bracket.
- Capstan turns freely.
- Baseplate bent/deformed
- The slip clutch was tested – measured 38 in-lbs in the CW and 40 in-lbs in the CCW directions. The specified limit is 35 +/- 4 in-lbs. The out-of-tolerance condition in the CCW direction would not adversely affect proper function.



KM 275 Servo Mount dataplate: P/N 065-0030-36, S/N 23836



KM 275 Servo Mount: rear view



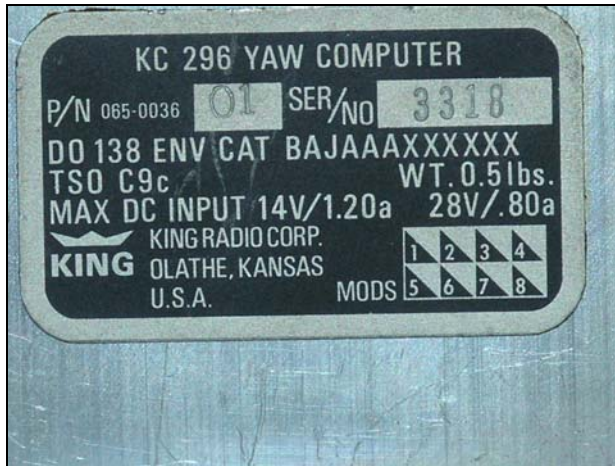
KM 275 Servo Mount: side view, base plate distorted as shown



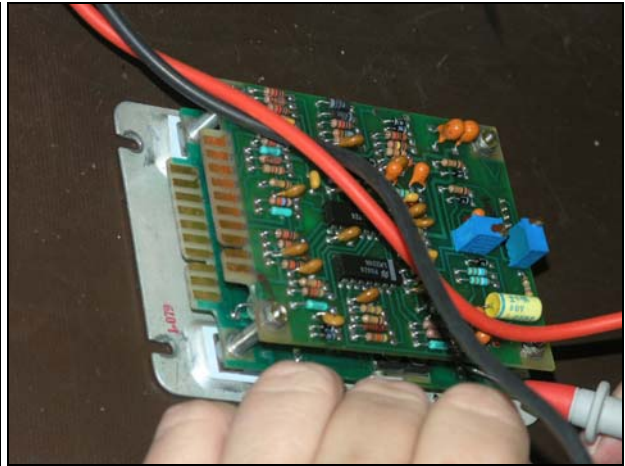
KM 275 Servo Mount: front view

#### 14. KC 296 Yaw Computer, P/N 065-0036-01, S/N 3318

The KC 296 Yaw Computer was received with a relay attached to the cover (NOT part of the KC 296), and minor dents in the cover. Removed the cover and inspected for damage – none found. The unit was subjected to functional testing per test procedure 942-01042-0001, rev 5. Unit passes functional testing.



KC 296 dataplate: P/N 065-0036-01, S/N 3318



KC 296 Yaw Computer w/cover removed – no damage detected



KC 296 Yaw Computer: relay attached to the cover is NOT part of the KC 296 Yaw Computer

**15. KRG 331 Rate Gyro, P/N 060-0024-00, S/N 5495**

The KRG 331 rate gyro was visually inspected – no damage noted. The unit was subjected to functional testing – power supply outputs meet specification; unit passes functional testing.



KRG 331 Rate Gyro (Yaw) dataplate: P/N 060-0024-00, S/N 5495



KRG 331 Rate Gyro: bottom view



KRG 331 Rate Gyro: passes functional testing

The KI 525A Pictorial Nav Indicator, KI 256 Flight Command Indicator, and KAS 297B Altitude Preselector could not be tested due to impact damage. Visual inspection did not reveal any pre-impact defects. NVM data was recovered from the KAS 297B and presented in this report.

The KC 192 Flight Computer was inoperative during initial power-up. Troubleshooting found a bad clock crystal for the microprocessor. The crystal was replaced. The unit passed self test with the exception of several bad mode annunciation bulbs (broken filaments). The KC 192 was subjected to functional testing – passes all functional tests except altitude hold (mode will not engage). The altitude hold fault was traced to a bad output from I120. No determination was made as to whether I120 was bad or the result of a damaged circuit board. The mode annunciator bulb filaments were examined – **YD**, **FD**, **ALT**, **APR**, and **AP** bulb filaments were broken and consistent with “cold breaks” (no snaking or spaghetti appearance of the filaments). The remaining mode annunciation bulb filaments contained no breaks or stretched filament coils – consistent with being cold at time of impact. The crystal was removed and subjected to computerized tomography scan (CT scan). The CT scan revealed that the piezoelectric disk (crystal) was broken in half – consistent with impact damage.

The KS 271A Yaw Servo and KS 271A Roll Servo passed final acceptance testing as received. The KS 270A Pitch Servo passed final acceptance testing after bent/misaligned parts as a result of impact were corrected.

The KS 272A Trim Servo was impact damaged and only limited testing was possible. The KS 272A Trim Servo was subjected to functional testing. The clutch engage solenoid engaged/disengaged and the motor runs in both directions. The clutch engage plate is broken and will not physically engage the servo as a result; however, the electrical operation of the solenoid was confirmed. Manual trim CW and autotrim were inoperative. These faults were traced to a defective mechanical relay, K201 (consistent with impact forces).

The slip clutches for the pitch, roll, yaw, and trim KM 275 Servo Mounts were tested. The KM 275 Roll Servo Mount meets specification. The Pitch, Yaw, and Trim KM 275 Servo Mounts were marginally out-of-specification as noted in this report. These out-of-tolerance conditions would not adversely affect proper operation.

The KG 102A Directional Gyro, KC 296 Yaw Computer, and KRG 331 Rate Gyro were subjected to functional testing – no defects were noted. Additionally, the KG 102A Directional Gyro was subjected to a ten minute drift test where it exceeded the maximum drift limit of 4° with a drift of 8°. This condition would not adversely affect proper operation.

Thank you for inviting Honeywell to assist with your investigation. Please contact me should you have questions/comment.

Sincerely,



Bill Gill,  
Air Safety Investigator