DRAFT:GCOLETTO:pares:2-28-75

GSFC INPUT TO ASTP PRESS KIT

History's first international space mission will present an unprecedented challenge to the personnel of the Spaceflight Tracking and Data Network to provide the vital link between the earth and the two orbiting spacecraft.

To meet this challenge many changes have been made to the data acquisition, communications and command equipment at the far flung global network of stations. Much of this was accomplished during the interim between Skylab and the Apollo-Soyuz programs.

Flight control personnel will maintain contact with the Apollo-Soyuz spacecraft through the Spaceflight Tracking and Data Network (STDN). This network is a complex of fixed ground stations, portable ground stations, specially equipped aircraft and an instrumented ship used for transmitting signals to and receiving and processing data from the spacecraft during the mission from launch to Earth return. Each station includes tracking telemetry, television and command systems; the communications systems and switching systems.

Under the overall supervision of NASA Headquarters Office of Tracking and Data Acquisition (OTDA), the Goddard Space Flight Center, Greenbelt, MD, is responsible for the operation and maintenance of the world-wide network. Approximately 2300 men and women at the global tracking sites and 500 personnel at GSFC will be actively engaged in the mission operations.

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Fourteen STDN stations will be supporting the ASTP mission. They are:

Merritt Island, Fla.	Tananarive, Malagasy
Rosman, North Carolina	Santiago, Chile
Hawaii	Madrid, Spain
Orroral, Australia	Ascension Island
USNS Vanguard (Tracking Ship)	Guam
Bermuda	Goldstone, California
Newfoundland	Quito, Ecuador

The Soviet network of stations which will support the joint venture consists of 7 ground stations and two ships. They are:

Evpatoria (EVT)	Korolev (tracking ship)
Ulan-Ude (ULD)	Kolpashevo (KLP)
Ussuryisk (USK)	Tbilisi (TBL)
Dzhusaly (DJS)	Gagarin (Tracking Ship)
Petropavlovsk-Kamchatski (PPK)	

Since the close of the Skylab Program, the network has undergone some major changes. Station equipment and personnel levels have had equipment and personnel added to provide the magnitude of support required for the mission. In addition, several stations have become totally staffed and operated by idigenous personnel. The major changes which have occurred are:

Canary Islands, Corpus Christi, Texas and Carnarvon, Australia have been closed.

Honeysuckle Creek, Australia station has been integrated into the Deep Space Network.

Newfoundland, a mobile site, has been reactivated to support the ASTP mission only.

Stations located at Rosman, North Carolina, Quito, Ecuador, Santiago, Chile, Orroral, Australia and Tananarive, Malagasy will support a manned flight for the first time.

The Apollo will be in an earth orbit with at least one station pass every 90 minutes; therefore requiring a 24-hour tracking effort.

As a result of the low altitude the spacecraft maintains in a near earth orbit, the use of the 85' antennas is severely restricted, therefore the network stations supporting the flight will utilize the 30' Unified 'S" Band antenna for tracking operations.

To assure the support required by ASTP all stations have dual channel receivers, additional decommutation equipment and special gear to handle the complex voice communications.

In addition, a new technical dimension will be added to the ASTP mission when, for the first time, an Applications Technology Satellite-6 will be used to provide a spacecraft to spacecraft communications capability never before attainable. Through use of this satellite the ground coverage of the mission will be increased from approximately 17% to 52%. Telemetry voice, command and

television will be relayed through the ATS-6 terminal and the portable station in Spain. Air-to-ground voice communications from the Soyuz spacecraft will be relayed from 10 VHF sites located throughout the network.

NETWORK OPERATIONS

The 14 Network stations supporting the mission will use the "S" Band systems developed and employed during the Apollo flights. The Unified "S" Band system is not only more powerful for longer reach and better coverage during near Earth activities, but also simplifies the ground task by combining all tracking and communications functions into a single unit.

The orderly flow of mission information, command and data between the station actively tracking the spacecraft and Mission Control Center in Houston is the prime considerations during manned missions. Prior to each pass over a particular station, ground controllers at MCC transmit information to the station to update the flight plan. At the station, high-speed computers compare the information to preprogrammed parameters for validity before transmitting it to the spacecraft.

The "unified" concept of the unified "S"-Band system permits the multiple functions -- command, telemetry, tracking and two-way voice communications -- to be accomplished simultaneously using only two carrier frequencies: an uplink frequency between 2090 and 2120 MHz and a downlink frequency between 2200 and 2300 MHz. The system will also receive television from Apollo.

As used in the Apollo program, the USB uplink, voice and updata (command information) frequency modulates subcarriers; these subcarriers are combined with ranging data and the composite signal comprises the uplink carrier frequency. A subcarrier is also used for uplinking voice information. Subcarrier use is required only when multiple uplink functions are required; for example, uplink command data is phase modulated onto the main carrier frequency for transmissions to the workshop. All USB systems can transmit two uplink frequencies simultaneously.

The USB downlink system includes four main receivers and is capable of receiving four downlink frequencies simultaneously in the 2200-2300 MHz frequency range. Normally the downlink carrier will be modulated with a composite signal consisting of ranging data and modulated subcarriers, but as with the uplink, other data can be modulated directly onto the main carrier.
Two Signal Data Demodulate or Systems (SDDS) are in each USB system to demodulate the various downlink signals. Television signals are taken directly from the carrier and filtered to remove subcarrier information, and then remoted directly to JSC, over wideband lines. Astronaut voice is normally sent over regular communications lines.

The entire network is linked by the facilities of the NASA Communications Network (NASCOM), a global communications network established by NASA to provide operational ground communications for support of all spaceflight operations.

COMMUNICATIONS

The NASA Communications Network, one of the most extensive and sophisticated communications networks in existence, links all the STDN stations and NASA installations together. Over two million circuit miles covered by the network includes data and voice channels, medium and high speed message circuits. The majority of these circuits connecting and servicing these centers are leased from common carriers such as AT&T, Western Union, ITT, and various local telephone companies throughout the world. The circuits are specially engineered and maintained for NASA.

Control Center for the NASCOM Network is the NASA Goddard Space Flight Center, Greenbelt, Md. Special computers are used in the system to act as traffic policemen. The computers are programmed to recognize specific types of information and automatically direct or switch it to the proper destination. Switching centers located in London, Madrid, and Australia are used to augment the network, receive data from the tracking stations and route it to Goddard.

Communications from the Soyuz spacecraft will be on VHF only.

Satellite Support

Communications from the Apollo-Soyuz spacecraft, including television, will be relayed through NASA's Applications Technology Satellite-6 (ATS-6). An advanced communications research satellite, the ATS-6 was launched into geosynchronous orbit from Cape Canaveral, Florida, on May 30, 1974.

Use of the ATS-6 for the ASTP tracking and data relay will provide about three times the communications coverage of the ground stations. Thus it will permit larger amounts of biomedical and spacecraft data to be relayed to the earth in one transmission and increase the television coverage from the flight.

Operations of the ATS-6 are coordinated and controlled from the ATS Control Center at the Goddard Space Flight Center, Greenbelt, Maryland. ATS ground stations are located at Rosman, N.C., Mojave, California, and a mobile station at Buitrago, Spain.

To support the ASTP mission, the ATS-6 will be positioned on the equator some 35,900 kilometers (22,260 statute miles) above the eastern edge of Lake Victoria in Kenya, East Africa. From this position, the spacecraft will be controlled through the Madrid mobile station and will command a view of about 50% of the Apollo-Soyuz's 225-kilometer (140 statute miles) orbit.

