SSVEO IFA List **Date:02/27/2003**

STS - 69, OV - 105, Endeavour (9) **Time:04:06:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-69-V-01	C&T - Ku-band
INCO-03	**GMT:**		**SPR**	**UA**	**Manager:**
			IPR 72V-0003	**PR**	x31450
					Engineer:

Title: Ku-Band BCE BYPASS ()

Summary: INVESTIGATION/DISCUSSION: At 251:00:56 G.m.t. (000:09:47 MET), a Ku-band bus control element (BCE) bypass fault occurred. An input/output (I/O) Reset was performed at 251:01:03 G.m.t. (000:09:54 MET) by the crew and Ku-band operation was recovered. Another BCE bypass occurred at 251:01:19 G.m.t. (000:10:10 MET) during the crew sleep period, and the system was placed in standby. After the crew was awakened, the Ku-band was powered off, the circuit breakers cycled, and the Ku-Band repowered at 251:07:20 G.m.t. (000:16:11 MET). Another I/O reset was performed, and the Ku-band system began functioning nominally.

The two BCE bypass events occurred as a result of under-voltage conditions at the Ku-band Electronics Assembly 1 (EA-1). A BCE bypass indicates the General Purpose Computer (GPC) interrogation of the Ku-band EA-1 did not get a response after two sequential attempts. After the BCE bypass and Ku-band reinitialization, the GPC continued to command the Ku-band system but discontinued interrogation (loss of Ku-band status). BCE bypass events have been observed in Orbiter Processing Facility (OPF) testing during STS-47, 54 and 67 flows with different EA-1 and different main bus signatures. Review of flight data and BCE Bypass event history indicates a vehicle power bus or grounding problem or EA-1 intermittent condition as probable causes. Although the signature does not indicate a Ku-band system hardware failure, an intermittent short due to a pinched wire or loose debris is not ruled out. The theory is that either the primary 28 Vdc power to EA-1 decreased sufficiently to cause the EA-1 under-voltage protection to activate or an intermittent internal current load caused the voltage drop. Also, a pinched wire or loose debris in the EA-1 could cause additional current load and a voltage drop which then activates the under-voltage protection. KSC technicians tested the EA-1 with the power on. Test cables were installed to allow monitoring of the EA-1 input voltage and current, EA-1 to deployment assembly (DA) control signals, Ground Interface Logic Unit (GCILU) to EA-1 control signals and panel A1U to GCILU control signals. The system was powered up and monitored five different times for as long as 6 hours. The system power was cycled from OFF to ON ten times. With the system powered up, the EA-1 wiring was wiggled, the panel R15 circuit breaker was tapped, and the LRU was tapped. The terminal board which is in the EA-1 return circuit was also tapped. The system operated nominally during all power-on testing with the flight problem not repeating. KSC technicians also performed troubleshooting with the power off. The EA-1 return wiring was visually inspected and resistance checks were performed with no anomalies found. The forward Power Control Assembly (PCA) 3, Remote Power Controller (RPC) 53 (EA-1 input power) was loaded to draw 7 amps and 10 amps. The

RPC was monitored for 2 hours at each level. No anomalies with the input wiring or the RPC were noted. EA-1 s/n 105 was removed and replaced with s/n 104. The OV105 Ku-Band system successfully passed the ground turnaround testing CAUSE(s)/PROBABLE Cause(s): The probable causes for the Ku-band BCE bypass event are a vehicle power bus or grounding problem or an EA-1 intermittent condition. CORRECTIVE_ACTION: Postflight investigation and troubleshooting was not able to repeat the in-flight anomaly; therefore, the cause of the anomaly could not be positively identified. The EA-1 s/n 105 unit was removed and replaced with s/n 104. EA-1 s/n 105 will undergo further LRU level testing at the NASA Shuttle Logistic Depot (NSLD). The Ku-Band system successfully passed the STS- 72 flow ground turnaround testing RATIONALE FOR FLIGHT: The anomaly appears to be a temporary and recoverable condition. The Ku-band system reinitializes with nominal performance after the proper voltage is restored and the GPC can communicate with the Ku-Band system after an I/O reset is performed. If a Ku-band BCE bypass was to occur in flight, nominal Ku-band system operation can be restored by power cycling the system, including the circuit breakers and performing an I/O reset.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-69-V-05	C&T - Ku-band
INCO-07	**GMT:**		**SPR** 69RF06	**UA**	**Manager:**
			IPR 72V-0007	**PR** COM-5-10-0107	x31450
					Engineer:

