

**NEW TECHNOLOGY APPLIED TO TELEMEDICINE**

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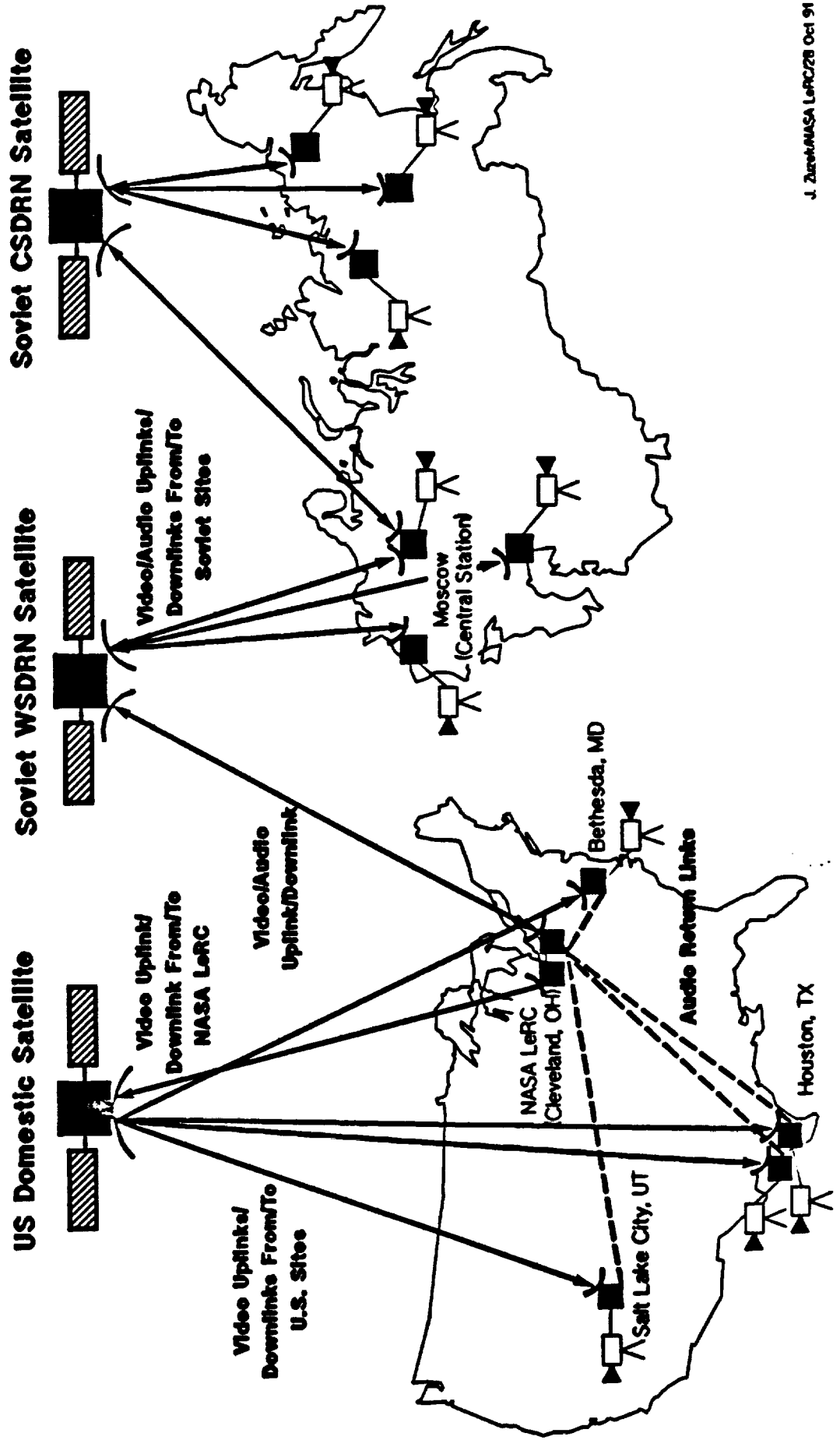
**BY  
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MEDICINE CONFERENCES  
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HEALTH SCIENCES  
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## 1.0 INTRODUCTION

SATELLITE COMMUNICATIONS TECHNOLOGY HAS BEEN USED FOR ESTABLISHING INTERNATIONAL TELEMEDICINE COMMUNICATIONS LINKS IN A NUMBER OF INSTANCES, (E.G., TELEMEDICINE SPACE BRIDGE BETWEEN ARMENIA AND THE UNITED STATES IN 1989, AND THE PROPOSED LINKAGES SHOWN IN THE FIGURE, FOR DEMONSTRATION DURING THIS CONFERENCE AND DURING 1992 AND 1993). IN THE CURRENT EXAMPLE, GEOSTATIONARY SATELLITES ARE USED TO PROVIDE INTERCONTINENTAL COMMUNICATIONS LINKS BETWEEN THE TWO COUNTRIES AND ALSO FOR DISTRIBUTION WITHIN EACH COUNTRY.

