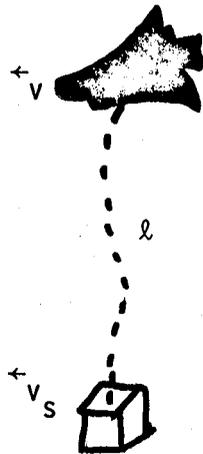


TETHER FACILITY PRESENTATION

Peter Banks

BASIC MECHANICAL PRINCIPLES



$$\uparrow mv^2/r$$

300 km

$$\downarrow mg_0(r_0/r)^2$$

$v \sim 7.8$ km/sec

$$T \uparrow \uparrow \frac{m_s v_s^2}{r_s}$$

200 km

$$\downarrow m_s g_0 (r_0/r)^2$$

$v_s \sim v + 59$ m/sec

If tether is acting to constrain the satellite, then

$$\Omega_{\text{Shuttle}} = \Omega_{\text{satellite}}$$

and

$$T = \frac{3\ell}{r} m_s g$$

NOTE: There are 2 stable points of equilibrium.

If $\ell = 100$ km

$r = 6670$ km (300 km altitude)

$m_s = 500$ kg ,

then

$$T \sim 200 \text{ N} \quad (\sim 91 \text{ lbs force}) .$$

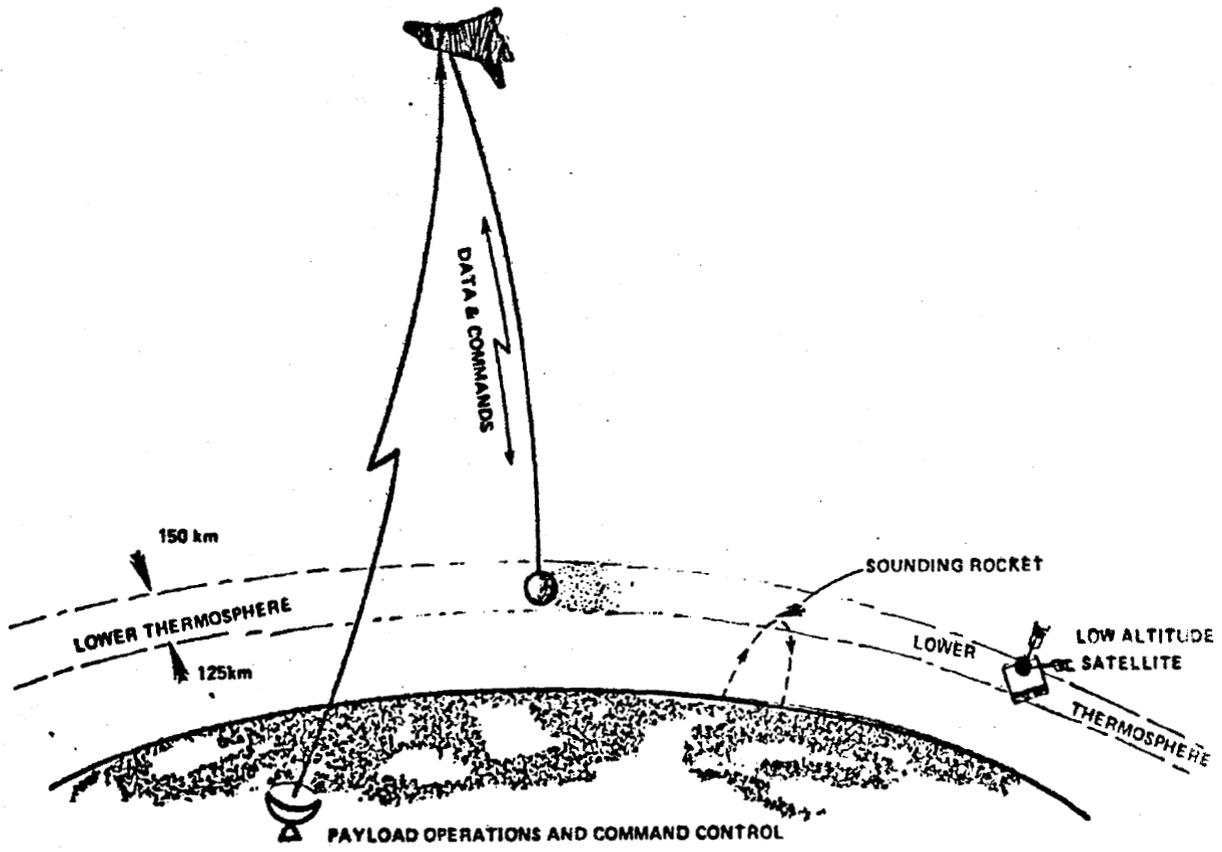
WAVES

$$v_{\omega} \sim \sqrt{\frac{T}{\rho_{\ell}}}$$

If $T \sim 200 \text{ N}$

$$\rho_{\ell} \sim 5 \times 10^{-3} \text{ kg/m ,}$$

then $v_{\omega} \sim 200 \text{ m/sec .}$

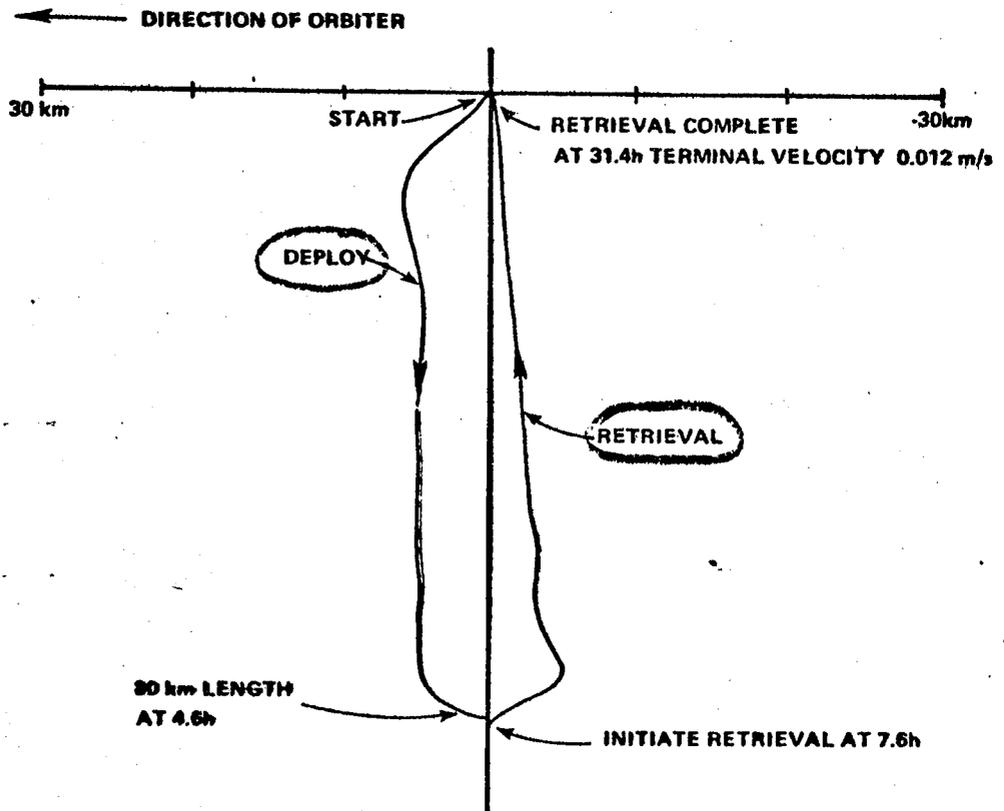
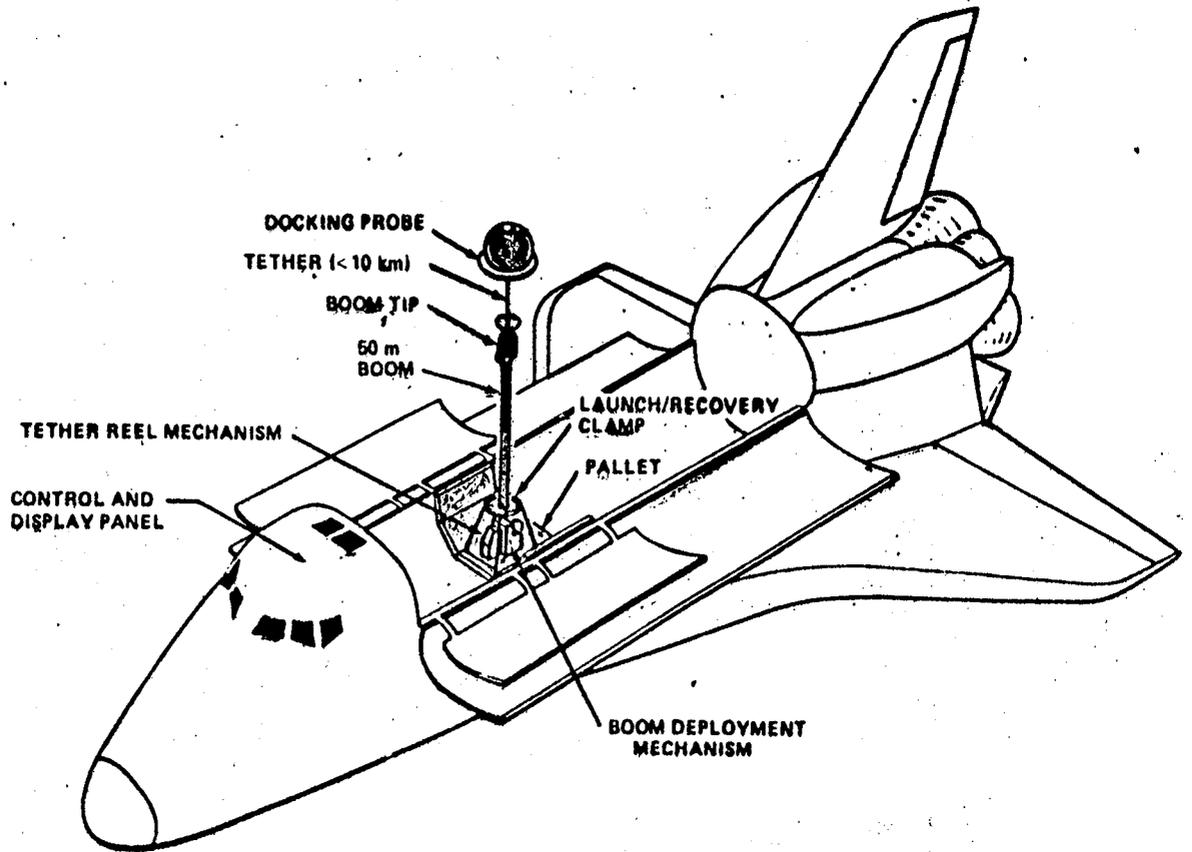