During operations, the ATS-6 will point its antenna towards the edge of the earth as seen from its orbit, and generate a signal for the Apollo spacecraft to lock onto when it moves into view. Apollo, using a wide-band antenna, will home-in on the signal and, after establishing contact, will transmit telemetry, voice

and live television to the satellite. ATS-6 will relay the communications to the Buitrago, Spain ground station, who will then relay the data via the commercial satellite Intelsat to the Johnson Space Center, Houston, Texas.

Ship Support

Three seagoing tracking stations will be employed to support the ASTP Mission. The U.S. ship USNS Vanguard will be stationed in a Test Support Position located at 25 degrees South and 155.0 degrees West and will be in position 48 hours prior to liftoff until released from the mission support role. Two Soviet ships will be employed. Ship No. 1, the Korolev will take up a position near Canada and Ship No. 2, the Gagarin, will be deployed in a position near Chile.

Range Instrumented Aircraft

Three instrumented aircraft will be used to support the mission, operating from Australia/South African airfields. The Advanced Range Instrumented Aircraft (ARIA) are used primarily to fill the voids between land and ship stations during the launch and early orbital phases of the flight.

The aircraft will depart Patrick AFB, Florida at T-5 days and deploy as follows:

Aria #1 & #3 will stage out of Perth, Australia

Aria #2 will stage out of Johannesburg, South Africa

During the flight Aria #1 will provide rev 1 coverage south of Australia of the SIVB maneuver for undocking, revolution 2 docking module extraction and will record SCM and SIVB data

and remote voice communications through the Pacific commercial communications satellite in realtime. The aircraft will then return to Perth for redeployment to Hawaii to cover reentry.

Aria #2 will provide coverage in the Indian Ocean area on rev 4 of the SIVB deorbit maneuver. The aircraft will also receive and record data for relay through the Atlantic communications satellite in realtime.

Aria #3 provides rev 4 coverage SW of Australia over the Indian Ocean of the last portion of the SIVB deorbit maneuver. The aircraft will then return to Guam.

Onboard Television Distribution

Television coverage during the mission will be both realtime and recorded. All stations in the STDN network are capable of receiving and recording video; however, only Buitrago, Spain, Merritt Island, Florida, Rosman, N.C., Goldstone, California, and Orroral Australia have been designated as "prime" for live television and will transmit video to the Johnson Space Center, Houston, Texas in realtime.

"Live" television will be transmitted via the CSM through the ATS-6 satellite to Buitrago, Spain who will relay the video through the Atlantic communications satellite to the Johnson Space Center via hardline where it will be color converted and released to the news media under the direction of the Public Affairs Office, Johnson Space Center. TV support period from Buitrago is approximately 55 minutes during each orbit scheduled for downlink of TV.

Video emanating from the Soyuz will be received by Soviet stations and remoted to Houston through a variety of routings which are shown on enclosures.

Color television from the ASTP spacecraft will be fed to the ground stations by 5 cameras. An on board videotape recorder permits delayed relay of up to 30 minutes of TV during any station pass.

Contingency Control Center

In the event of a catastrophic event at the Johnson Space Center Control Center, responsibility for mission operations and control will be immediately assumed by the Goddard Space Flight Center. There, personnel in the Spaceflight Operations Control Center will implement the control of the mission operations until the flight control teams of the JSC can be transported to GSFC to resume their duties.

Redundant systems for operations are presently available at GSFC and personnel staffing on an around-the-clock basis is on hand during all manned flight missions for this purpose.

Similarly, the Public Affairs operations would also be shifted to GSFC in the event this occurs.

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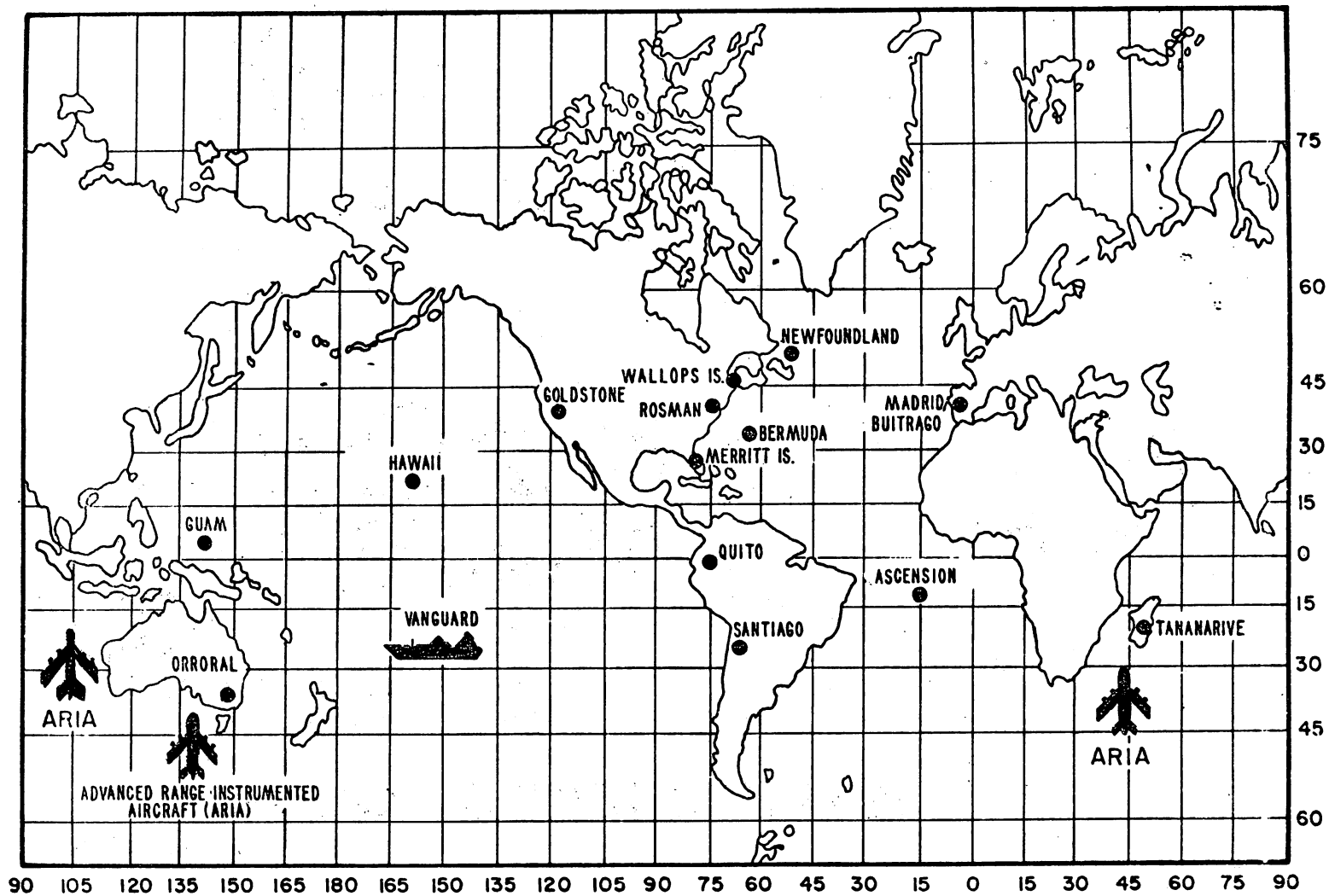
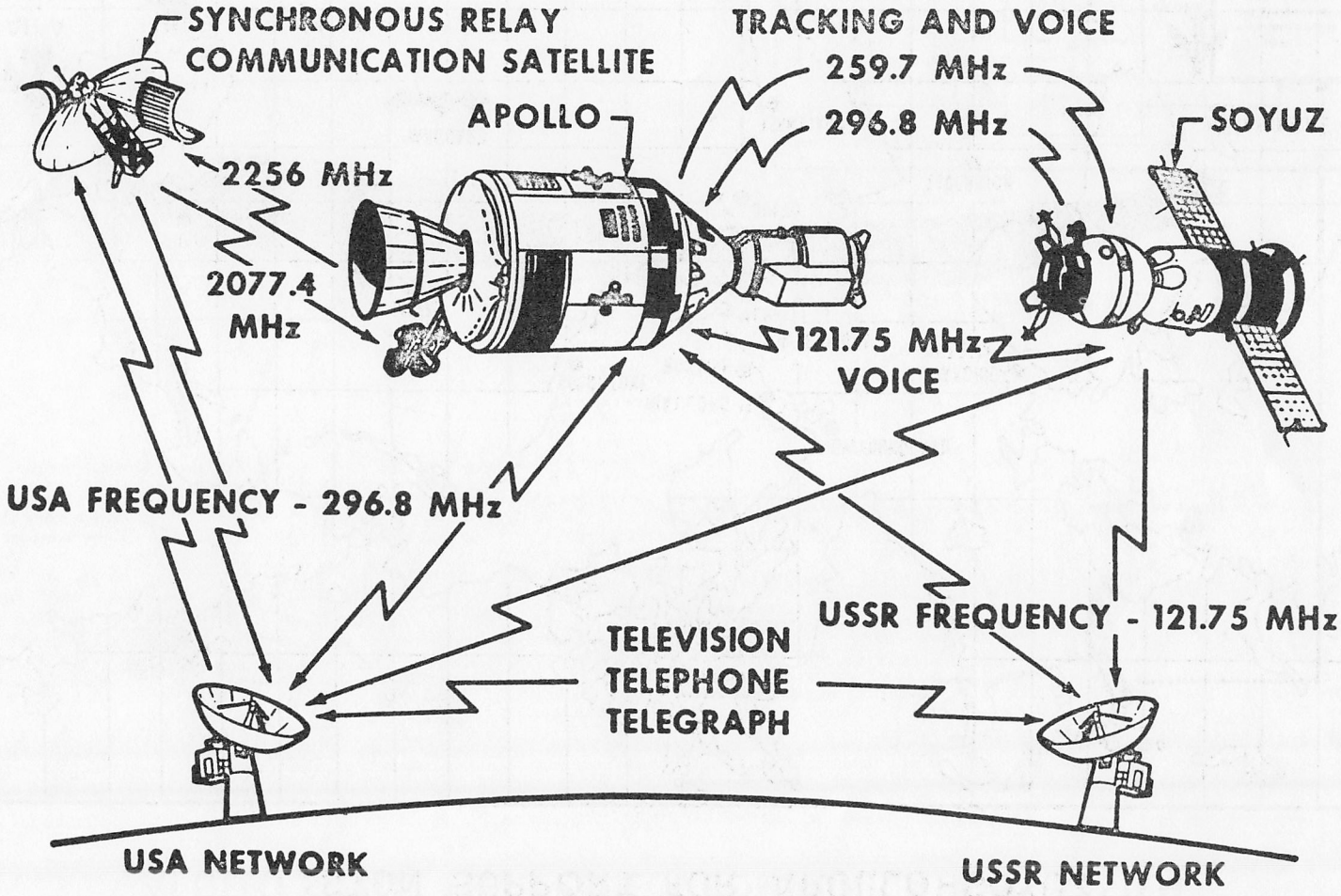
STDN SUPPORT FOR APOLLO-SOYUZ



