REVISED 10-14-86

FMEA NO. 1.1.9 CRITICALITY 2/2	SHUTTLE CCTV CRITICAL ITEMS LIST	UNIT Remote Control Unit (RCU) DWG NO. 2294824-506, 507 SHEET 1 OF 8

FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
oss of control data to VSU. auses: 1) Control data registers, storable circuitry, or line drivers on VSU Interface Assy A6, 2592386-501 or 2294865-504 2) Microcomputer Assy, A7, 2599298-501, or 2294866-504	(1) & (2) Loss of VSU control capability. Worst Case: Loss of mission critical video	DESIGN FEATURES The RCU is a microprocessor-based command and control unit using an RCA 1802 CMOS microprocessor, CMOS RAM, and TTL PROM. Computer I/O circuitry is implemented in CMOS CD4000 series logic to minimize power dissipation. The design incorporates a dual master oscillator (one active, one cold backup). The master oscillator is a Temperature Compensated Crystal Oscillator (TCXO) purchased from Vectron to an RCA specification control drawing (SCD). Decode logic consists of Low Power Schottky TTL, and the sync amplifier design uses monolithic NE5539 wideband op amps. Parts were required to be JAN reliability level parts or their equivalent. Part selection falls into three categories: (1) JAN or better parts from the Military QPL, (2) Parts demonstrated to NASA to be equivalent to JAN level via test data (e.g., CD4000/3W series parts), or (3) Parts procured to an RCA spec control drawing which calls out tests and screening to effect JAN equivalency. BARE BOARD CONSTRUCTION (A6, A7) The boards are of "welded wire" construction. At the bare board level this does not distinguish it from a normal PC board except that holes which will take weld pins generally are not connected to PC traces. Only those pins which bring power and ground potentials to the ICs are on PCs. An annular ring surrounds the hole in the board where each power and ground pin is located. These pins are then soldered to the trace like any other component lead. Aside from this feature, all design & construction techniques used in PC board layout apply. BOARD ASSEMBLY (A6, A7) The drilled and etched boards are populated with several hundred solderable or weldable pins. Power and ground pins, as well as connector pins, are soldered in place. Discreet components (resistors, diodes, capacitors) are attached to bifurcated terminals, where they are soldered. Flatpack ICs are welded, lead-by-lead, to the tops of the weld pins. After welding, extra lead material is trimmed away. Circuit connections are made using #30 AWG nickel weld wire. The wire is welded to the pin surfaces on the board backside. All wire welds are done using a machine which is tape driven, thus eliminating the possibility of miswiring due to operator error. All wiring & circuit performance is tested prior to box-level installation. After successful testing, components are staked as required by drawing notes and the assembly is coated with urethane. The boards are inserted in the box on card-edge guides, in the same manner as the other PC boards.

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FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
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Loss of control data to VSU. Causes: (1) Control data registers, storable circuitry, or line drivers on VSU Interface Assy A6, 2592386-501 or 2294865-504 (2) Microcomputer Assy, A7, 2599298-501, or 2294866-504	(1) & (2) Loss of VSU control capability. Worst Case: Loss of mission critical video	QA/INSPECTION Procurement Control - The RCU EEE parts and hardware items are procured from approved vendors and suppliers, which meet the requirements set forth in the CCTV contract and Quality Plan Work Statement (WS-2593176). Resident DCAS personnel review all procurement documents to establish the need for GSI on selected parts (PAI 517). Incoming Inspection and Storage - Incoming Quality inspections are made on all received materials and parts. Results are recorded by lot and retained in file by drawing and control numbers for future reference and traceability. All EEE parts are subjected to incoming acceptance tests as called for in PAI 315 - Incoming Inspection Test Instructions. Incoming flight parts are further processed in accordance with RCA 3846684 - Preconditioning and Acceptance Requirements for Electronic Parts, with the exception that DPA and PIND testing is not performed. Mechanical items are inspected per PAI 316 - Incoming Inspection Instructions for Mechanical Items, PAI 305 - Incoming Quality Control Inspection Instruction, and PAI 612 - Procedure for Processing Incoming or Purchased Parts Designated for Flight Use. Accepted items are delivered to Material Controlled Stores and retained under specified conditions until fabrication is required. Nonconforming materials are held for Material Review Board (MRB) disposition. (PAI-307, PAI IQC-531.) Board Assembly & Test - Prior to the start of RCU board assembly, all items are verified to be correct by stock room personnel, as the items are accumulated to form a kit. The items are verified again by the operator who assembles the kit by checking against the as-built-parts-list (ABPL). DCAS Mandatory Inspection Points are designated for printed circuit, wire wrap and welded wire boards, plus harness connectors for soldering wiring, crimping, solder splices and quality workmanship prior to coating of the component side of boards and sleeving of harnesses. Specific RCU board assembly and test instructions are provided in drawing notes, and applicable documents are called out in the Fabrication Procedure and Record (FPR-2294824) and parts list PL-2294824. These include wire connection List 2295001, Process Standard RTV-566 2280881, Process Standard - Bonding Velcro Tape 2280889, Specification Soldering 2280749, Specification Name Plate Application 1960167, Specification - Crimping 2280800, Specification - Bonding and Staking 2280878, Specification - Urethane coating 2280877, Specification - Locking Compound 2026116, Specification Epoxy Adhesive 2010985, Specification - Marking 2280876, Specification - Workmanship 8030035, Specification Bonding and Staking 2280875. RCU Assembly and Test - An open box test is performed per TP-IT-2294824, and an Acceptance Test per TP-AT-2294824, including vibration and thermal-vacuum. Torques are specified and witnessed, traceability numbers are recorded, and calibrated tools are checked prior to use. RCA Quality and DCAS inspections are performed at the completion of specified FPR operations in accordance with PAI-204, PAI-205, PAI-206, and PAI 217. DCAS personnel witness RCU button-up and critical torquing. RCA and

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FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
Loss of control data to VSU. Causes: 1) Control data registers, storable circuitry, or line drivers on VSU Interface Assy A6, 2592386-501 or 2294865-504 2) Microcomputer Assy, A7, 2599298-501, or 2294866-504	(1) & (2) Loss of VSU control capability. Worst Case: Loss of mission critical video	QA/INSPECTION (Continued) DCAS personnel monitor acceptance tests and review the test data/results. These personnel also inspect for conformance after all repair, rework and retest. Preparation for Shipment - The RCU is packaged according to 22B0746, Process Standard for Packaging and Handling guidelines. All related documentation including assembly drawings, Parts List, ABPL, Test Data, etc., is gathered and held in a documentation folder assigned specifically to each assembly. This folder is retained for reference. An EIDP is prepared for each RCU in accordance with the requirements of MS-2593176. RCA QC and DCAS personnel witness crating, packaging, packing and marking, and review the EIDP for completeness and accuracy.

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