TETHERED SATELLITE SYSTEM

FRDT STUDY

HISTORY

- INITIAL IDEA OF TSS PRESENTED BY M. GROSSI AND G. COLOMBO (SMITHSONIAN ASTROPHYSICAL OBSERVATORY) TO MSFC (1973, 1974).
- AMPS STUDY PRESENTATIONS AT MSFC AND GSFC (1974-1976).
- MSFC STUDIES (1975-PRESENT).
- SAO STUDIES (1974-PRESENT).
- UTAH STATE UNIVERSITY, ELECTRODYNAMIC TETHER SYSTEM STUDIES (1976-PRESENT).
- ADVANCED SYSTEM DEFINITION STUDIES BY BALL AEROSPACE AND MARTIN-MARIETTA (1979-PRESENT).
- FRDT ESTABLISHED APRIL, 1979. TEAM MEETINGS HELD IN MAY, JULY AND OCTOBER, 1979.
- FRDT FINAL REPORT COMPLETED IN MAY, 1980



TETHERED SATELLITE SYSTEM

FUTURE USES

GEOPHYSICS

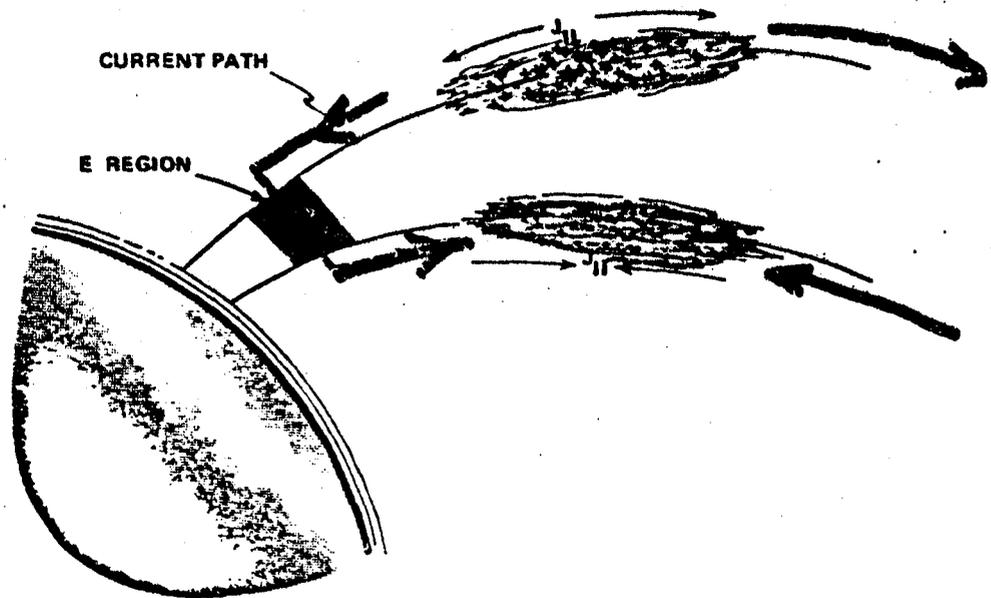
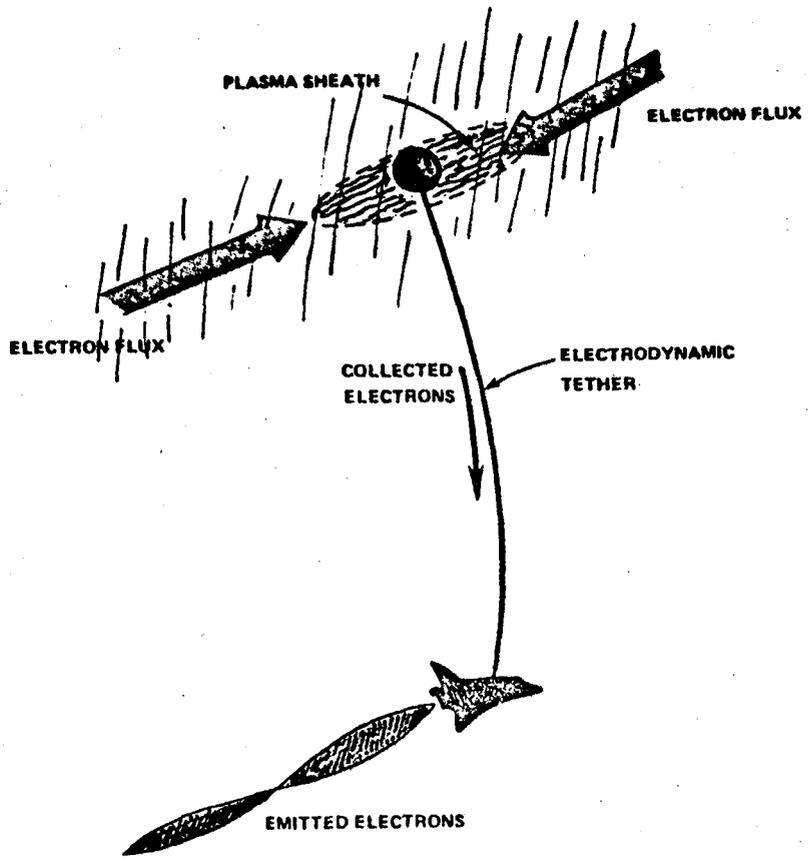
THERMOSPHERE ELECTRODYNAMICS
THERMOSPHERE DYNAMICS
THERMOSPHERE COMPOSITION
METASTABLE SPECIES DYNAMICS
DEEP ATMOSPHERE PROBES
GEOMAGNETIC ANOMALIES