Title: Ku-Band EA-1 Failure ()

Summary: INVESTIGATION/DISCUSSION: At 258:23:45 G.m.t. (008:08:36 MET), loss of the Ku- band forward link was reported. Return link capability had also been lost, but was regained by going to “DESIGNATE”, which is an open-loop pointing mode. Subsequent on-orbit investigation revealed evidence of good forward- link signal strength, but the data were not being demodulated. This failure signature indicated that the problem was within the costas lock circuitry of EA-1 (Electronics Assembly 1). An attempt to regain the forward-link capability by changing from spread-spectrum to unspread-spectrum transmission mode was unsuccessful. A subsequent attempt to recover forward-link capability by cycling the Ku-band system power was also unsuccessful. Ku-band forward-link capability was declared lost for the remainder of the mission, and S-Band was used for the forward link.

Post flight troubleshooting repeated the condition and isolated the anomaly to EA-1. CAUSE(s)/PROBABLE Cause(s): The most probable cause of the condition is a failure of the costas lock circuitry in EA-1 serial number 105. CORRECTIVE_ACTION: The EA-1 was removed from the Orbiter and returned to NSLD for further troubleshooting and failure analysis. RATIONALE FOR FLIGHT: The S-Band system provides redundancy for loss of Ku- Band forward link capability. The failure has no effect on Ku-Band DA (Deployed Assembly) stow capability, and no effect on radar capability.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-69-V-06	Hydraulics
MMACS-02	**GMT:**		**SPR** 69RF07	**UA**	**Manager:**

IPR 72V-0008 **PR**

Engineer:

Title: Hydraulic System 3 Main Pump Depressurization Anomaly (ORB)

Summary: INVESTIGATION/DISCUSSION: During the entry prestart procedures for auxiliary power unit (APU) 3 at 261:10:24:45 G.m.t. (10:19:15:45 MET), the main pump S/N 193657 depressurization solenoid did not activate when switched to low pressure. The two 3-ampere remote power controllers (RPCs) current limited for approximately 2.5 seconds and then shut off. For this condition to occur, the RPC’s must supply energy to a short or overloaded circuit. Real-time analysis, however indicated that the depressurization switch had caused the failure to drive the depressurization solenoid. As a result, the depressurization switch was cycled multiple times and on the fourth cycle, the problem cleared which allowed the power to be supplied to the pump solenoid. However, a later review of the data indicated that a short or an overload condition existed in the system.

Troubleshooting and tests on the vehicle did not reveal a problem; however the hydraulic main pump was removed and replaced, and the unit was sent to the vendor. X-rays and tests of the depressurization solenoid and header subassembly revealed damaged wiring near the solenoid. The outer sleeving appeared narrowed near the grommet, and the epoxy was split, revealing several conductors. The conductor strand were broken and enough length was present for a short to take place with an adjacent conductor. However, there was no evidence of any shorts (arcing or beaded wires). This was the first occurrence of this type of failure. STS-69 was the first flight of this main hydraulic pump after being modified with the redesigned repressurization piston/piston cap. This modification did not affect the electrical circuit; however, the solenoid was changed out at that time because of wire damage to the original unit. Inspection of the fleet pumps for indications of wire damage at the solenoid header grommet area revealed bare wires at the solenoid inlet of two other pumps: system 3 of OV-104 and the system 3 pump replacement on OV-105. The damage observed on these two pumps also appears to be caused by mishandling. However the damage is not as extensive as S/N 193657. Both of the pumps have been removed and replaced, and the pumps will undergo failure analysis. The observed damage to the header subassembly was most likely caused by mishandling subsequent to the flight. However, the extent of the damage prior to flight is not known. This is the first occurrence of this type. CAUSE(s)/PROBABLE Cause(s): The failure of the hydraulic system 3 main pump depressurization solenoid to activate when switched to low pressure may have been due to damaged wiring near the depressurization solenoid and header subassembly. However, there is no evidence to completely substantiate this failure mode. CORRECTIVE_ACTION: The hydraulic system 3 main pump and damaged replacement pump have been removed and replaced. All 3 system main pumps have been inspected. A