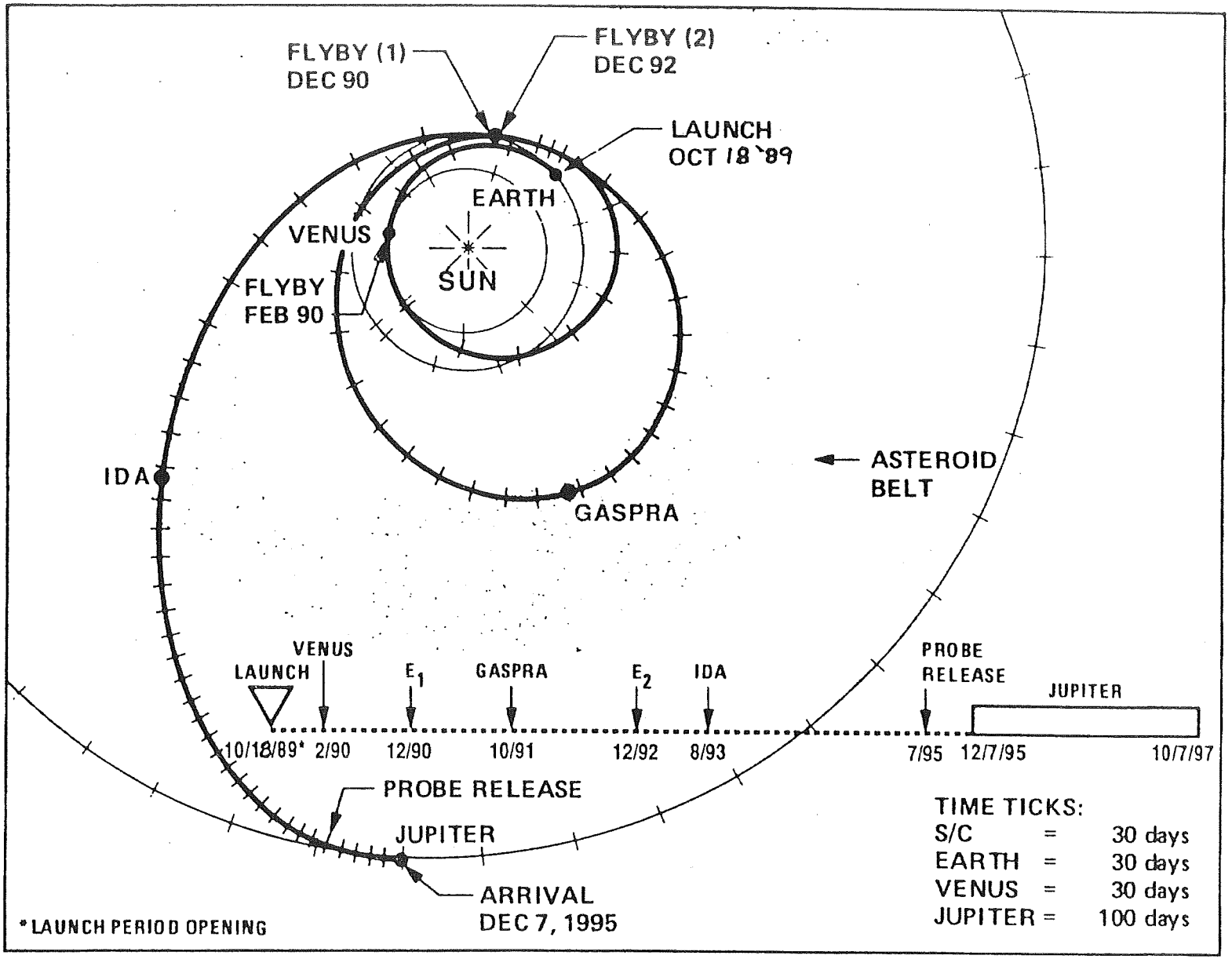
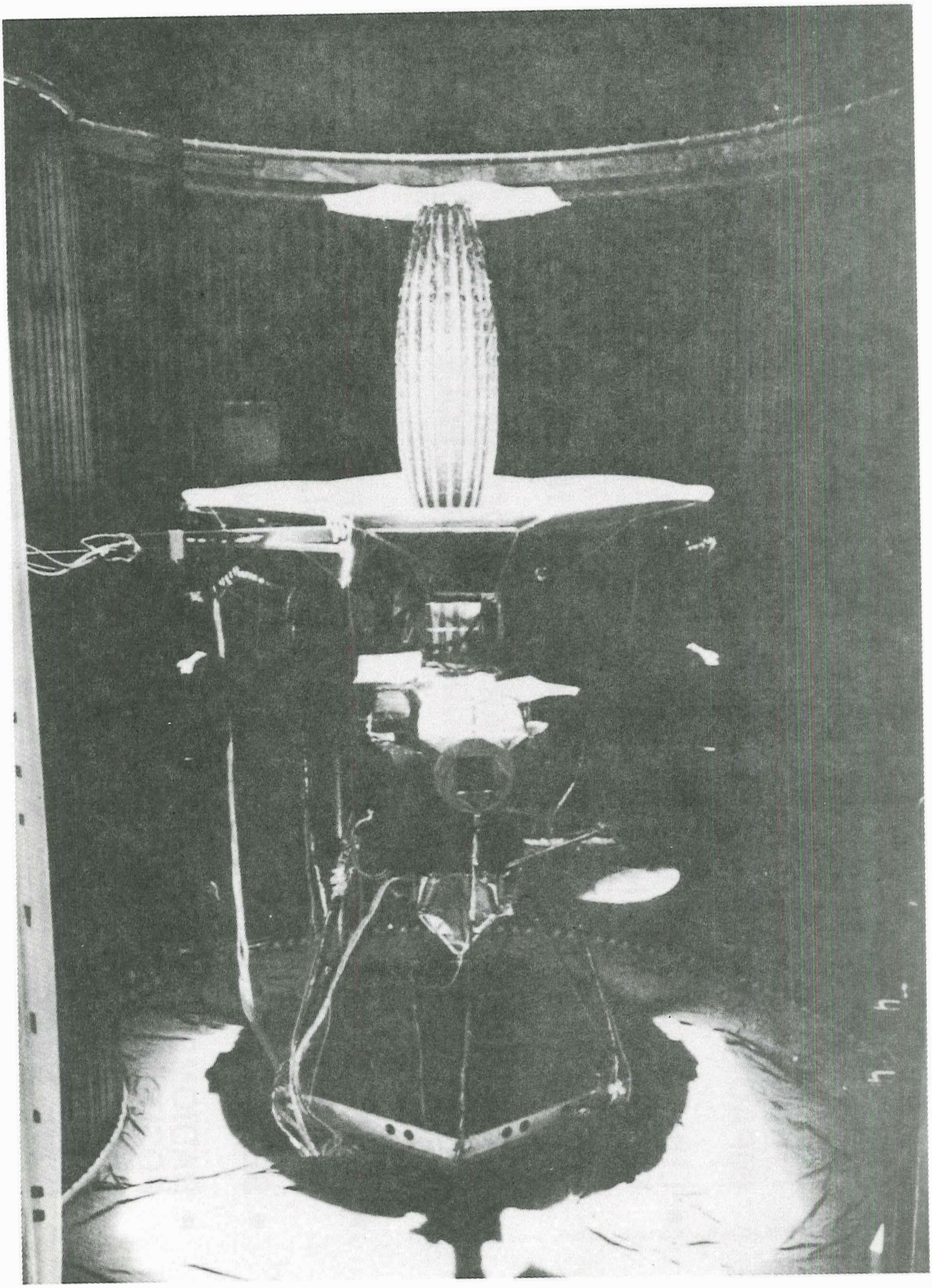
Galileo
THE EARTH ENCOUNTER