# Telemedicine Space Bridge (Two-Way Video)





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Lewis Research Center

## SATELLITE COMMUNICATIONS, TECHNICAL CHARACTERISTICS

### WSDRN SATELLITE

ANTENNA DIAMETER  
TRANSMITTER POWER

1.6 m OR 3.0 m  
13 W

### WSDRN EARTH STATION

ANTENNA DIAMETER  
TRANSMITTER POWER

2.0 m OR 5.0 m  
100 W OR 240 W

### US DOMSAT

ANTENNA DIAMETER  
TRANSMITTER POWER

1.6 m  
20 W

### DOMSAT EARTH STATION

ANTENNA DIAMETER  
TRANSMITTER POWER

3.7 m, TYPICAL  
300 W OR 600 W



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## TECHNICAL CHARACTERISTICS OF CURRENT TELEMEDICINE LINKS BY SATELLITE

SATELLITE ANTENNAS

1.6 TO 3.0 m

SATELLITE TRANSMITTER POWER

10 TO 20 W

EARTH STATION ANTENNAS

2 TO 5 m

EARTH STATION TRANSMITTER POWER

100 TO 600 W

CHANNEL BANDWIDTH FOR ANALOG VIDEO

34 TO 54 MHz

FREQUENCIES

Ku-BAND 11-15 GHz

## **APPLICATIONS OF NEW TECHNOLOGY**

### **VIDEO CODING**

- **REDUCES BANDWIDTH & POWER REQUIRED**
- **PRESERVES FULL MOTION AND FULL RESOLUTION**

### **APPROACH**

- **DEVELOPMENT OF VIDEO CODING ALGORITHMS**  
2:1, 5:1, 10:1 COMPRESSION
- **PROTOTYPE EQUIPMENT**
- **DEMONSTRATIONS WITH SATELLITES**

### **BENEFITS**

- **LOWER COST OF TELEMEDICINE TRANSMISSIONS**
- **MULTIPLE TELEMEDICINE CHANNELS IN A SINGLE SPACECRAFT TRANSPONDER**
- **REDUCED POWER, SMALLER ANTENNA SIZES**

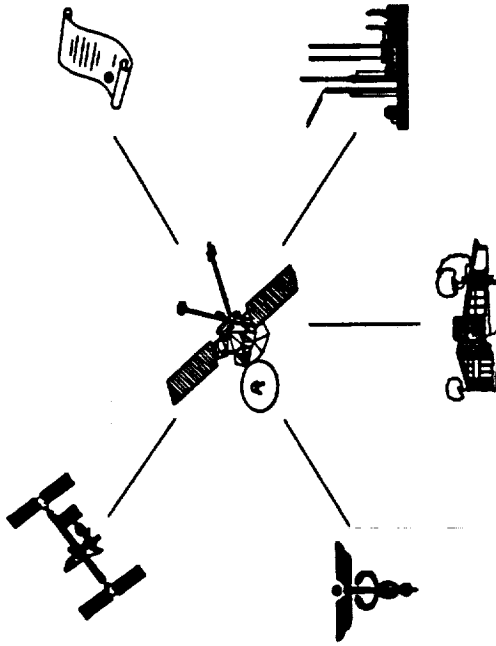


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## VIDEO COMMUNICATIONS BANDWIDTH COMPRESSION



### SCOPE/OBJECTIVES:

- DEVELOP VIDEO DATA COMPRESSION TECHNOLOGY FOR TRANSMISSION OF IMAGE DATA OVER SPACE COMMUNICATIONS LINKS
- EFFICIENT BANDWIDTH UTILIZATION
- INCREASED PROCESSING SPEED THROUGH EFFICIENT CODING TECHNIQUES
- COST EFFECTIVE HARDWARE IMPLEMENTATION

### BENEFITS:

- INCREASE ORBIT/SPECTRUM CAPACITY
- ENABLE COST EFFECTIVE COMMERCIAL DIGITAL VIDEO TRANSMISSION
- ENHANCE NASA SCIENCE MISSION VIDEO CAPABILITIES
- REDUCE SPACE SEGMENT COSTS BY REDUCING BANDWIDTH REQUIREMENTS