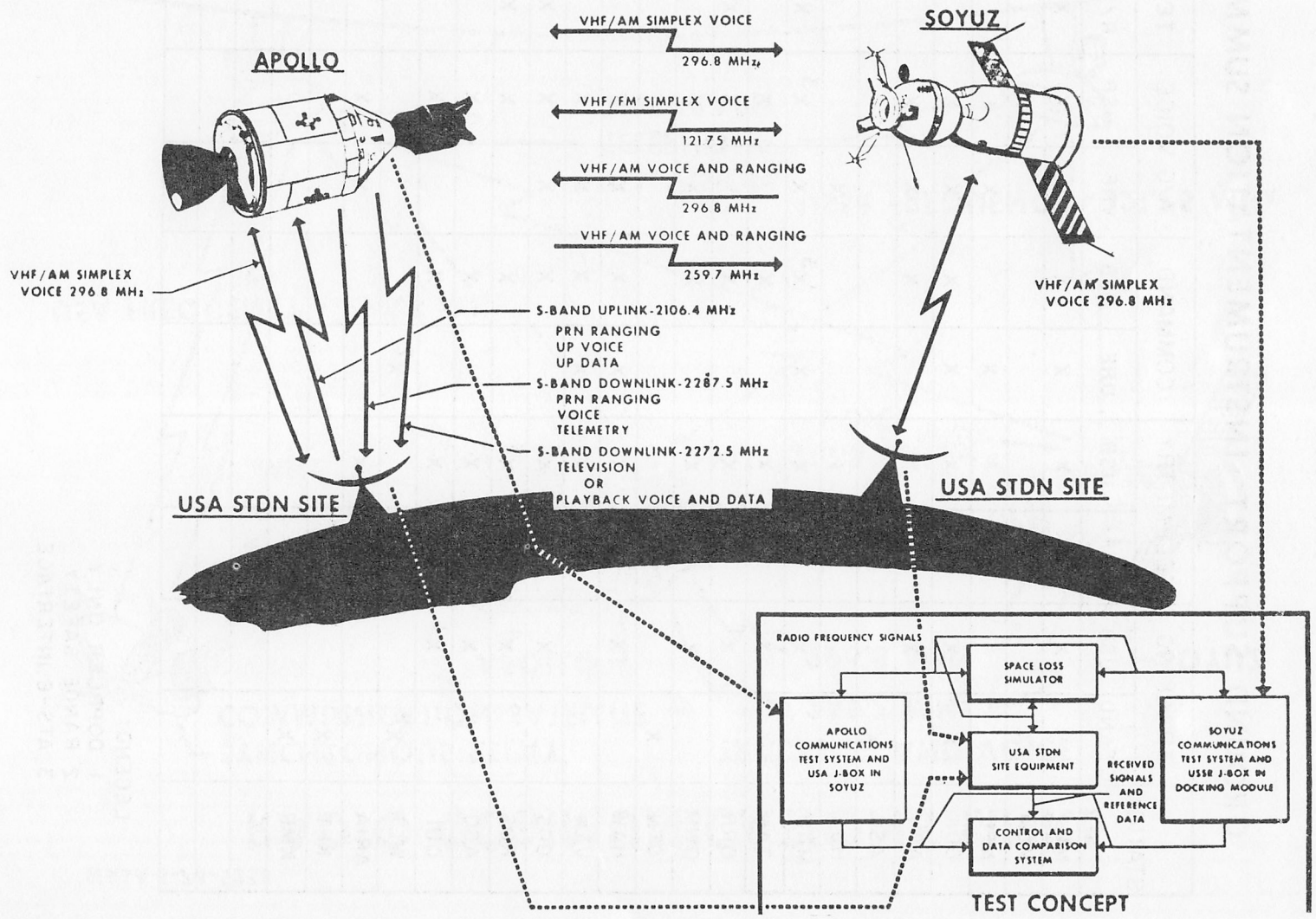
NASA-S-74-5258

RADIO COMMUNICATIONS LINKS



NASA
S-74-17588

APOLLO SOYUZ TEST PROJECT COMMUNICATIONS SYSTEM

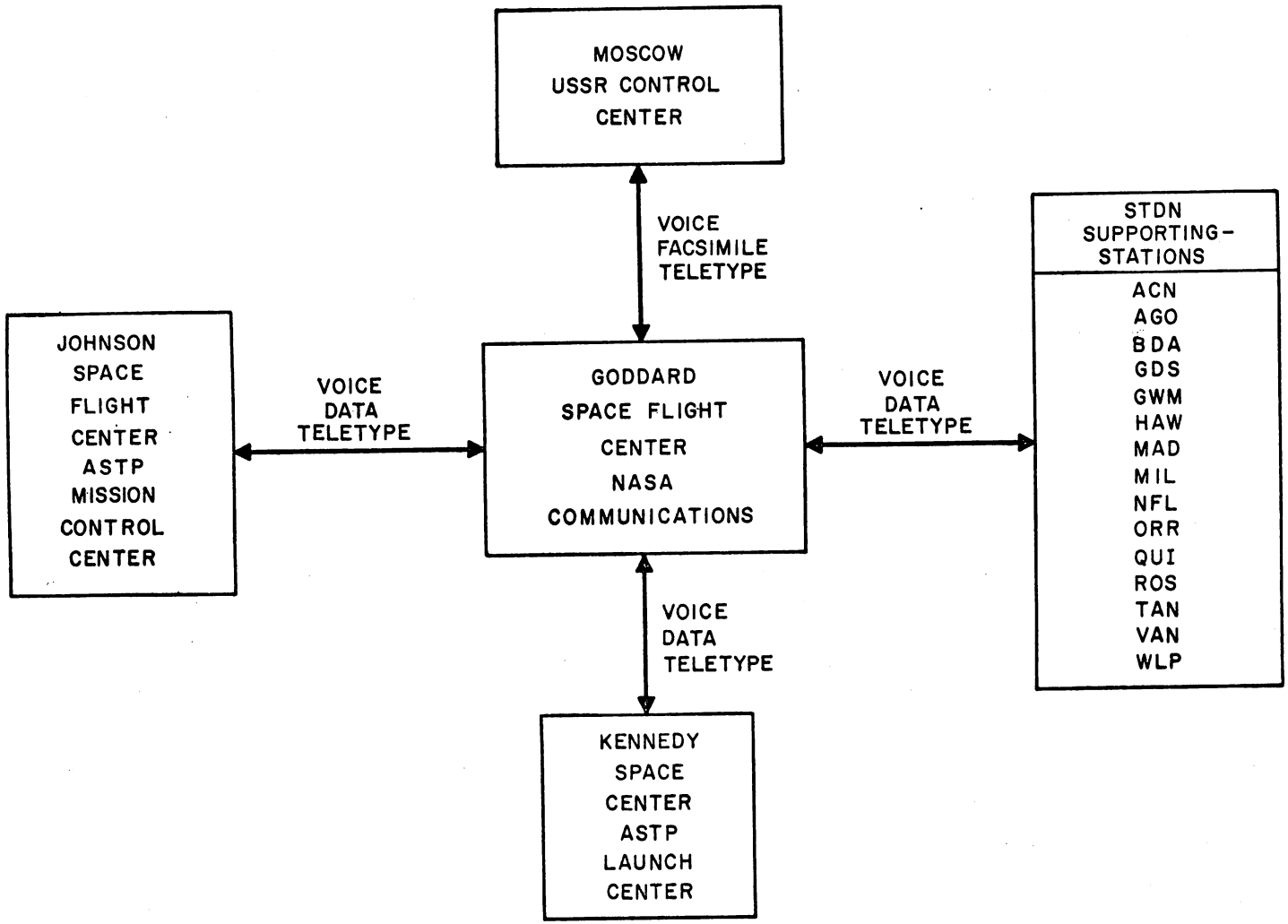


GROUND SUPPORT INSTRUMENTATION SUMMARY

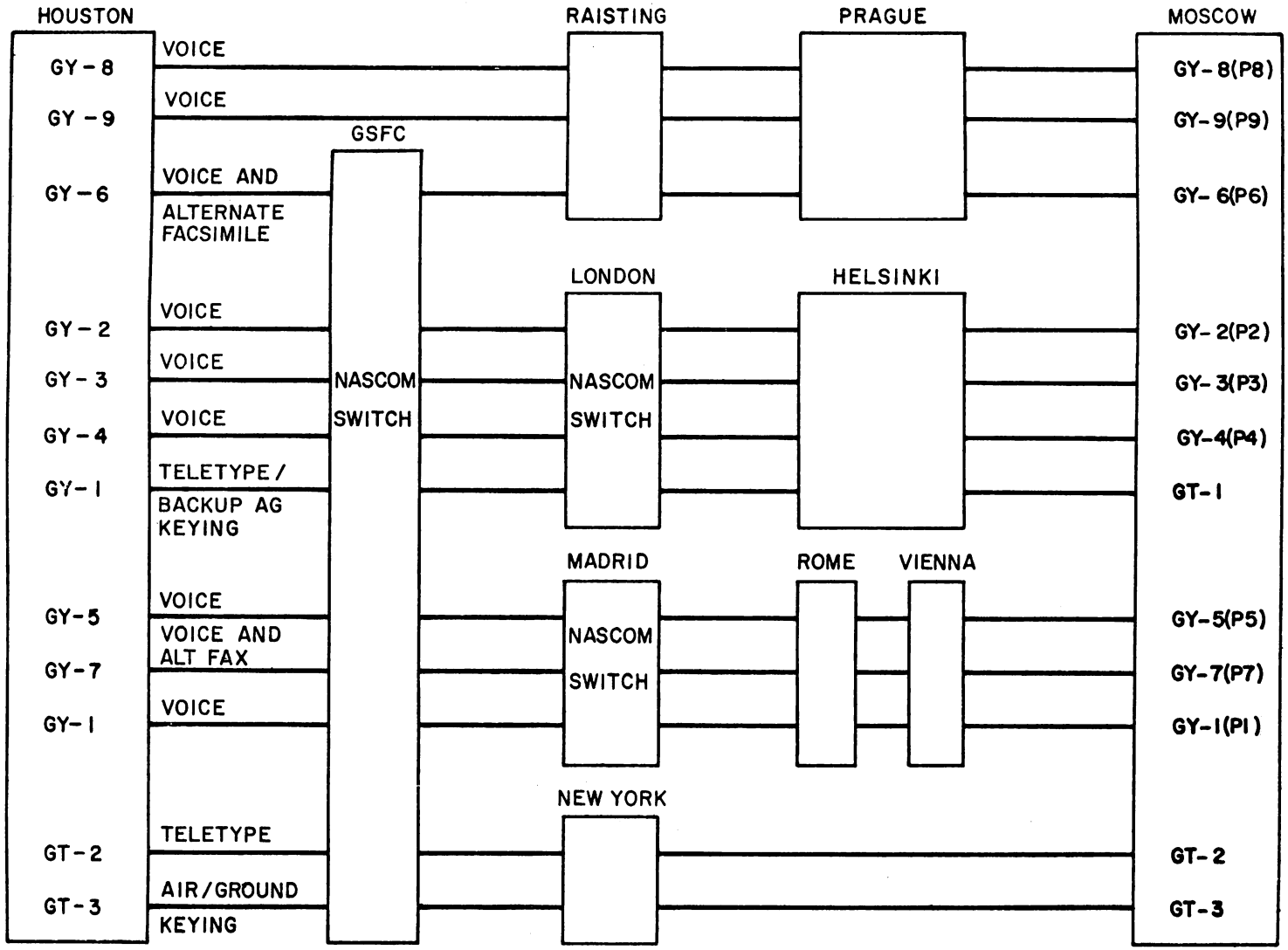
STATION	TRACKING		TELEMETRY		COMMAND		A/G VOICE		TELEVISION	
	C-BAND	USB	VHF	USB	UHF	USB	VHF	USB	R/T	S-BAND RECORD
MIL		X	X	X	X	X	X	X	X	X
MLA	X									
NFL			X		X		X			
BDA	X	X	X	X	X	X	X	X		X
ACN		X		X		X	X	X		X
ASC	X									
HSK							X			
MAD		X	X	X	X	X[3]	X	X[3]	X[3]	X
TAN	X	X[1]		X		X		X		X
ORR		X[1]		X		X		X	X	X
GWM		X		X		X	X	X		X
CTN	X									
HAW		X	X	X	X	X	X	X		X
VAN			X	X	X	X	X	X		X
GDS		X		X		X	X	X	X	X
ROS		X[1]		X		X		X	X	X
AGO		X		X		X		X		X
QUI		X[1]		X		X		X		X
WLP	X[2]				X[2]					
ARIA			X	X			X	X		
KPT	X									
KMR	X									

