NAS 9-7976 July 1970

COMMUNICATIONS CARRIER ASSEMBLY
(Model A-3C)

FINAL REPORT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Contract NAS 9-7976

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CR-108663

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FOREWORD

The Communications Carrier Assembly, Model A-3C, is an advanced design derived from Communications Carrier Model A-2C procured under National Aeronautics and Space Administration Contract NAS 9-1186.

This report outlines design and fabrication changes that evolved during the production of the Modél A-3C Communications Carrier Assembly, states the reasons for changes and also provides test data and illustrations.

This report is submitted in compliance with Article XIV, paragraph c, Contract NAS 9-7876.

1.0 PURPOSE

The purpose of the effort under NASA Contract NAS 9-7976 was to fabricate, test, and deliver Communications Carriers (CC) to be used in the Apollo Manned Space Flight Program.

2.0 GENERAL HISTORY

The Apollo Flight Communications Carrier Model A3-C, David Clark Company Incorporated Part Number 16536G, evolved from the Model A2-C delivered under NASA Contract NAS 9-1186.

Significant changes were made in the major components of the assembly resulting in improved performance, particularly in crew comfort, acoustical attenuation and reliability of the Personal Communications Assembly.

3.0 CONFIGURATION

The Model A3-C CC consists of two (2) major subassemblies. These are the skull cap (soft goods) and the Personal

Communications Assembly (PCA).

3.1 Skull Cap - The skull cap replaces the strap design used on Model A2-C in order to obtain more stability for the PCA on the astronaut's head, and to provide more comfort for long term wear.

The skull cap is made of Teflon and Lycra fabric which provides a conformal fit to the head without adjustment lacing or straps.

Optional use of a chin cup or neck strap was provided by the design.

An ear seal assembly consisting of a foam insert covered with deerskin was provided in all models.

A sweat pad using Rhovyl fabric was provided as an attachment to the skull cap. The pad was located in the front portion of the skull cap and served to absorb perspiration which might accumulate on the brow of the astronaut.

3.2 Personal Communications Assembly - This assembly comprised the earphones, microphones, earcups, cable assembly and connector for interface with the Extravehicular Mobility Unit PGA Electrical Harness Assembly.

4.0 TECHNICAL REQUIREMENTS

The technical requirements of the Statement of Work of Contract NAS 9-7976 specified that the configuration would be based on CC DCC P/N 10625G-08 or -09 with a skull cap type design in lieu of the strap design.

4.1 Electrical Circuit

4.1.1 Due to modifications under consideration in spacecraft electrical circuits, it was necessary to contemplate production of either the P/N 10625G-08 or the P/N 10625G-09 configuration circuitry. The -08 contained a signal slicer circuit and the -09 and 8dB attenuator in the microphone signal output leads.

Contract modification 3S directed that the PCA's to be delivered under the contract would contain the 8 dB attenuation circuit. See Figure 1.

4.1.2 Redundancy was essential for Space Flight Communications. A bridging circuit was developed and included in the splice block assembly to improve the redundancy of the two microphones and the earphones. See Figure 2.

4.1.3 A contract change notice required some CC's to be delivered with double shielding on the electrical wiring. A problem of Radio Frequency Interference (RFI) was reported during Apollo operations. An attempt was made to reduce this interference by use of double shielding on the electrical wiring connecting the Government Furnished Pacific Plantronics components of the PCA. This PCA was identified as DCC P/N 16495G-03.

Evaluations conducted by NASA-MSC established that the double shielding did not improve RFI susceptibility, therefore, only three (3) CC's were delivered using this configuration PCA.

4.2 Skull Cap

4.2.1 The skull cap design was to provide adequate adjustment without the use of lacing, provide for easy removal and replacement of the earcup PCA assembly and provide a replaceable sweatband.

4.3 <u>Communications Carrier Assembly Configuration Designations</u>

4.3.1 The two (2) development prototypes were identified by P/N 16445G-01 and -02 respectively.

4.3.2 P/N 16536G-02. This production configuration used PCA P/N 10625G-09 with an 8 dB attenuator circuit.

4.3.3 P/N 16536G-04. This configuration was the same as 16536G-01 except that it contained the bridging circuit.

4.3.4 P/N 16536G-05 was the same as the 16536G-04 with the exception of the double shielding.

4.3.5 The 16536G-04 was the configuration ultimately standardized. See Figure 3.

5.0 TEST REQUIREMENTS

5.1 Due to the critical use nature of the CC, a test plan was developed and implemented to provide the required confidence in the capabilities of the CC.