### ACCOMPLISHMENTS:

- PATENT PENDING ON IN-HOUSE DEVELOPED ENHANCED DPCM CODEC PROVIDING BROADCAST QUALITY ENCODING IN REAL TIME
- UNIVERSITY GRANTS IN PLACE FOR INVESTIGATION AND DEVELOPMENT OF NEW ENCODING TECHNIQUES
- RECENT SCAR AWARD TO COMSAT FOR DEVELOPMENT OF FLEXIBLE-RATE HDTV CODEC

## **APPLICATIONS OF NEW TECHNOLOGY (CONT.)**

### **SPOT BEAM & MULTIPLE BEAM ANTENNAS**

- **FOCUS SPACECRAFT POWER ON INTENDED REGIONS**
- **HIGH GAIN SPACECRAFT RECEIVE ANTENNA**

### **APPROACH**

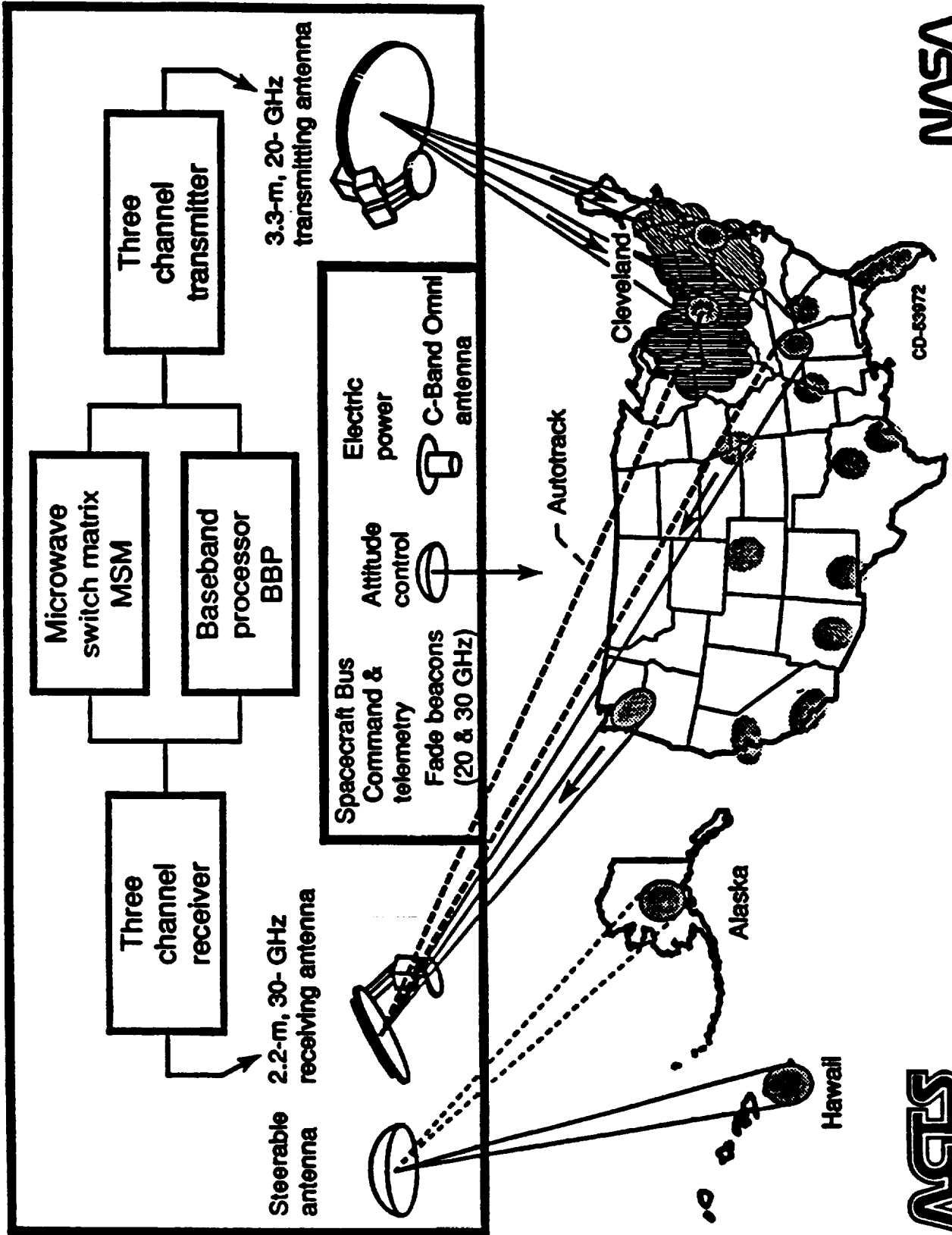
- **MULTIPLE FEED ANTENNAS FOR MULTIPLE SPOT BEAMS**
- **ARRAY ANTENNAS FOR SCANNING BEAMS**
- **PROTOTYPE HARDWARE**
- **SPACE EXPERIMENTS/DEMONSTRATIONS**

### **BENEFITS**

- **REDUCED POWER & COST PER TELEMEDICINE CHANNEL**
- **AREA ADDRESSABLE COMMUNICATIONS**
- **PORTABLE OR MOBILE EARTH STATIONS BECOME POSSIBLE**



# ACTS Flight Segment



CD-53972





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## APPLICATIONS OF NEW TECHNOLOGY (CONT.)