LEGEND:

1 DOPPLER ONLY
2 RANGE SAFETY
3 ATS-6 INTERFACE

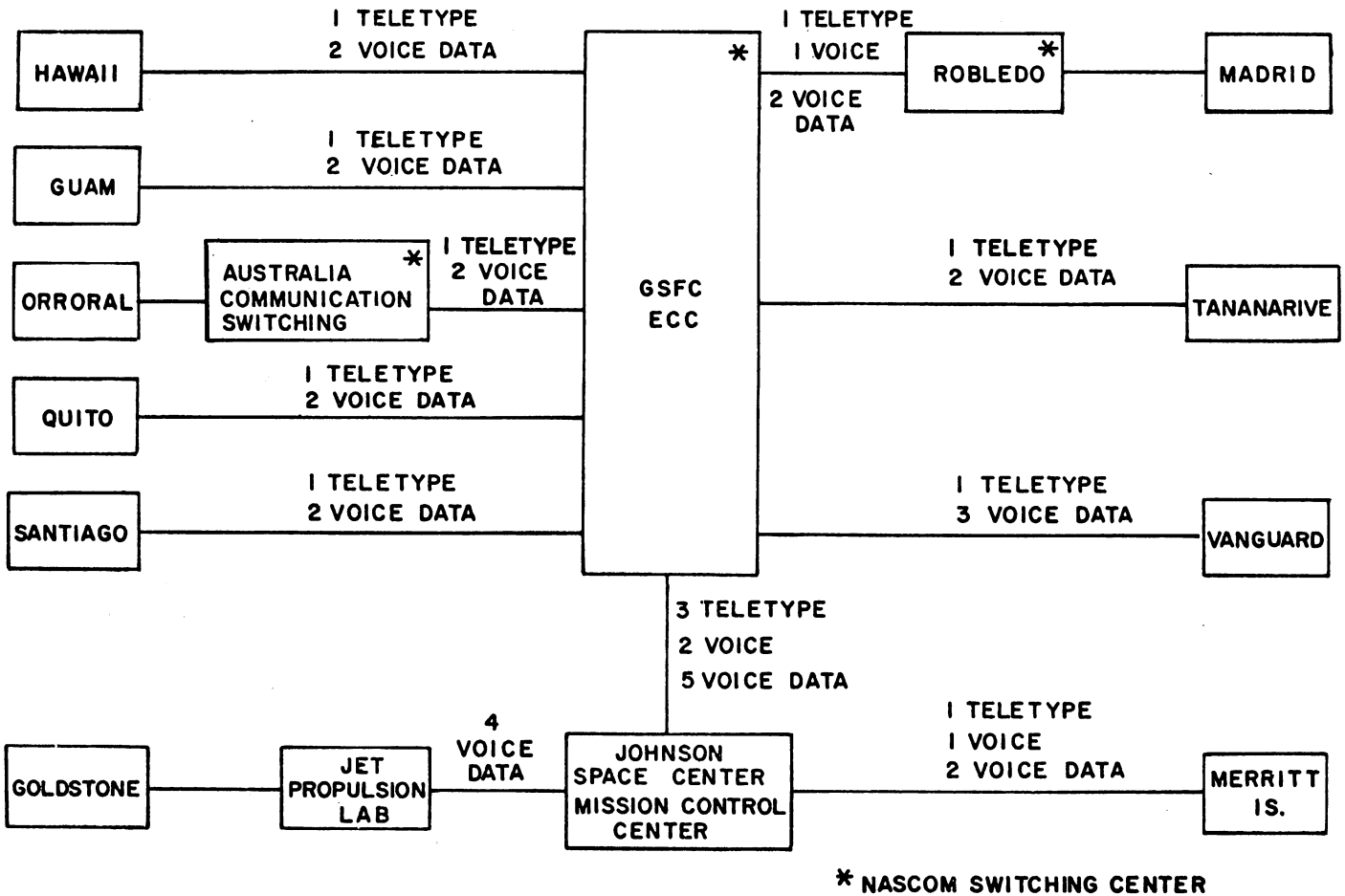


ASTP COMMUNICATIONS NETWORK



HOUSTON TO MOSCOW
CIRCUIT ROUTING FOR ASTP

GSFC ECC COMMUNICATIONS CONFIGURATION



JSC TO GSFC

9 VOICE/DATA

12 VOICE

2 WIDEBAND