5.1.1 The major emphasis was on testing the electrical circuits to establish that no short circuits resulted during the fabrication process. Particular emphasis was placed on verifying the bridging circuit.

5.1.2 The strain relief assembly was redesigned and subjected to tensile load tests.

6.0 DISCUSSION OF PROBLEMS

6.1 The major problems encountered in the performance of the contract and their solutions are described in the following paragraphs.

6.1.1 Strain Relief Cables. Because of the close proximity of the strain relief cables to the electrical conductors and the possibility of causing damage to the conductors because of high heat during silver soldering, a soft soldering method was evaluated. Tests established that the soft soldering method provided adequate strength but also resulted in more consistent performance of the strain relief assembly under structural load. The reason for the consistency seemed to be related to the fact that the stainless steel cable retained more of its strength during cold soldering. Breaking strength of the cold soldered cables was well in excess of 100 lbs. The standard test for acceptance of production cables was 50 lbs. tensile load.

6.1.2 Microphone Boom Failures. Some GFE microphones received in CC's to be modified had splits in the boom tubing beyond the bend relief sleeve and the potting fitted where the boom exited the transducer case. Analysis showed that the failures were attributable to sharp bending of the tube.

6.1.3 Failure analysis of a microphone circuitry on a CC S/N 150 disclosed that there was insufficient clearance between the terminal board potting well and EMI shields. The analysis concluded that this type failure could be induced on all microphones of this configuration. The conclusion was that the EMI shield was too narrow for the potting well (was not a press fit), and if not properly positioned would short out one of the terminals when a little pressure was placed on the shield. Pacific Plantronics representatives reshaped the EMI shield and verified that this was effective corrective action. DCC representatives were trained and qualified by PPI to make in-plant repairs on additional GFE microphones at DCC.

7.0 CONCLUSIONS

7.1 The requirements of the contract for delivery of CC's and documentation with quality and reliability were met without significant delay or serious problem.

7.2 This Final Report completes the effort under Contract NAS-97976 except for the requirement for reporting New Technology under Extract Clause 82 which will be submitted separately.