### ON-BOARD DETECTION AND SWITCHING

- RECONSTITUTED SIGNAL IMPROVES IMMUNITY TO NOISE
- MESSAGE/DATA ROUTING PERFORMED ON SPACECRAFT

### APPROACH

- DEVELOP IMPROVED MODULATION AND CODING
- DEVELOP BULK DEMODULATORS (MULTI-CHANNEL DEMODULATORS)
- DEVELOP BASEBAND SWITCHING FOR INDIVIDUAL MESSAGES
- PROTOTYPE HARDWARE
- SPACE EXPERIMENTS/DEMONSTRATIONS

### BENEFITS

- REDUCED POWER AND COST FOR TELEMEDICINE DATA AND VOICE MESSAGES
- MESSAGE ROUTING TO SUPPORT A LARGE NUMBER OF USERS

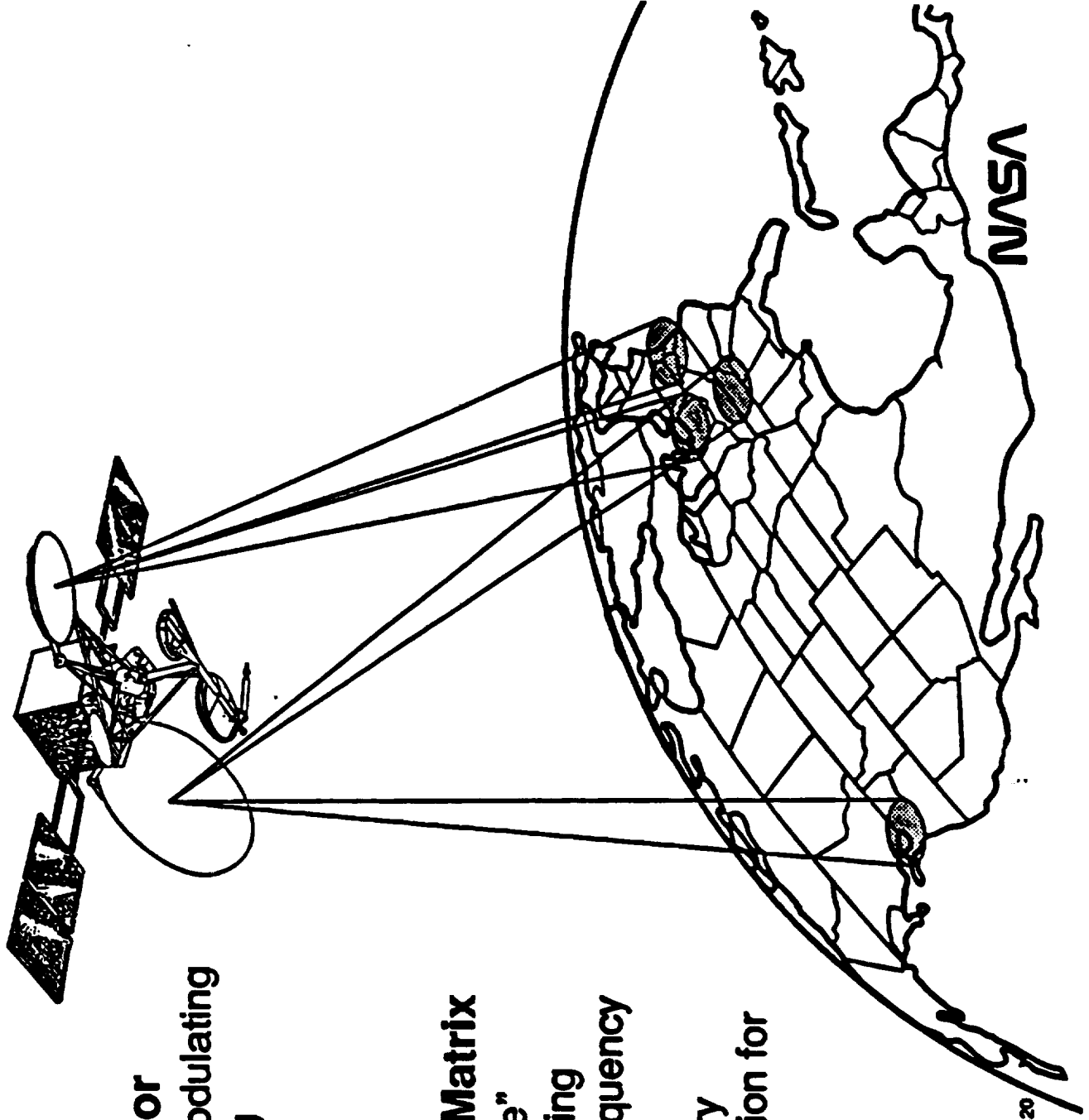
# ACTS Switching and Processing Technology