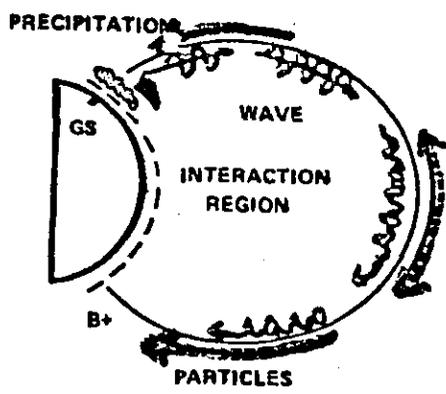
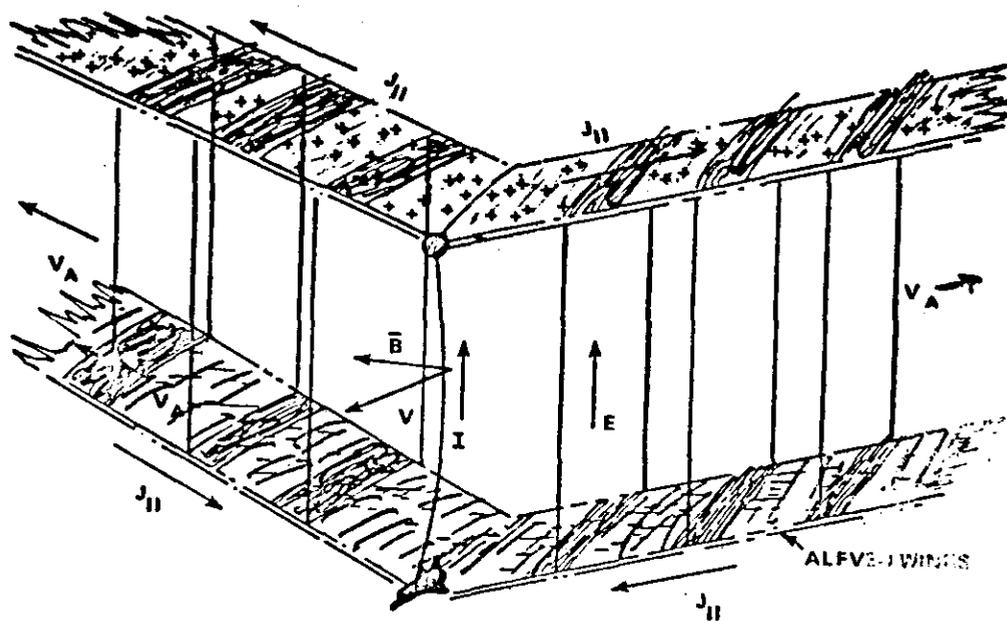
PLASMAS