PRESENTED TO THE NSIUWG

Theodore C. Clarke
February 13, 1991

GALILEO VEEGA TRAJECTORY TO JUPITER





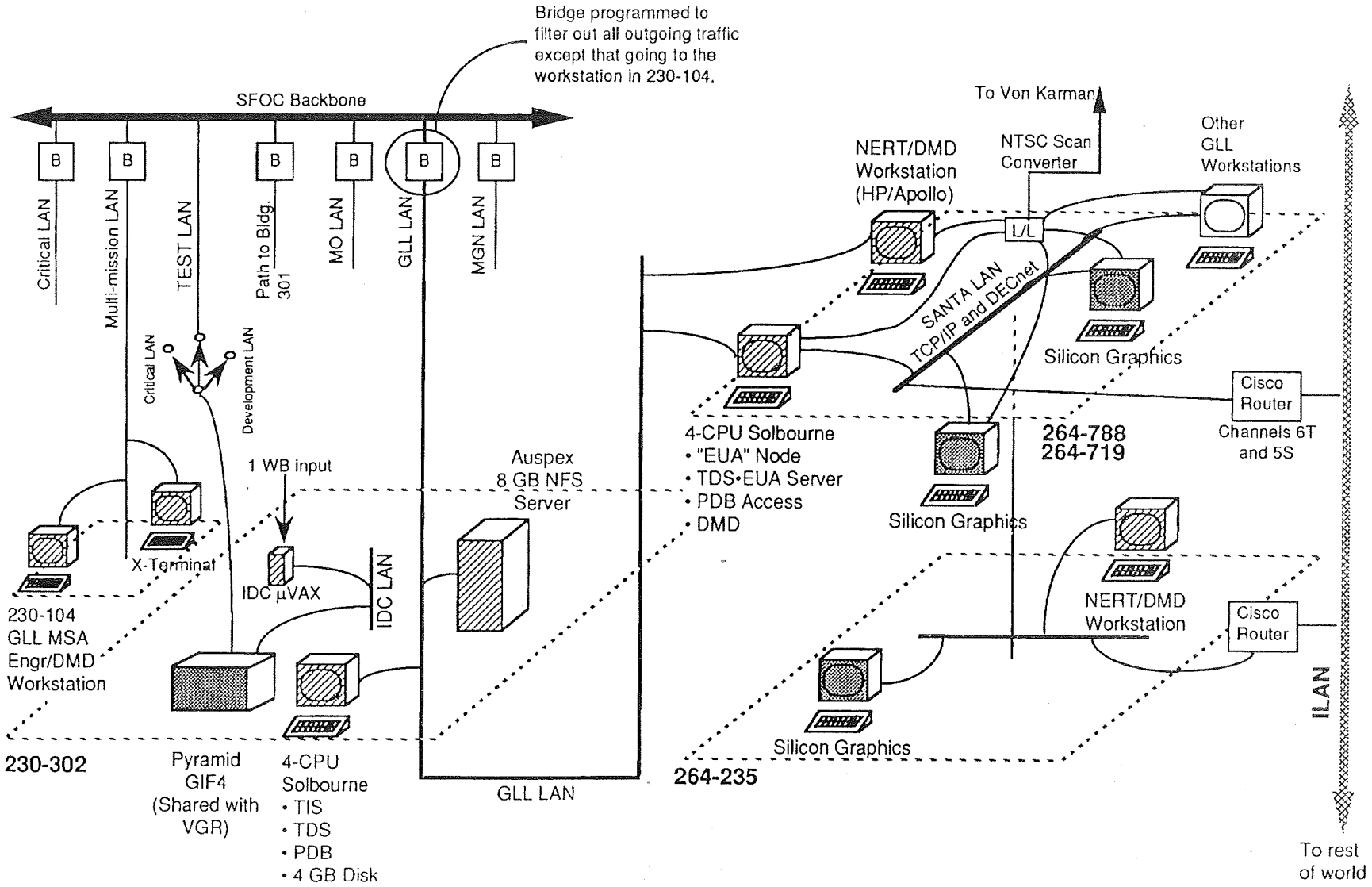
LUNAR SCIENCE OBJECTIVES

- MARE ORIENTALE: COMPOSITION AND MULTISPECTRAL CHARACTERIZATION; SAMPLE DEEP LUNAR INTERIOR; IMPACT PROCESS STUDIES (SSI, NIMS, UVS, PPR)
- LUNAR FARSIDE COVERAGE: ILLUMINATED AND DARKSIDE COMPOSITION AND MULTISPECTRAL CHARACTERIZATION; NEARSIDE/FARSIDE ASYMMETRIES IN THE LUNAR MARIA, HIGHLANDS AND PLAINS (SSI, NIMS, UVS, PPR)
- MAP THE UNMAPPED LUNAR SOUTH POLAR REGION - ~ 105°W LONG, 50°S LATITUDE TO SOUTH POLE (SSI, NIMS, UVS, PPR)
- MAP LUNAR NORTH POLE; SEARCH FOR H_2O IN PERMANENTLY SHADED CRATERS (SSI, NIMS, UVS, PPR)
- SEARCH FOR HYDRATED MATERIAL ON THE MOON (NIMS)
- RADIOMETRIC BRIGHTNESS vs. WAVELENGTH AND POSITION ON LUNAR DISC FOR TOPOGRAPHIC CHARACTERIZATION AND CALIBRATION AGAINST SIMILAR OBSERVATIONS ON THE JOVIAN SATELLITES (PPR, NIMS)