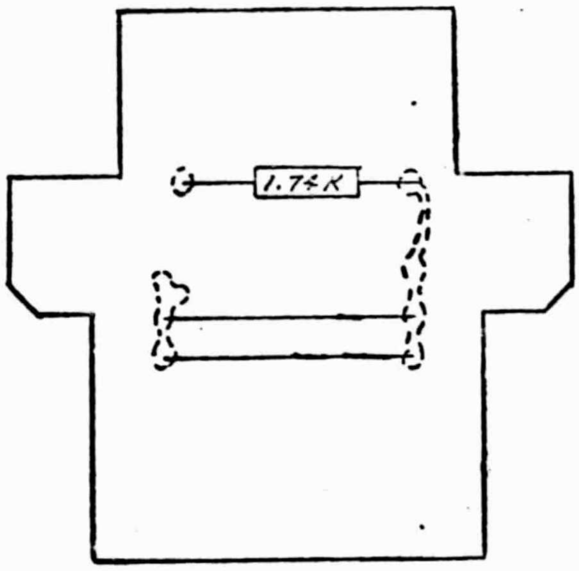

Figure 1

8db Attenuator Circuitry

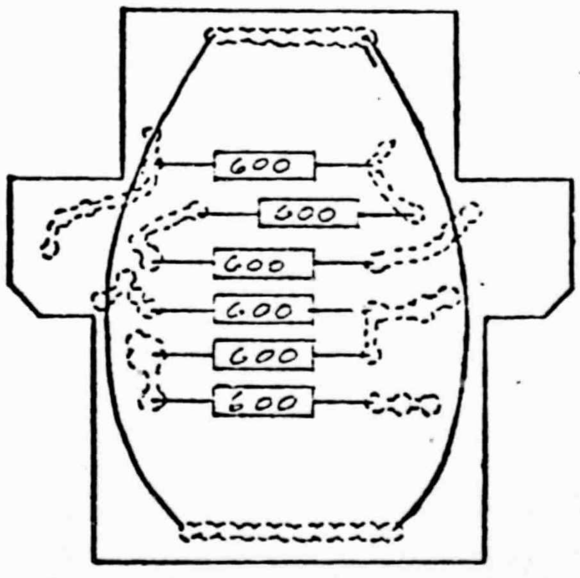

Figure 2

Bridging Circuitry

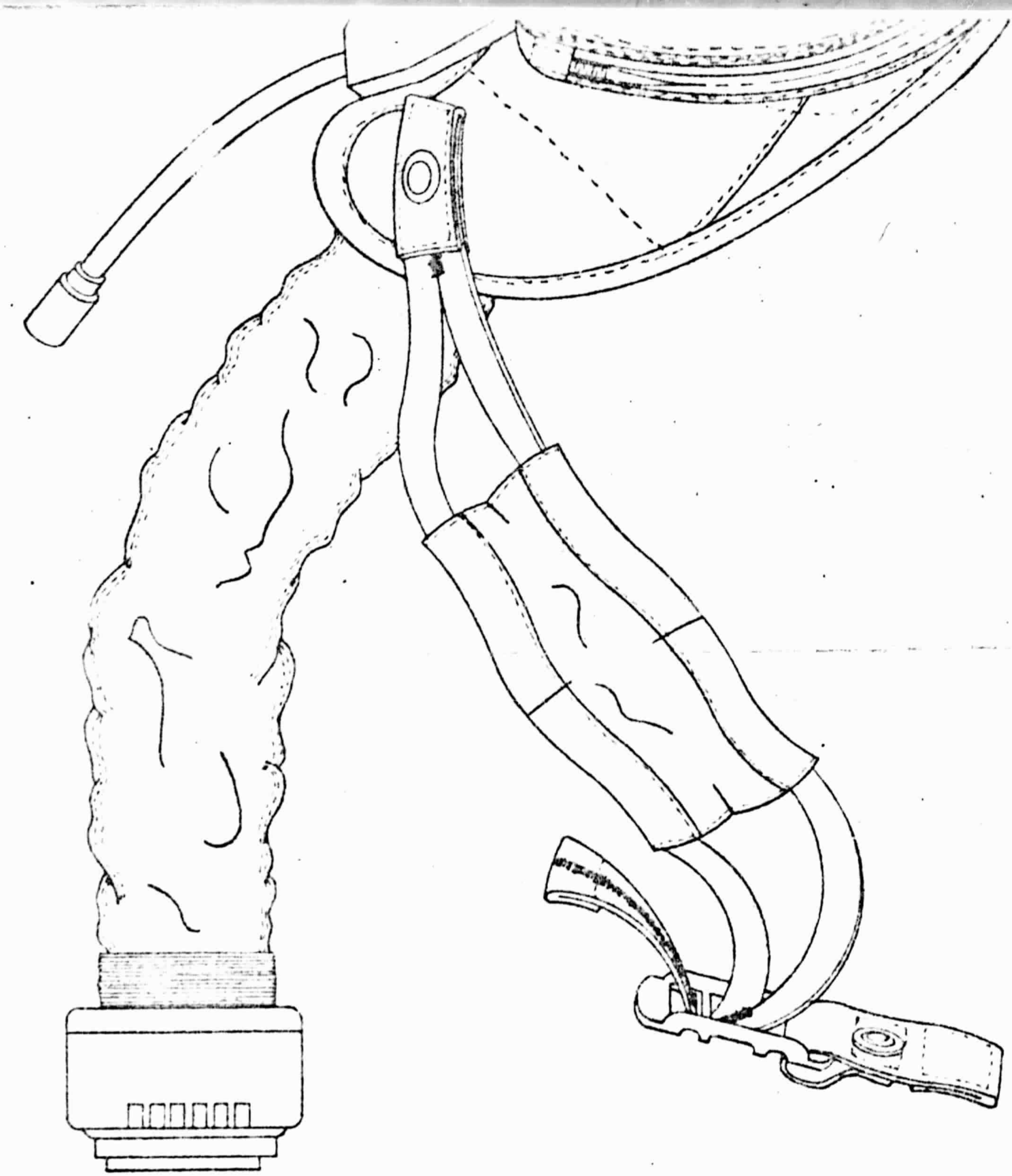

FIGURE 3