## Baseband Processor

- Demodulating/remodulating
- Decoding/encoding
- Routing
- Circuit switching
- Onboard memory

## Microwave Switch Matrix

- Dynamic "Bent Pipe" beam-to-beam routing
- Uplink/downlink frequency translation
- No onboard memory
- Static-mode operation for continuous carriers



1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and processing, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data collection and analysis. It identifies common issues such as data quality, privacy concerns, and the complexity of large datasets, and offers strategies to overcome these challenges.

5. The fifth part of the document provides a detailed overview of the data collection and analysis process. It describes the steps involved in identifying data sources, collecting data, cleaning and validating the data, and performing various types of analyses to extract valuable information.

6. The sixth part of the document discusses the importance of data security and privacy. It outlines the measures that should be taken to protect sensitive data from unauthorized access, loss, or disclosure, and emphasizes the need for compliance with relevant data protection regulations.

7. The seventh part of the document explores the applications of data collection and analysis in various industries. It provides examples of how data-driven insights can be used to optimize business processes, improve customer experiences, and make strategic decisions.

8. The eighth part of the document concludes by summarizing the key findings and recommendations. It reiterates the importance of a robust data collection and analysis framework and encourages organizations to embrace data-driven decision-making to achieve their goals.





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## APPLICATIONS OF NEW TECHNOLOGY (CONT.)

### MISCELLANEOUS TECHNOLOGY IMPROVEMENTS

- HIGH EFFICIENCY TRANSMITTERS
- AUTOMATIC TRACKING ANTENNAS FOR RECEIVING SYSTEMS
- IMPROVED PERFORMANCE SOLID STATE AMPLIFIERS

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## APPLICATIONS OF NEW TECHNOLOGY (CONT.)