2 VFTG SYSTEMS (INCLUDED IN THE 9 VOICE/DATA SHOWN ABOVE

JSC TO HOSC

10 VOICE

1 WIDEBAND

JSC TO KSC

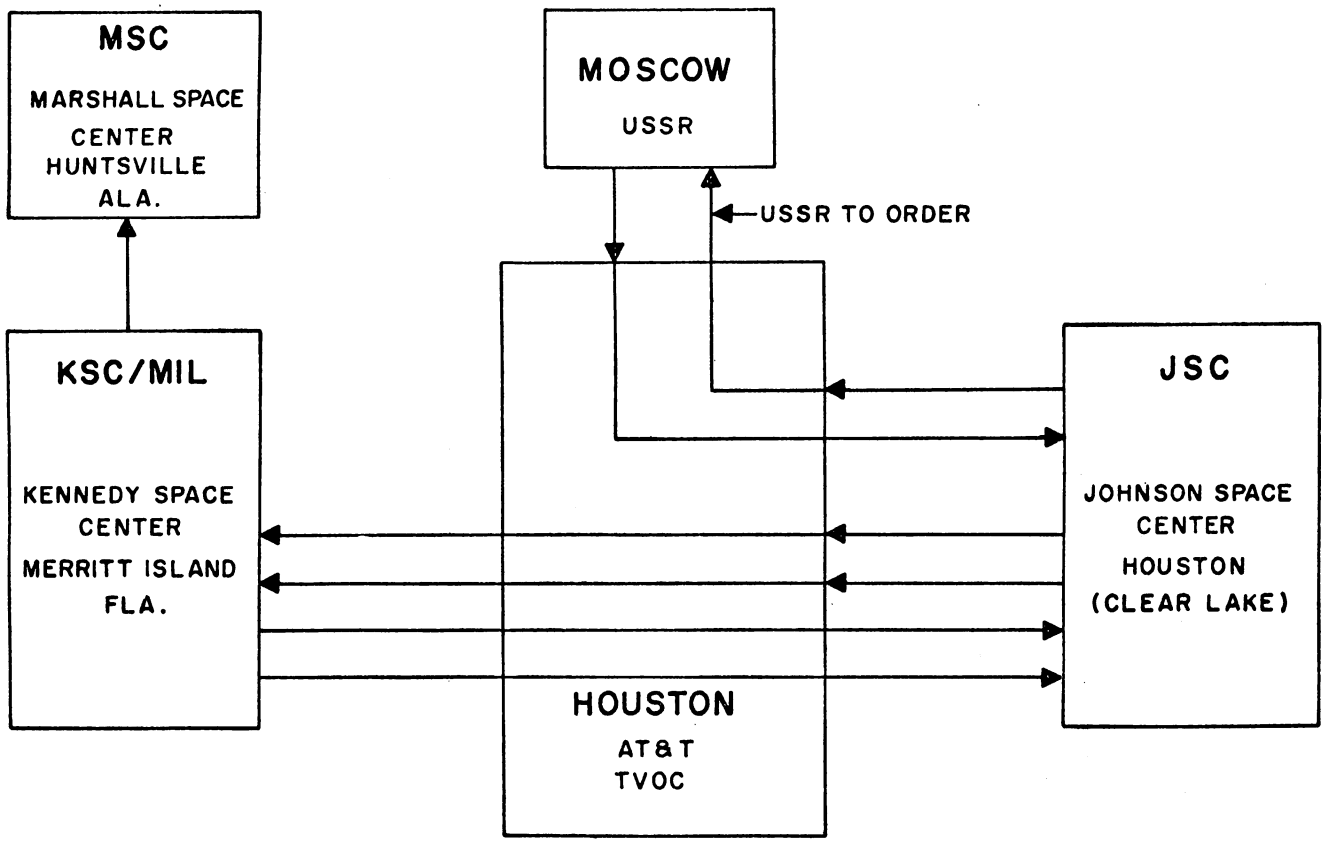
37 VOICE

3 VOICE / DATA

1 SPECIAL A/G CKT (MIL A/G)

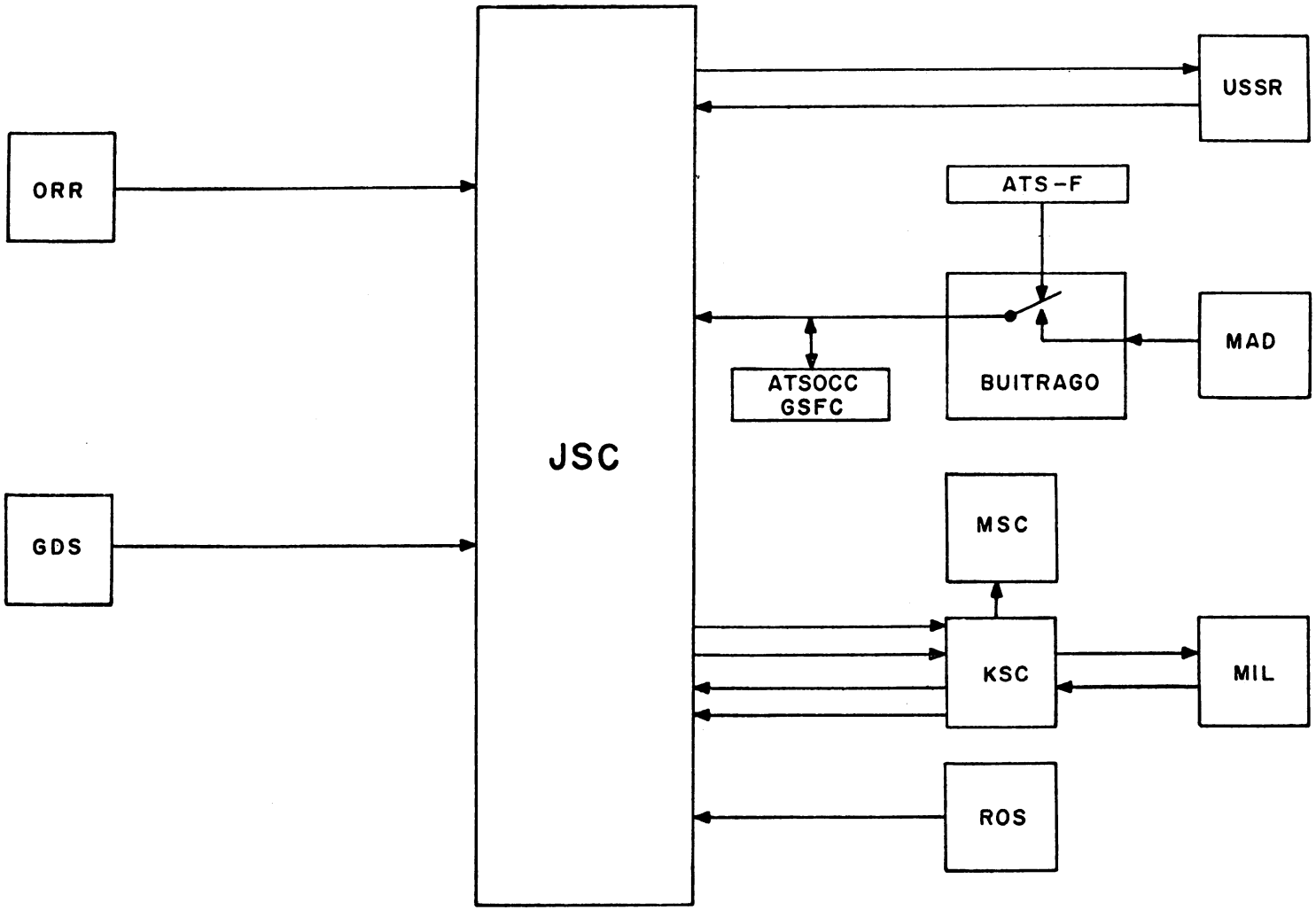
3 SPECIAL DATA CKTS (CAST/CASRS, WIND PROFILE IP DATA)