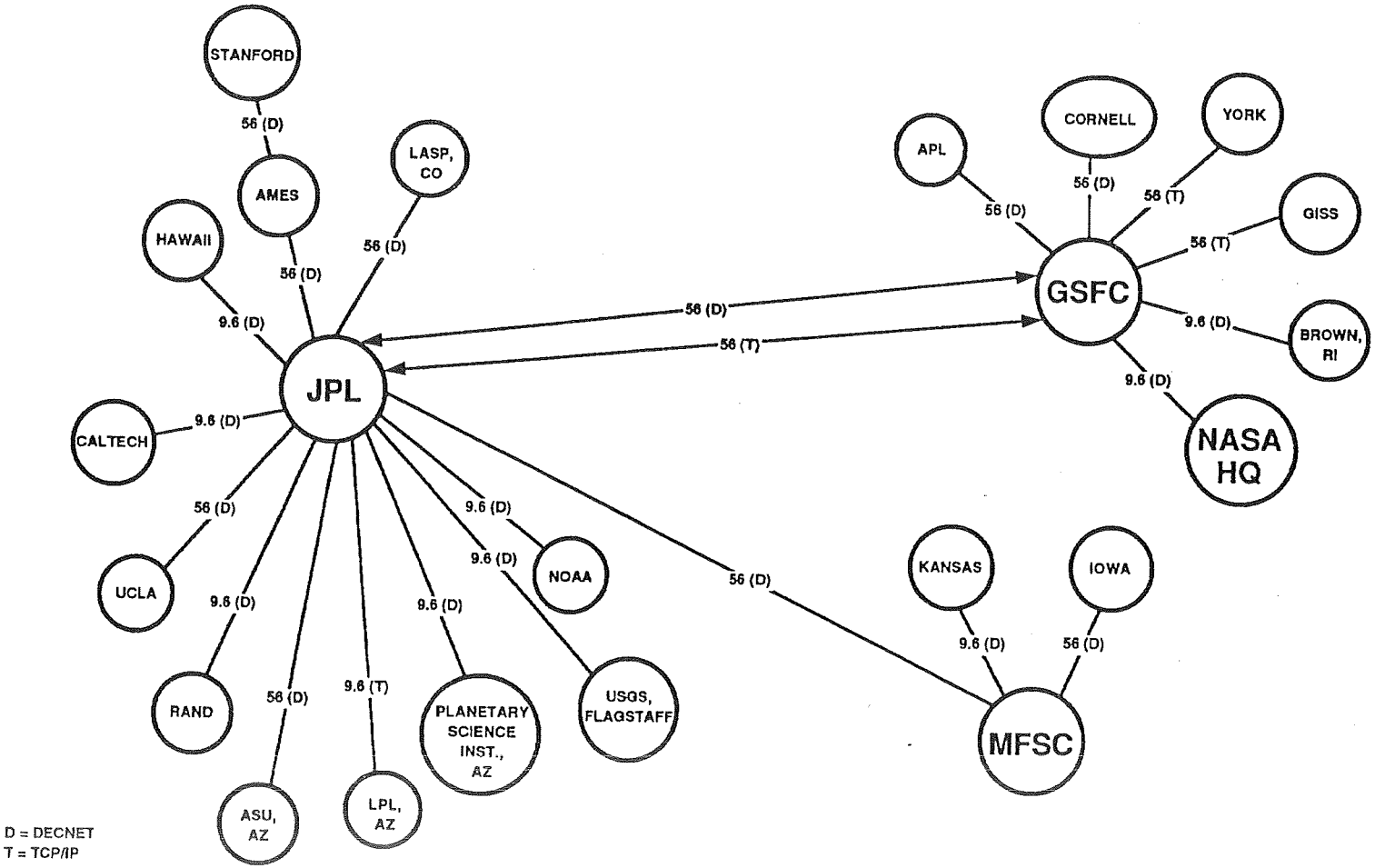
EARTH SCIENCE OBJECTIVES

- GLOBAL MAPPING OF MESOSPHERIC WATER AND MESOSPHERIC CARBON DIOXIDE (NIMS)
- GLOBAL MAPPING OF METHANE AND OTHER "GREENHOUSE" GASES (NIMS)
- CHARACTERIZE DYNAMICS OF THE PLASMA ENVIRONMENT IN THE EARTH'S MAGNETOSPHERE AND MAGNETOTAIL (F&P)
- GROUND TRUTH SPATIAL RESOLUTION AND SPECTRAL MEASUREMENTS OF EARTH FEATURES FOR COMPARISON WITH OBSERVATIONS OF ASTEROIDS AND JOVIAN SATELLITES (SSI, NIMS)
- CHARACTERIZE HYDROGEN GEOTAIL (UVS)
- EARTH ATMOSPHERE AIRGLOW STUDIES (UVS)
- MEASURE MASS OF THE EARTH (RS)
- EARTH/MOON SYSTEM MOVIE, INBOUND TRAJECTORY LEG (SSI)
- 5 DAY EARTH ROTATION MOVIE, OUTBOUND TRAJECTORY LEG (SSI, NIMS, UVS, PPR)