### MOBILE SATELLITE COMMUNICATIONS SYSTEMS

- UBIQUITOUS TERMINALS FOR POST-DISASTER TELEMEDICINE
- LOW EARTH ORBIT SATELLITES REQUIRE SMALLER TERMINALS

### APPROACH

- COMMERCIAL SYSTEMS ALREADY PROPOSED
- DEVELOPING INFRASTRUCTURE CAN BE USED FOR TELEMEDICINE APPLICATIONS

### BENEFITS

- LOW COST BY USING DEVELOPED SYSTEM
- WIDESPREAD ACCESS TO NETWORK FOR DATA, FACSIMILE, AND VOICE TRANSMISSIONS

**GLOBALSTAR**

**GLOBALSTAR INFRASTRUCTURE**

**SS/L SATELLITES**

**LORAL CELLULAR TRANSMISSION SERVICES**

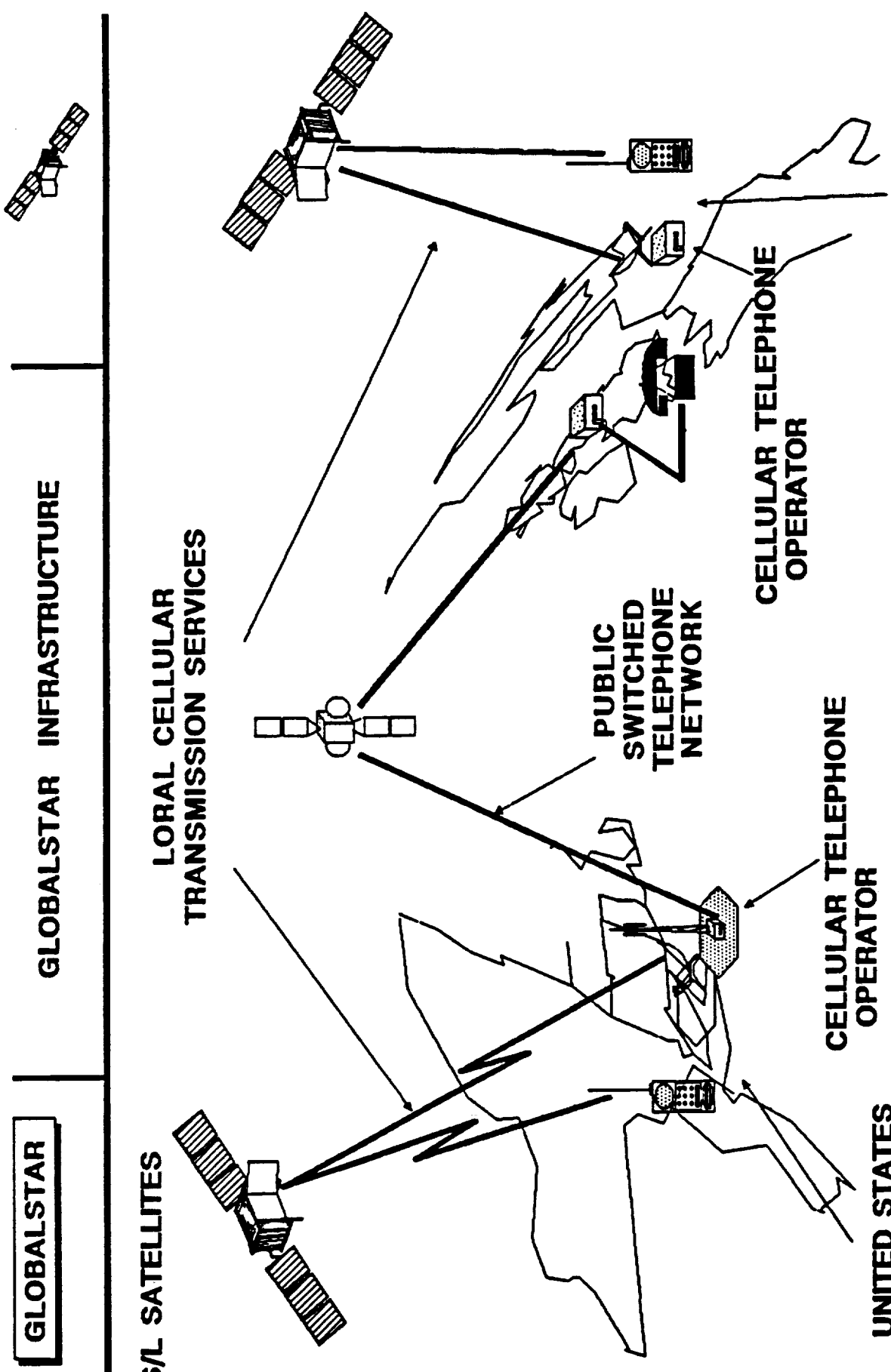
**UNITED STATES USER & GATEWAY EQUIPMENT**

**CELLULAR TELEPHONE OPERATOR**

**PUBLIC SWITCHED TELEPHONE NETWORK**

**CELLULAR TELEPHONE OPERATOR**

**EUROPEAN USER & GATEWAY EQUIPMENT**





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### USE OF HIGHER FREQUENCIES

- PRACTICABLE, HIGH GAIN, SPOT BEAM ANTENNAS
- ACCESS TO UNCROWDED PART OF FREQUENCY SPECTRUM  
(20 GHz AND 30 GHz, FOR EXAMPLE)

### APPROACH

- DEVELOP TECHNOLOGIES OF ANTENNAS, ON-BOARD DETECTORS, SPACECRAFT SWITCHING, HIGH FREQUENCY COMPONENTS, ....
- DEVELOP AN EXPERIMENTAL SATELLITE (ACTS - 1993)
- PERFORM EXPERIMENTS TO DEMONSTRATE USE (1993-1995)

