

NASA TECHNICAL TRANSLATION

RADIOTELEPHONE COMMUNICATIONS BETWEEN MANNED
SPACECRAFT OF THE SOYUZ TYPE

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RADIOTELEPHONE COMMUNICATIONS BETWEEN MANNED
SPACECRAFT OF THE SOYUZ TYPE

ABSTRACT: Radiotelephone communications between manned spacecraft of the Soyuz type are described.

Manned spacecraft of the Soyuz type are equipped with standardized radio sets that provide the various types of communications required on all sections of the flight. Some of these radio sets, comprising two transceivers, and the antenna-feeder and terminal devices, are used for inter-spacecraft communications during rendezvous, maneuvering, and docking. This equipment provides telephone and telegraph communications on one frequency in the ultrashort-wave band, and on one frequency in the shortwave band. Frequency modulation, with a band of frequencies for the audio signal of 300 to 400 Hz, is used in the ultrashort-wave band for the telephone mode. Voice frequency keying is used in the telegraph mode. Transmitter output power has been selected such it will provide communications with the required probability with quasi-isotropic antennas on both spacecraft for arbitrary relative motion of the spacecraft. The receiver in the ultrashort-wave band has a sensitivity of the order of microvolt units, an attenuator at the input, and manual volume control. The terminal devices used are microphones and telephones built into the helmet phone, and a compact microphone and loudspeaker. Amplitude modulation, as well as quasi-isotropic antennas, are used in the shortwave band. /1

Experience in the operation of this equipment has shown that working conversations with the crews are carried on principally with the equipment in ultrashort-wave band because quality and dependability are high. There is sufficient to limit joint radio communication equipment to this band. Moreover, simple equipment with minimal weight can be used in the ultrashort-wave band to build an on-board omnidirectional antenna with a good duty factor. The equipment in this band can also be used as standby equipment for communication with the ground.

Inter-spacecraft wire telephone communications were planned and carried out during the marriage of the electrical plugs in the Soyuz spacecraft.

* Numbers in the margin indicate pagination in the foreign text.

The greatest attention during the development of the equipment for inter-spacecraft radio communications was given to (1) duplication of the electrical parameters of the instruments and to their stability, (2) providing functional and equipment dependability, and (3) convenience and simplicity of testings and operating. A list of parameters that are subject to strict duplication without regard for the type of spacecraft in which the sets used for radio communication are installed, was established. Included among these parameters are:

working frequency, accuracy of its initial setting, and long-term stability;

transmitter output power, traveling wave ratio on the antenna feeder, rated input impedance for the antenna;

sensitivity of receivers;

standards for "cross" interference between the receivers and transmitters in the radio systems;

input and output levels of low-frequency signals.

Standardized as well were the control circuits, the cable net and the plugs used for inter-spacecraft communication.

Redundancy of ultrashort-wave transmitters, relay circuits, and individual conductors in the cable net was planned in order to provide dependability. The equipment has technological outputs for monitoring during tests and outputs for telemetry monitoring in flight.

A solution providing a good duty cycle for the quasi-isotropic pattern of the antenna, installed on the solar battery, or on the hull of the spacecraft in a specially selected place, was found during the development of the antenna installation. High-frequency relays and coaxial switches, controlled by the pressure of the tangent, are used as the antenna changeover switches.

Repeated tests of the equipment in flight have confirmed the correctness of the technical solutions selected, the dependability of equipment operation, and its operational convenience.

APPENDIX. Block diagram of the equipment for inter-spacecraft radio communications aboard spacecraft of the Soyuz type.

Appendix I. Block Diagram of the Equipment for Radio
Communication Aboard the Soyuz Spacecraft

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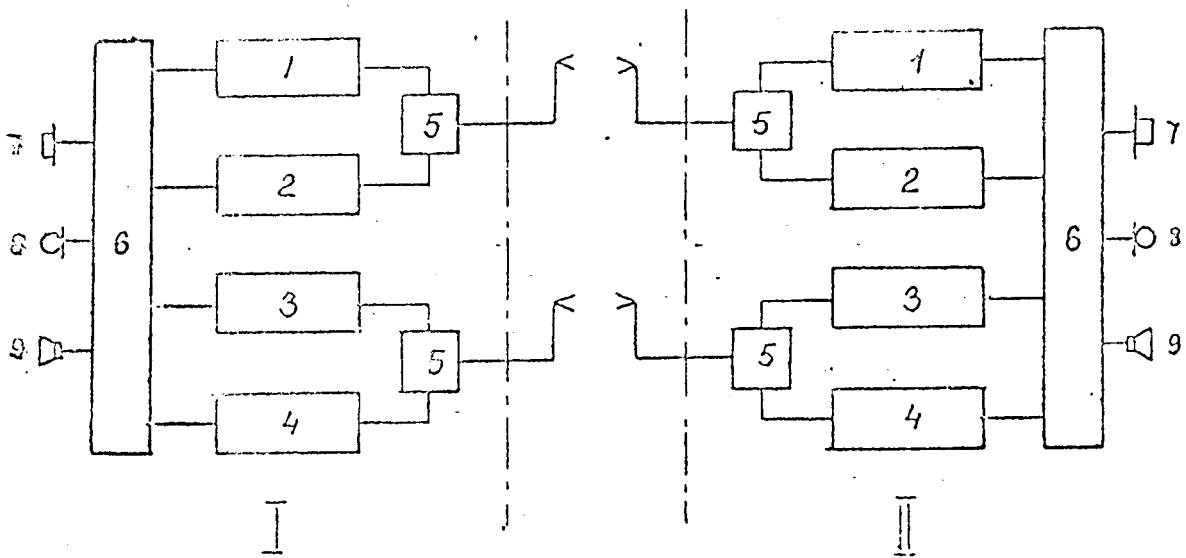


Figure 1. 1- ultrashort-wave transmitter; 2- ultrashort-wave receiver; 3- shortwave transmitter; 4- receiver; 5- switch; 6- switchgear; 7- helmet phones; 8- microphone and control panel; 9- loudspeaker.

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