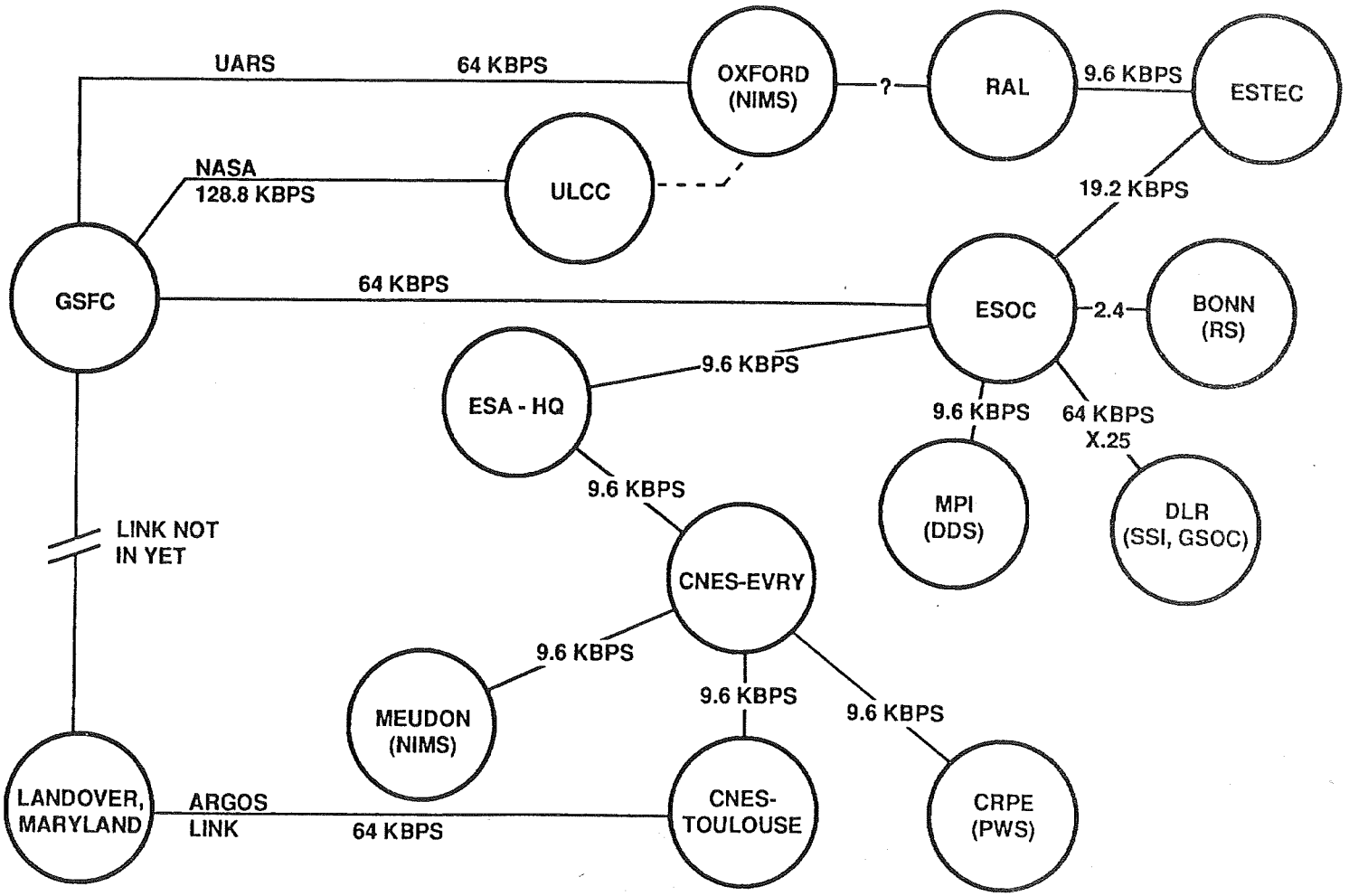
SANTA 2 DATA FLOW

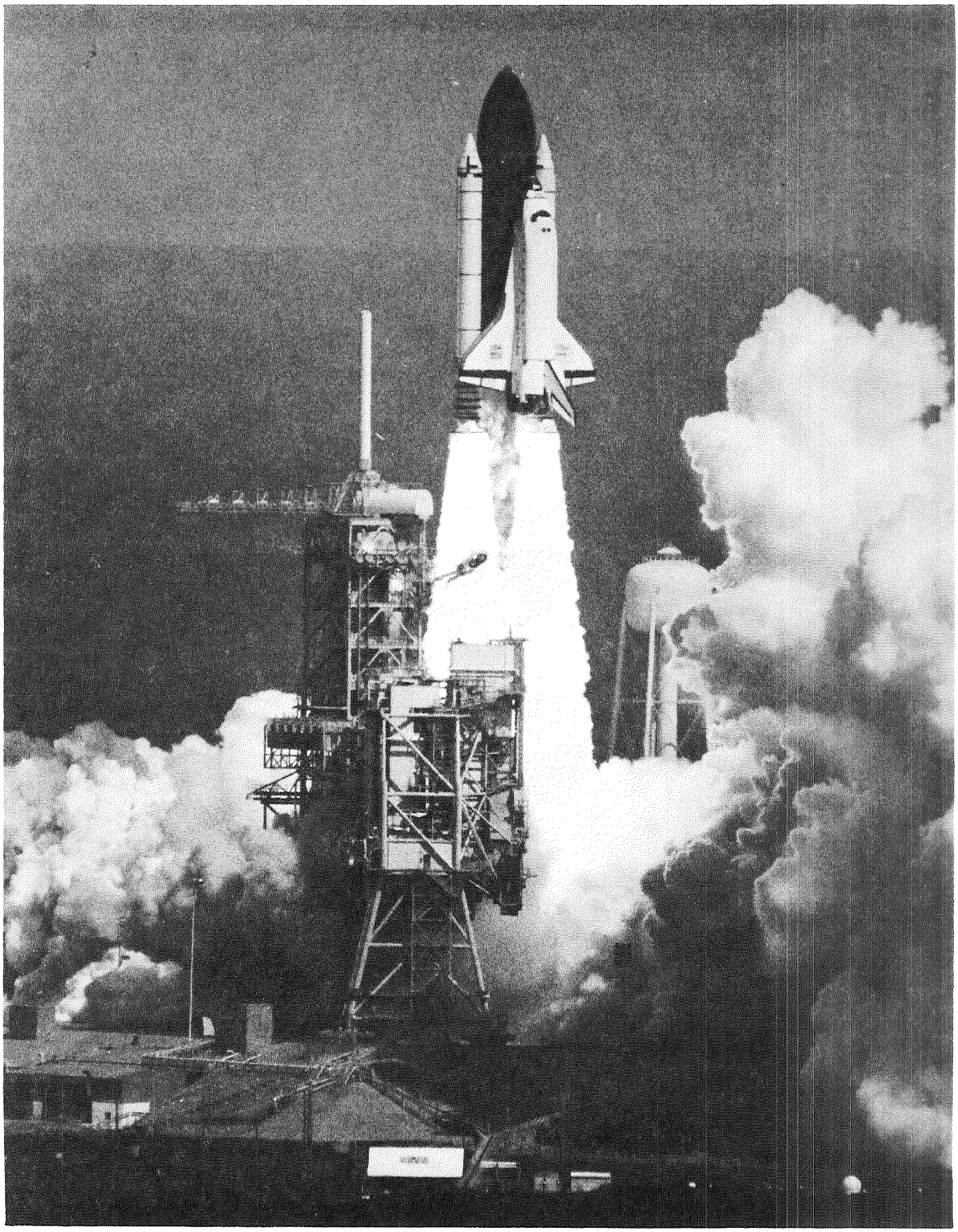