ASTP SUPPORT CIRCUITS



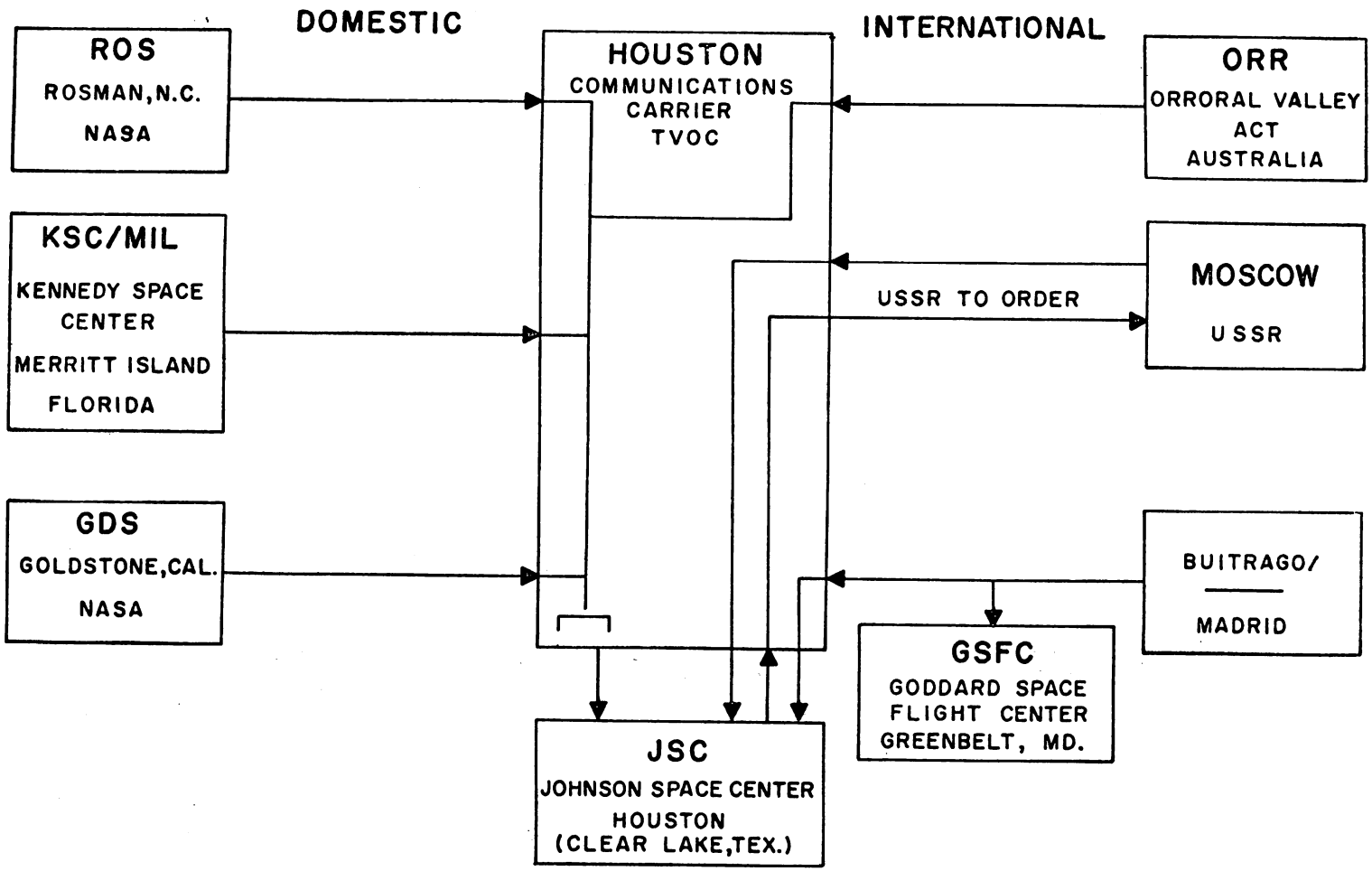
ASTP NASA VIDEO FOR LAUNCH SUPPORT

GSFC
C.J. GOODMAN
NOV. 1974



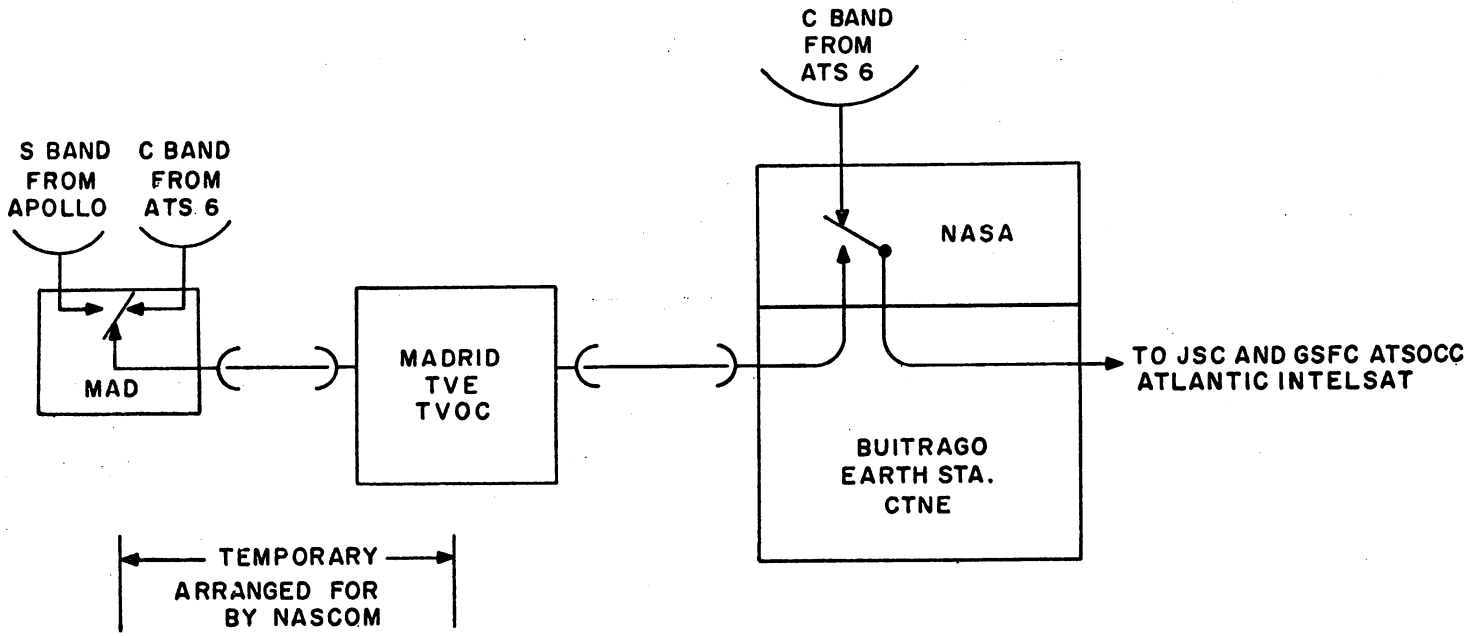
ASTP VIDEO NETWORK

C.J. GOODMAN
NOV. 19, 1974



ASTP-NASA VIDEO FOR ORBITAL SUPPORT

GSFC
C.J. GOODMAN
NOV. 19, 1974

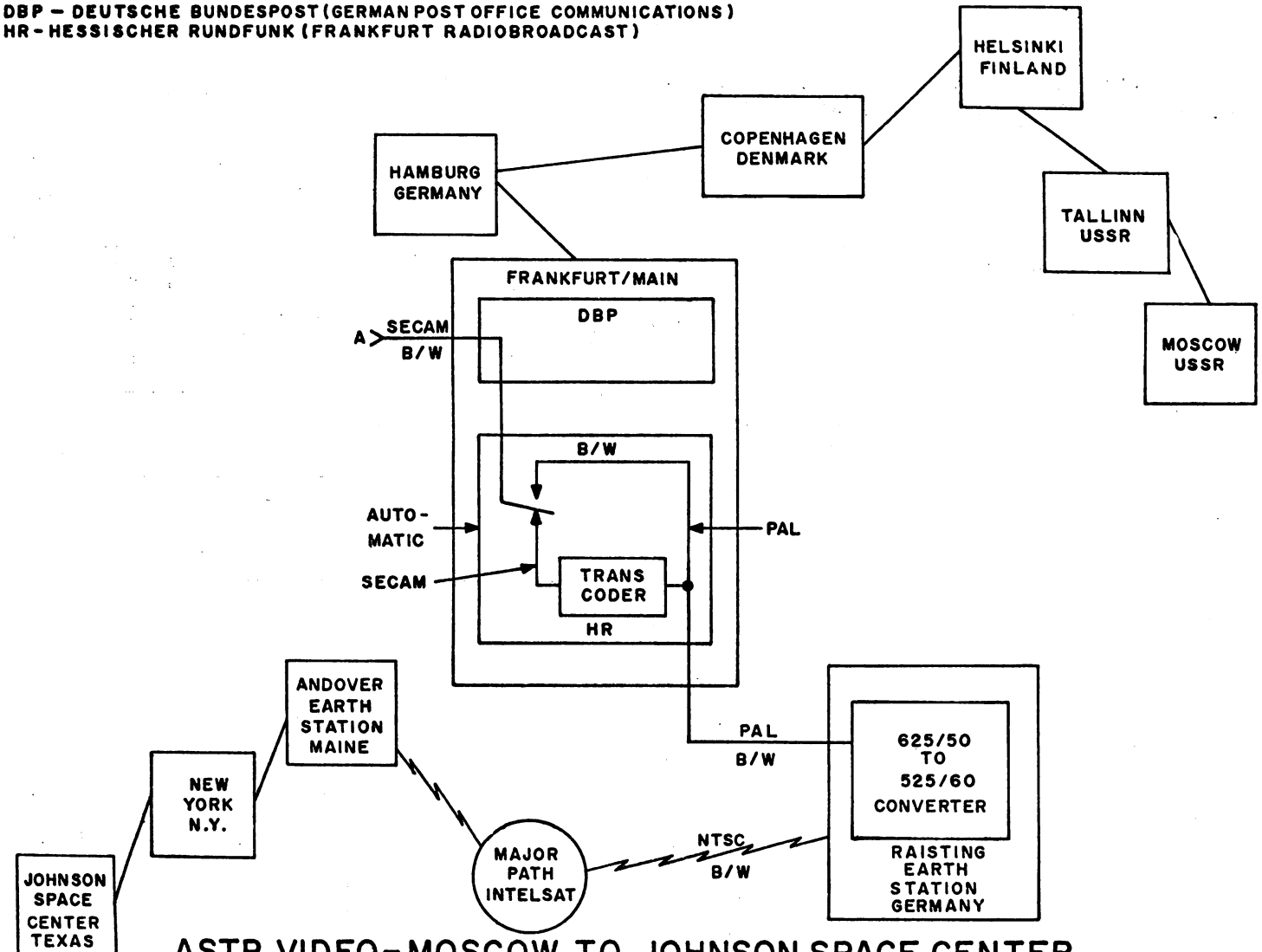


BUITRAGO ALSO WORKS INDIAN OCEAN INTELSAT