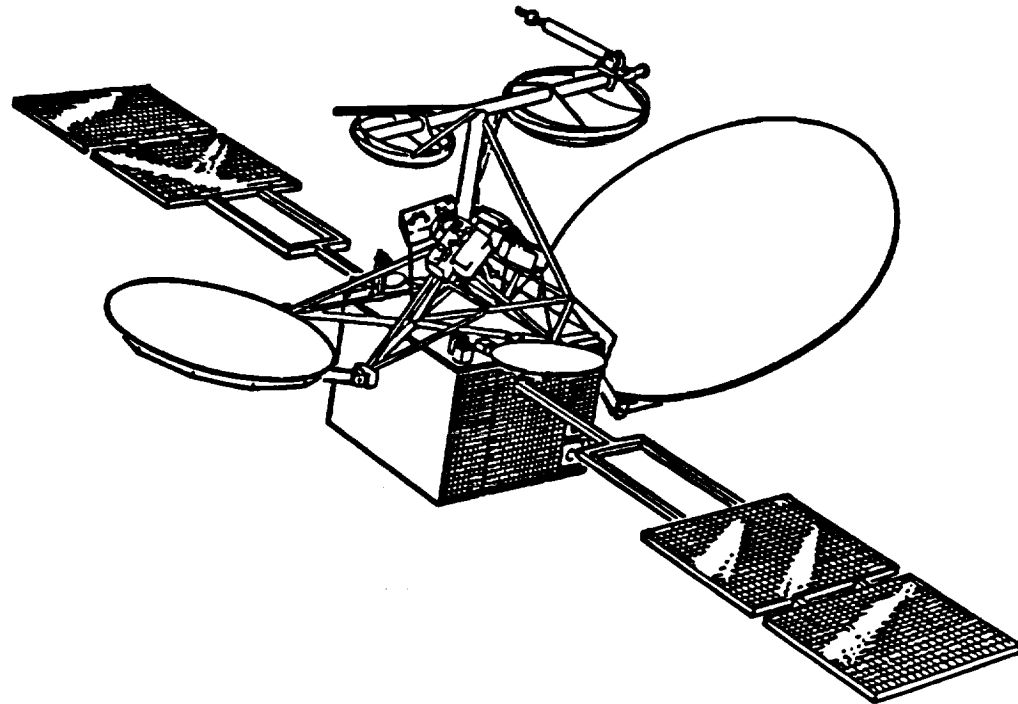
### BENEFITS

- COMBINED ADVANTAGES OF TECHNOLOGIES USED  
LOWER POWER  
LOWER COST  
MESSAGE SWITCHING  
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# ACTS Spacecraft Characteristics

<b>Weight:</b>	3250 lbs (on-orbit)
<b>Power:</b>	1770 W BOL four panel solar array (134.5 ft <sup>2</sup> )
<b>Frequency bands:</b>	Ka-band (30/20 GHz)
<b>Payload:</b>	Multibeam antenna, on-board processing and routing
<b>Spacecraft pointing accuracy:</b>	+ 0.025°
<b>Launch date:</b>	February 1993
<b>Mission requirement:</b>	2 yrs Experiment period 4+ yrs Station keeping fuel