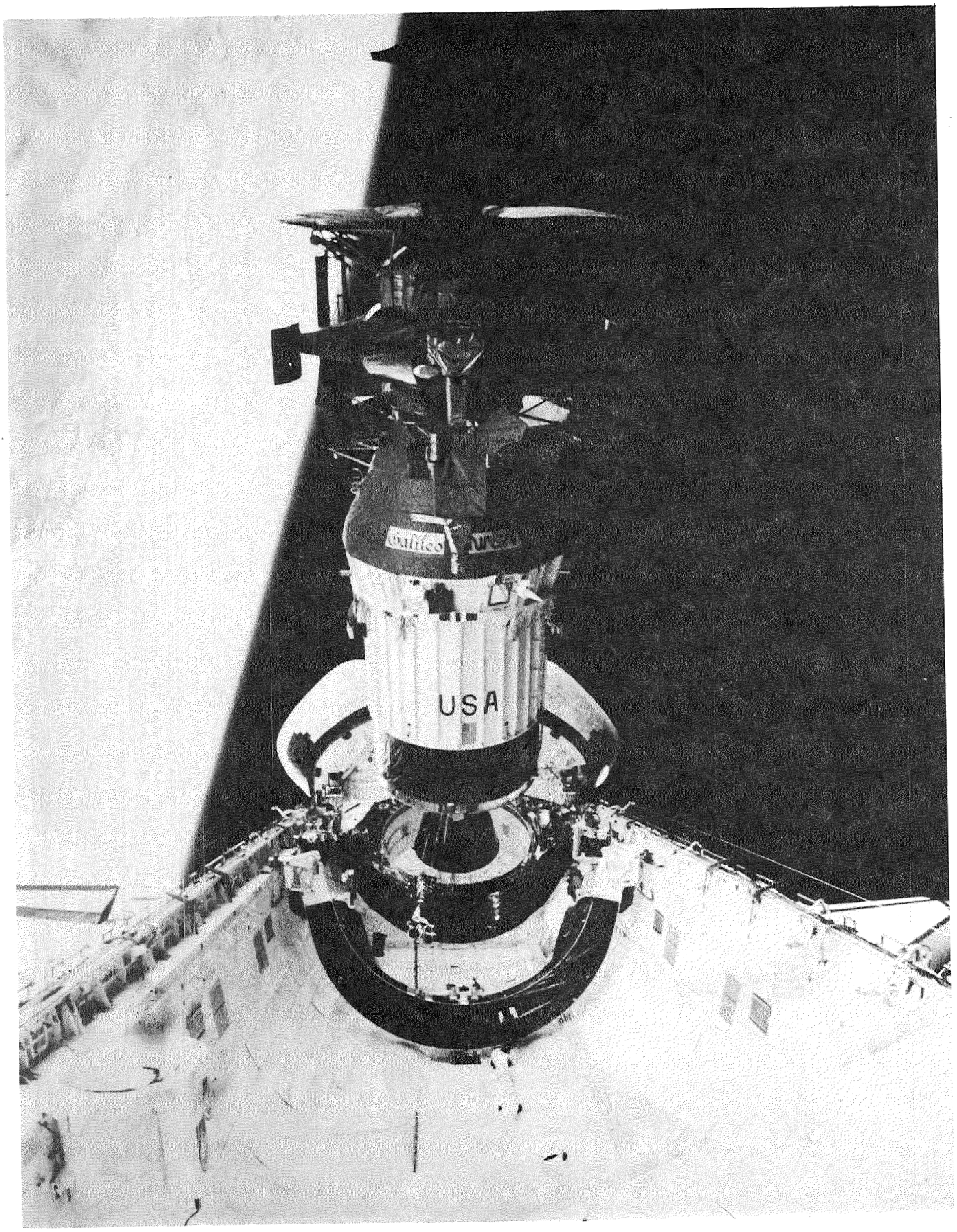
Galileo
THE U.S./CANADA CONNECTIONS

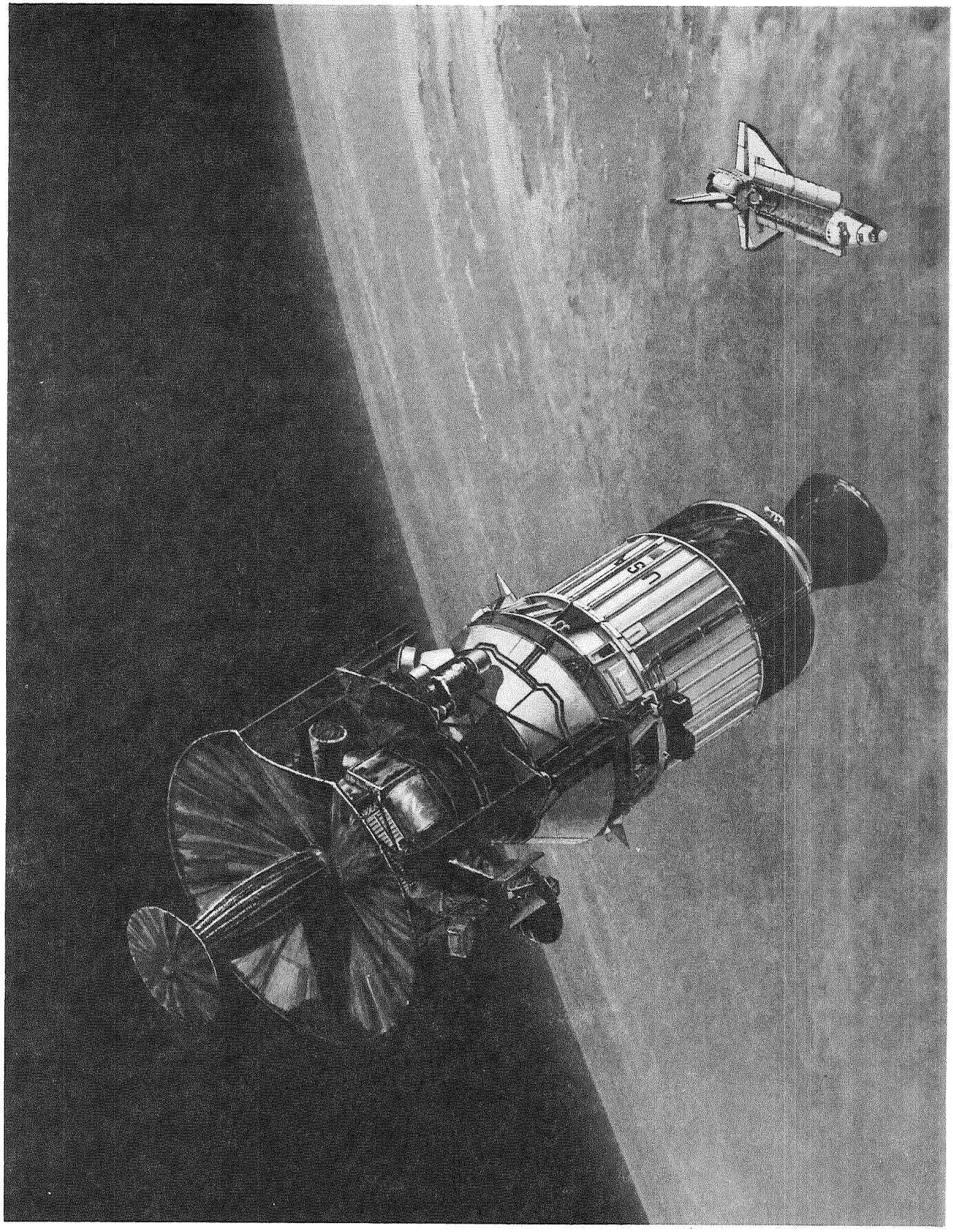