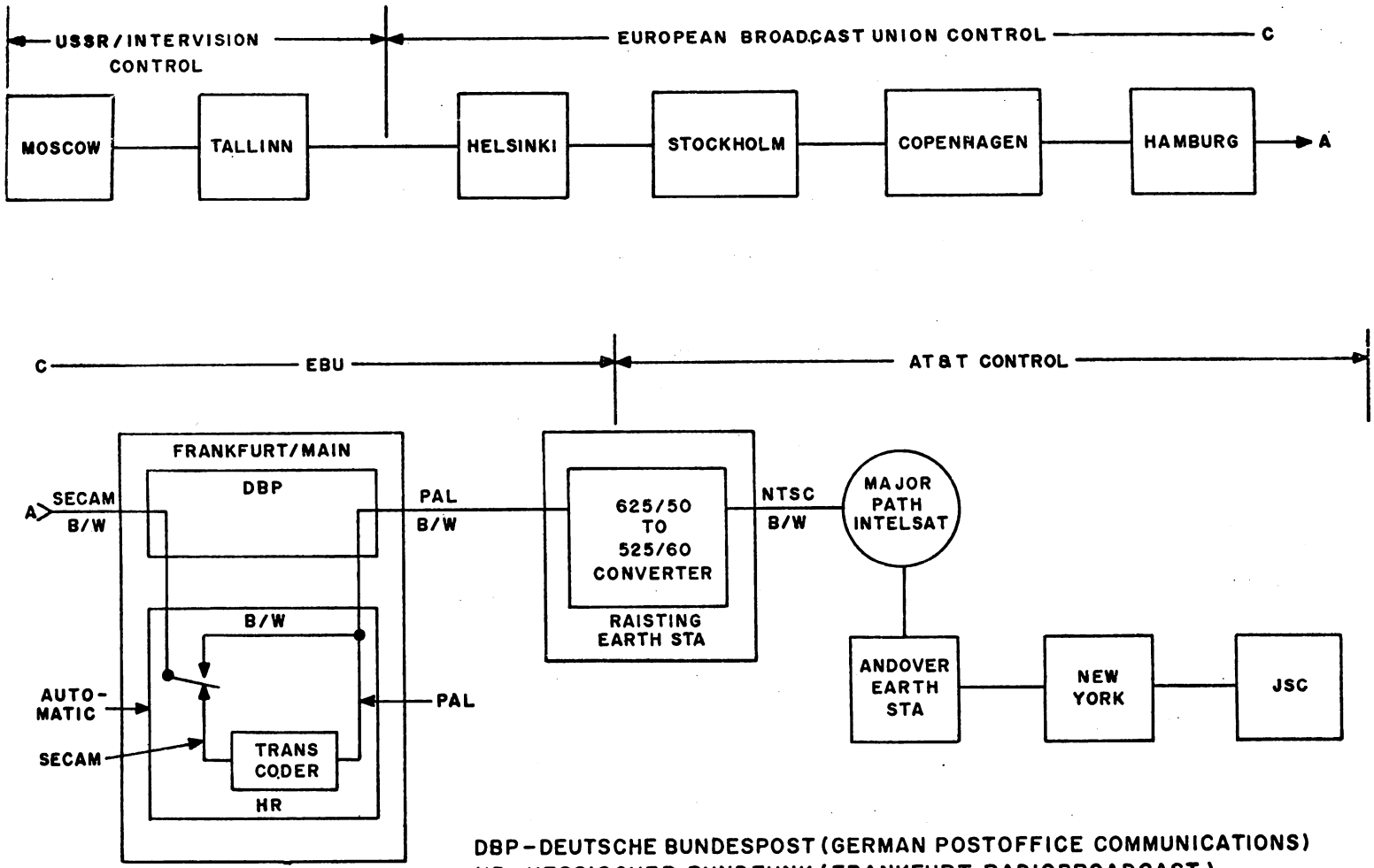
ASTP VIDEO - SPAIN TO JSC

GSFC
C.J. GOODMAN
NOV. 19, 1974

DBP – DEUTSCHE BUNDESPOST (GERMAN POST OFFICE COMMUNICATIONS)
HR - HESSISCHER RUNDFUNK (FRANKFURT RADIOBROADCAST)



ASTP VIDEO - MOSCOW TO JOHNSON SPACE CENTER



DBP-DEUTSCHE BUNDESPOST (GERMAN POSTOFFICE COMMUNICATIONS)
HR-HESSISCHER RUNDFUNK (FRANKFURT RADIOBROADCAST)

ASTP VIDEO-MOSCOW TO JSC