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WIDE BAND DATA COLLECTION SYSTEM

by

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The Incorporated Research Institutes for Seismology (IRIS) approached NASA Headquarters in 1986 about the need to collect data daily from seismic stations around the world as part of the Earth Observing System (Eos) mission. A typical IRIS Seismic Station generates 16 Megabytes of data per day under background conditions, and up to 24 Megabytes of data per day when there is seismic activity. A competitive contract was won by ORI to perform a preliminary design study which would yield a design to the block diagram level, and provide a link analysis, size, weight, power and cost estimate. Technical Report No. 2773, "EOS WIDEBAND DATA COLLECTION SYSTEM: BLOCK DIAGRAM, LINK ANALYSIS, SIZE, WEIGHT, POWER AND COST ESTIMATES," was delivered on September 30, 1987.

The following is a summary of the Preliminary Design Parameters of the Wide Band Data Collection System:

Concept

1. Spacecraft

WBDCS: fixed earth coverage antenna, 7 GHz receiver, 8.5 GHz transmitter, programmable controller for generating commands to stations, power converter

Eos: Data multiplexer, storage for up to 2 orbits (0.4 Gbytes) of seismic data, communications link to TDRSS

2. Seismic stations - land based

Active track antenna, 1.2 m diameter, similar to Marisat Tracking and Command Receiver at 8.5 GHz Storage for up to 24 hours of seismic data (24 Megabytes) Transmitter, 10 watts, 7 GHz

3. Operation

WBDCS: Commands seismic stations in sequence to transmit data Receives seismic data, and sends it to Eos Data System

Eos: Multiplexes seismic data with Eos data Stores multiplexed data Transmits multiplexed data to TDRSS

TDRSS: Relays data to TDRSS ground station

TDRSS ground station: Strips out seismic data Sends data to IRIS Data Center

Note: Daily collection of data by Eos means some of the data are almost 24 hours old before they are received by Eos. An additional maximum delay of 218 minutes (two orbits) may occur before the data are transmitted to TDRSS and relayed to a TDRSS ground station. There may be additional delay at the TDRSS ground station before the seismic data are stripped from the Eos data and sent to the IRIS Data Center.

COMMUNICATIONS LINKS - Summary

DOWNlink * WBDCS tracking beacon and command transmitter

| | |
|------------------|---------------------|
| frequency | 8.5 GHz |
| command bit rate | 100 bits per second |
| margin | 20 db |

UPlink * Collect data from seismic stations

| | |
|------------|-------------------------------|
| frequency | 7 GHz |
| bit rate | 1 Megabits per second |
| modulation | quadriphase with rate 1/2 |
| | convolutional coding |
| margin | 2 db for 10 ⁻⁷ BER |

Note: 24 hours of data can be collected from each station during one satellite pass, leaving the second pass during a 24-hour day for repeat transmissions as required.

* One earth coverage 80 cm diameter antenna for UPlink and DOWNlink

TYPICAL LAND BASED GROUND STATION

Antenna 1.2 m diameter (similar to Marisat)
Active tracking at 8.5 GHz
Transmit at 7 GHz
Receiver 8.5 GHz: tracking beacon signal from Eos
commands at 100 bps from WBDCS
on Eos
Transmitter 7 GHz, 10 watts
EIRP 45.4 dbw
Cost Order of magnitude - \$100K.

WIDE BAND DATA COLLECTION SYSTEM - SUMMARY Cost, Mass, Volume, Power

Space Segment

| | | | |
|------------|--|---------------------|-----|
| RDT & E | \$9.17 M | 1 | 19% |
| First Unit | \$1.86 M | 1 | 49% |
| Mass | 18.5 kg | | |
| Power | 54 watts | | |
| Volume | 17,641 cm ³ | 0.02 m ³ | |
| Antenna | fixed metal reflector, 80 cm diameter, with feed horn | | |

Ground Segment

Order of magnitude cost for - \$100K, includes 1.2 m
land based Uplink and DOWN- diameter active
link communications with Eos track antenna

CONCLUSION

The Wide Band Data Collection System is to be funded by Eos for further development to a space qualified system.