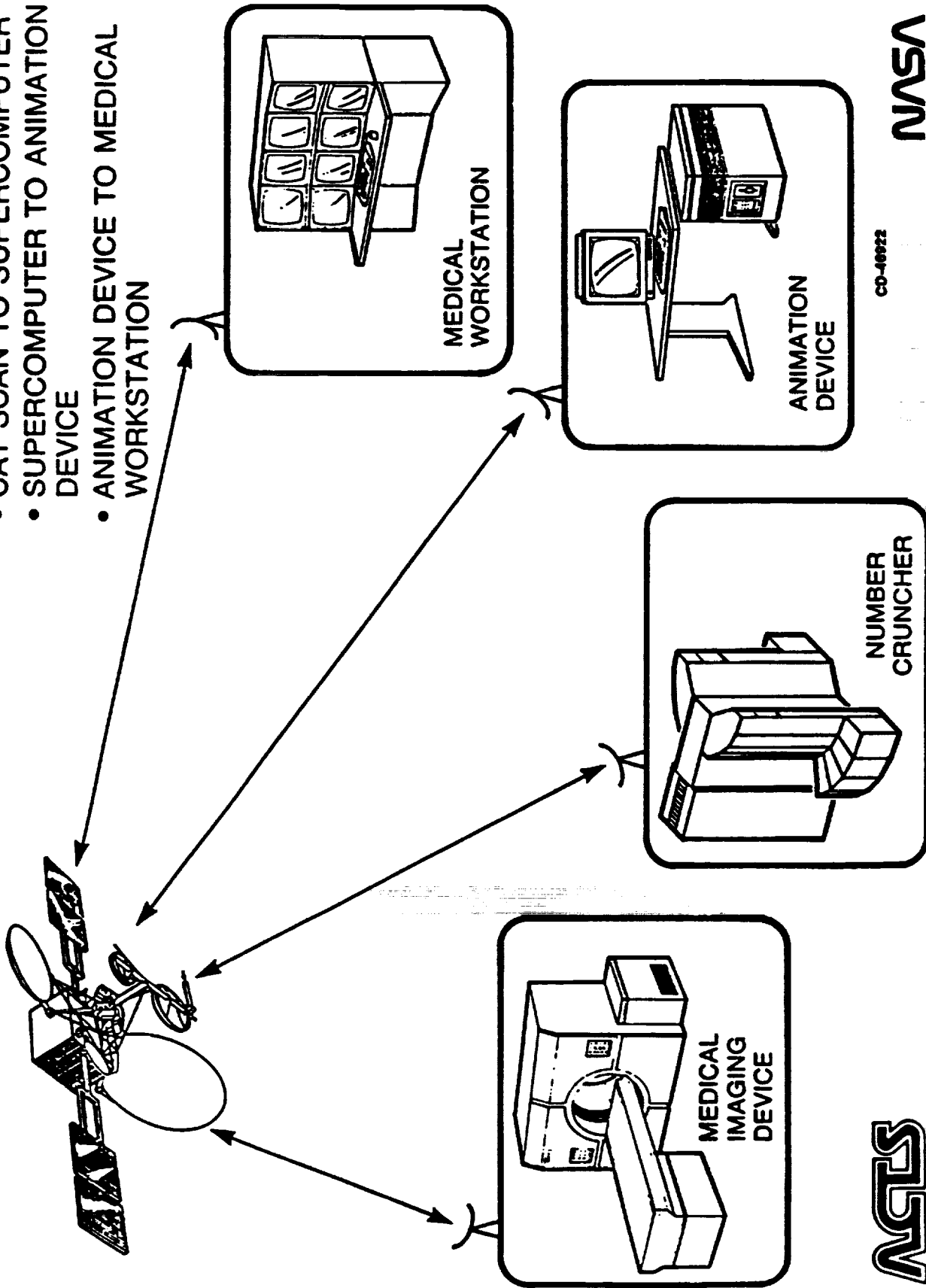
**ACTS**

CD-55709

**NASA**

# “REMOTE” MEDICAL IMAGING

- CAT SCAN TO SUPERCOMPUTER
- SUPERCOMPUTER TO ANIMATION DEVICE
- ANIMATION DEVICE TO MEDICAL WORKSTATION



**ACTS**

CO-46622

**NASA**

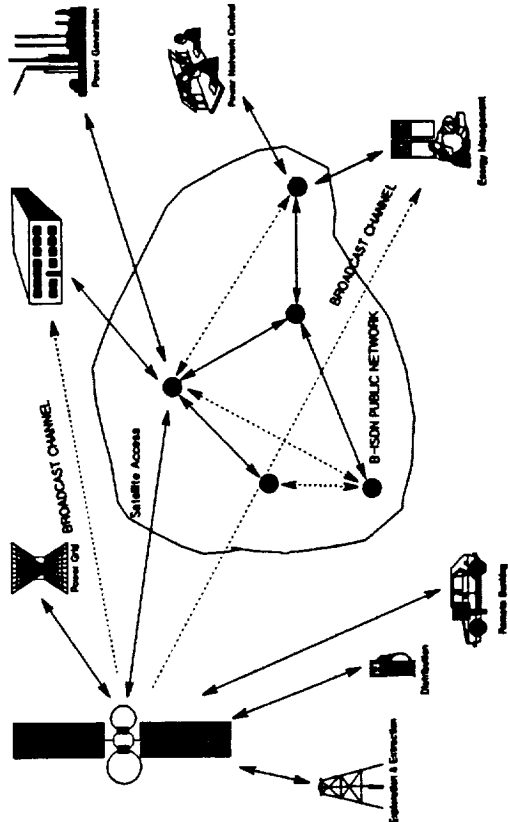


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## SATELLITE ENHANCEMENT OF B-ISDN PUBLIC NETWORK



### SCOPE/OBJECTIVES:

- EVALUATE SATELLITE ARCHITECTURES FOR PROVIDING COMPLEMENTARY MULTICAST/BROADCAST CAPABILITY TO A BROAD-BAND ISDN BASED TERRESTRIAL NETWORK
- COMPATIBLE WITH PLANNED ATM PROTOCOL
- PROVISIONS FOR CIRCUMVENTING SATELLITE PATH DELAY

### BENEFITS:

- ENHANCES MARKET POTENTIAL OF SATELLITE TECHNOLOGY
- TAKES ADVANTAGE OF B-ISDN FEATURES TO ENHANCE SATELLITE HARDWARE EFFICIENCY AND UTILIZATION
- STRAIGHTFORWARD IMPLEMENTATION OF MULTICAST/BROADCAST ENHANCEMENT OF B-ISDN PROTOCOL

### ACCOMPLISHMENTS:

- STUDY RESULTS SUPPORT GENERAL CONCEPT

**SUMMARY**

**NEW TECHNOLOGY DEVELOPMENTS APPLIED TO SATELLITE COMMUNICATIONS CAN FACILITATE  
TELEMEDICINE APPLICATIONS. BENEFITS FROM USING NEW TECHNOLOGY INCLUDE LOWER POWER,  
SMALLER SIZE, REDUCED COST, AND GREATER AVAILABILITY IN POST DISASTER SITUATIONS.**