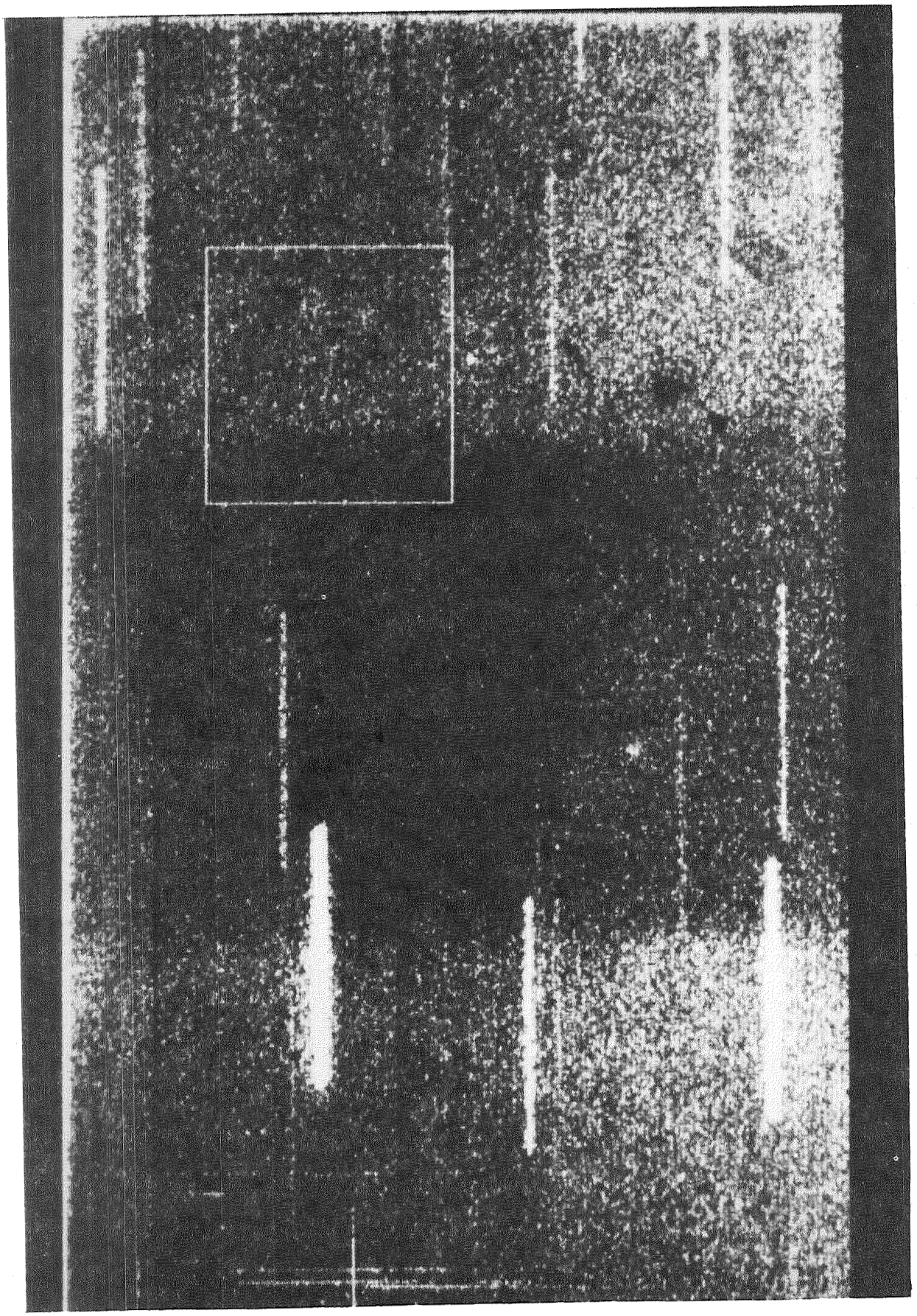
Galileo
THE EUROPEAN CONNECTIONS





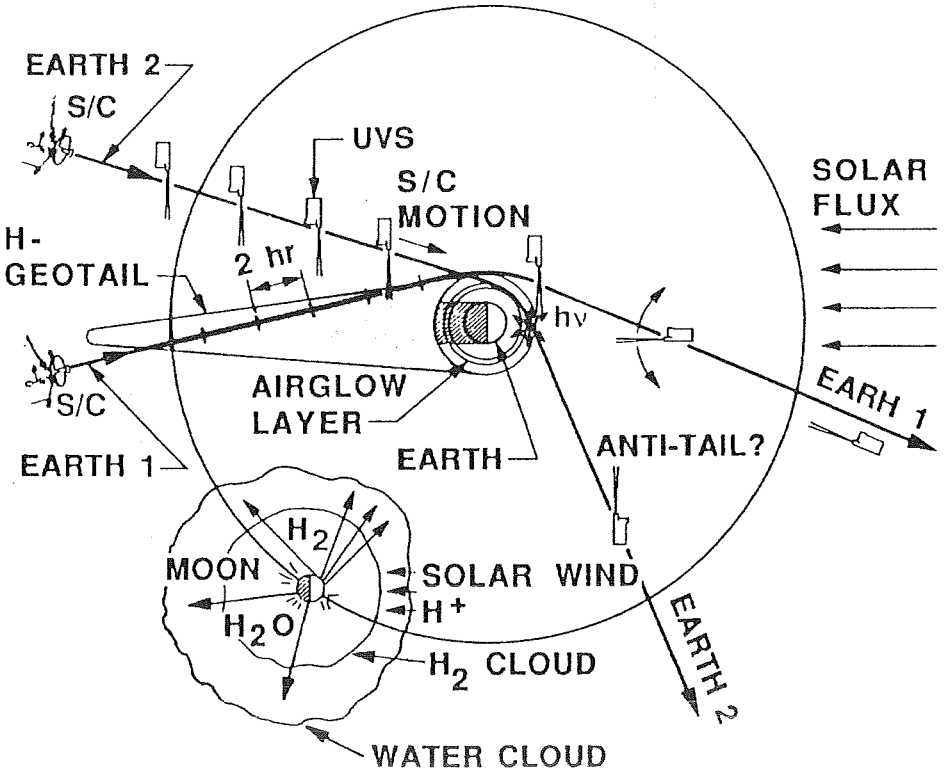