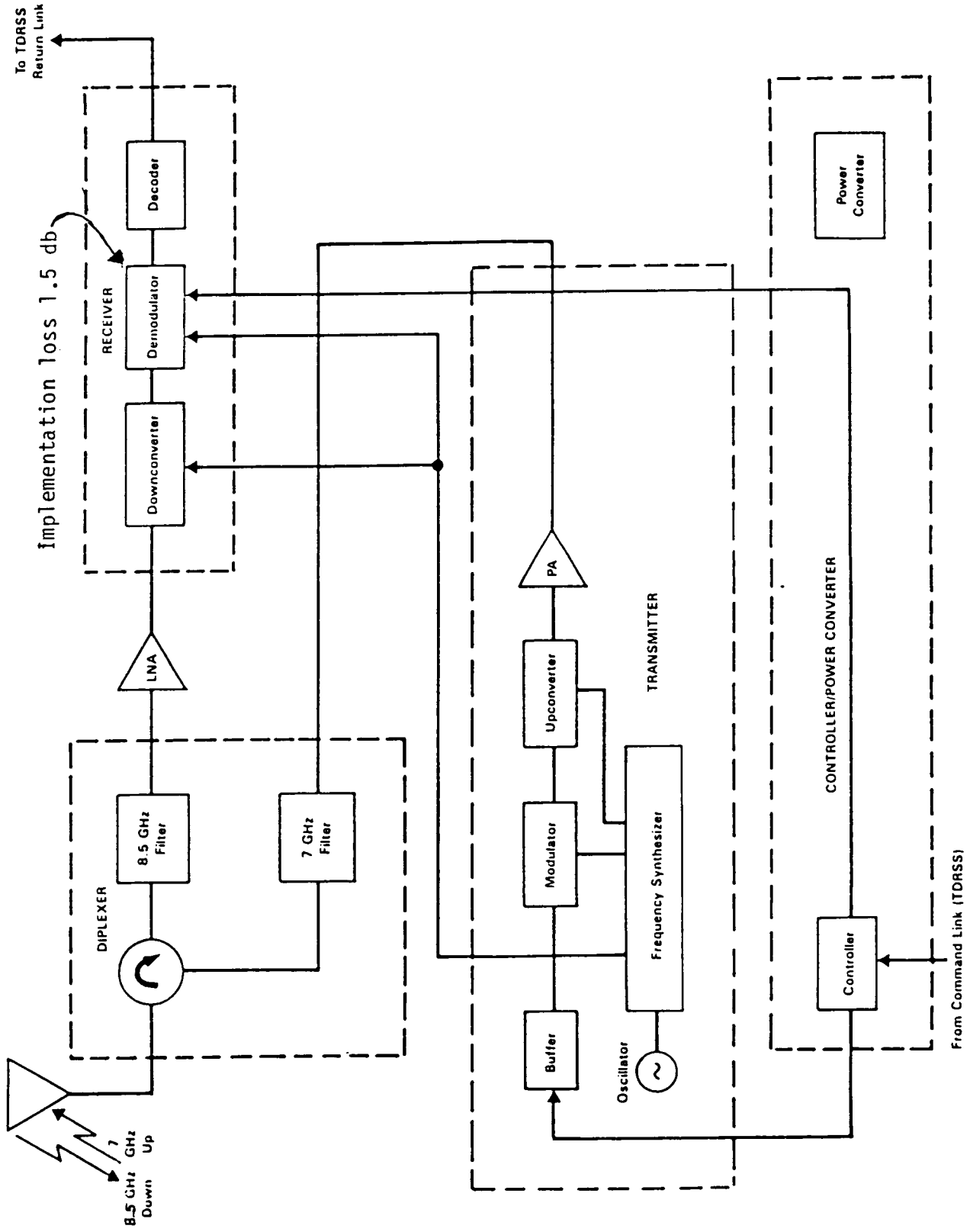


Figure 1. WBDCS Space Terminal Block Diagram