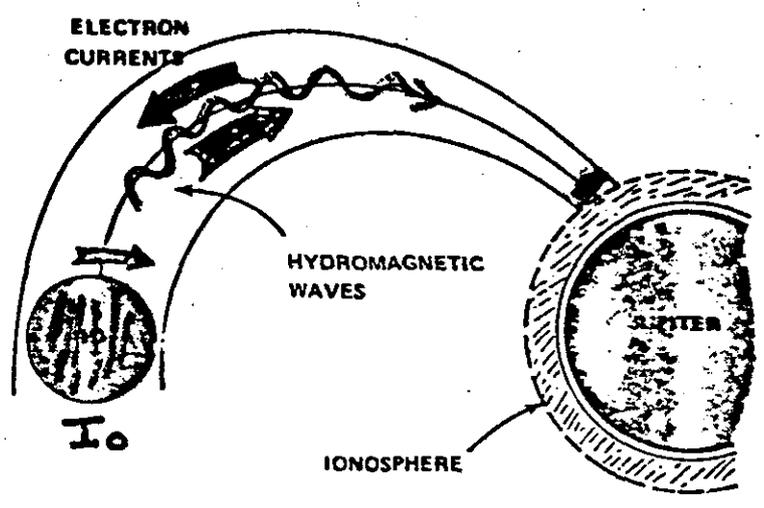
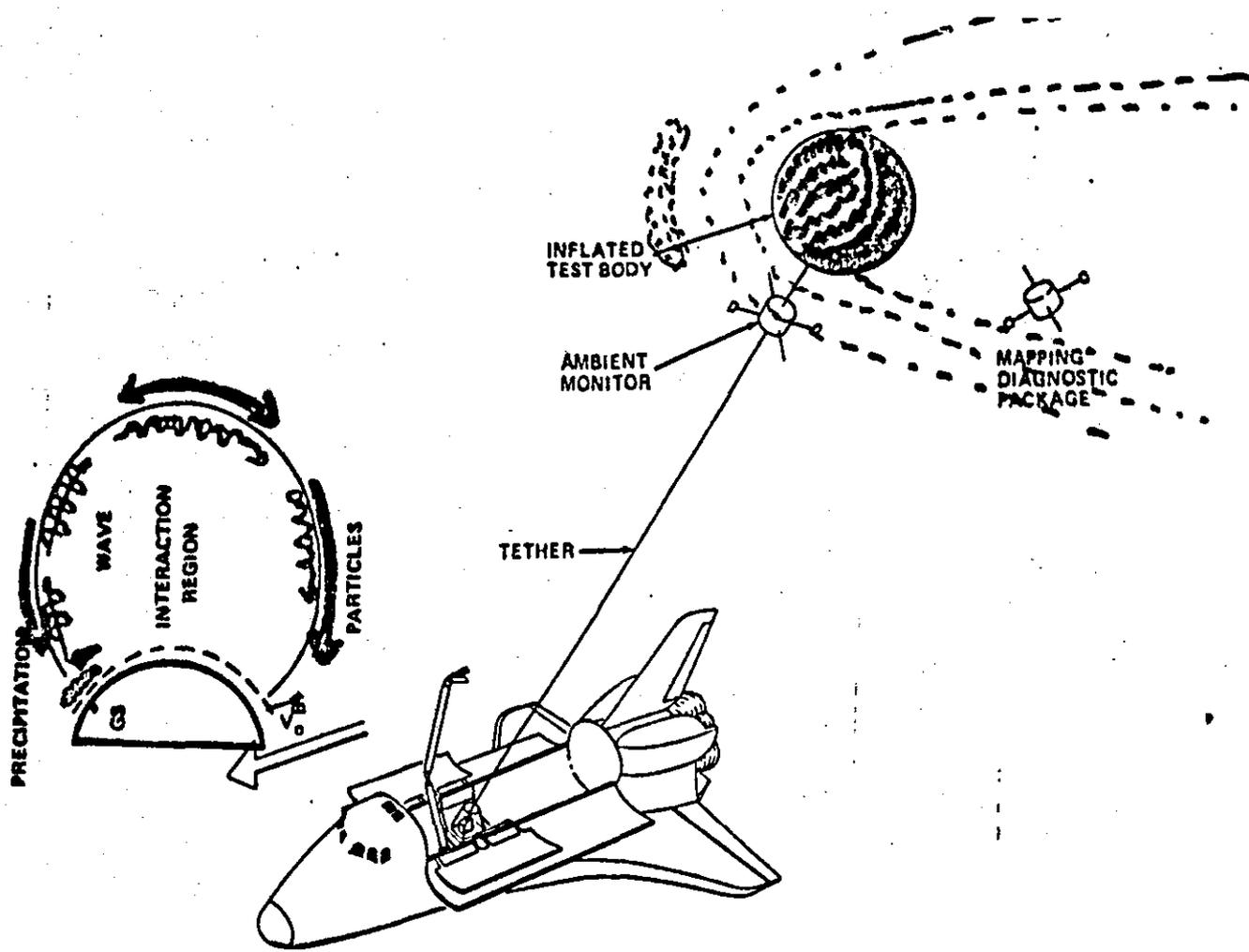
PLASMA SHEATH STUDIES
PLASMA WAVE GENERATION
PLASMADYNAMIC STUDIES
VLF WAVE GENERATION
CHARGE NEUTRALIZATION

SUPPORT ACTIVITIES

TETHERED CHEMICAL RELEASES
TETHERED ELECTRON/ION ACCELERATOR
SUPPORTING MEASUREMENTS PLATFORM







FRDT RECOMMENDATIONS

- SCIENTIFIC USE OF THE TSS SHOULD BE GOVERNED BY COMPETITIVE PEER GROUP SELECTION.
- THE TSS FACILITY SHOULD BE DESIGNED TO ACCOMMODATE A BROAD RANGE OF POTENTIAL USERS.
- THE TSS FACILITY SHOULD PROVIDE FOR INTERACTIVE EXPERIMENTS INVOLVING ORBITER AND GROUND SCIENTIFIC PERSONNEL.
- ACCOMMODATIONS SHOULD BE MADE TO PERMIT PALLET-BASED EXPERIMENTS TO OPERATE IN CONJUNCTION WITH TSS EXPERIMENTS.
- SCIENTIFIC PLANNING FOR THE TSS WILL BENEFIT FROM A TSS SCIENCE WORKING GROUP.
- A TSS SUPPORT GROUP TO AID SCIENTIFIC INVESTIGATORS SHOULD BE ESTABLISHED AT A NASA CENTER.
- TWO RE-USABLE, MULTIPLE INSTRUMENT PLATFORMS SHOULD BE DEVELOPED FOR ELECTRODYNAMIC TETHER AND GEOPHYSICAL OBSERVATIONS,

APPROVAL

SPACE PLASMA PHYSICS ACTIVE EXPERIMENTS

Edited by W. T. Roberts

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.



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