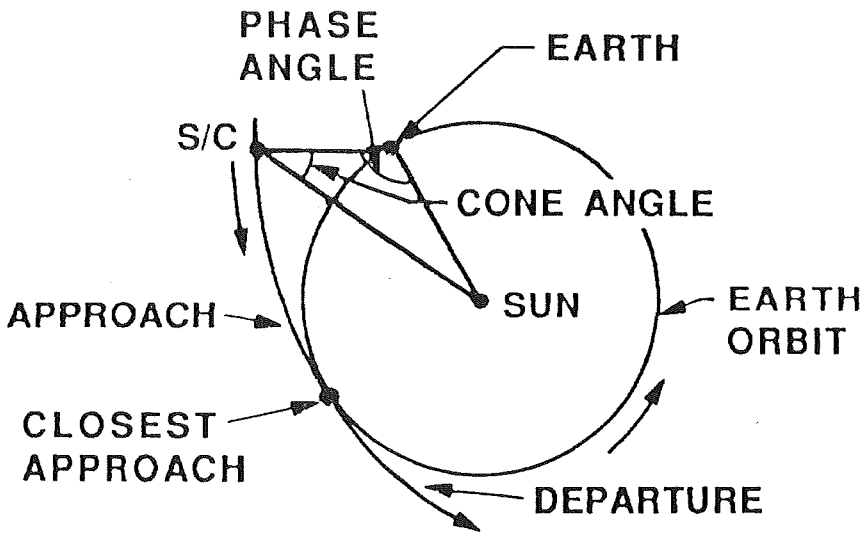


ULTRAVIOLET SPECTROMETER OBSERVATIONS DURING CLOSE ENCOUNTER PERIODS

- H GEOTAIL
- INTERACTION OF SOLAR WIND WITH H AT THE MOON $\longrightarrow H_2$
- COMETESIMAL CAUSED H_2O CLOUD DIFFUSING FROM THE MOON
- ANTI-TAIL

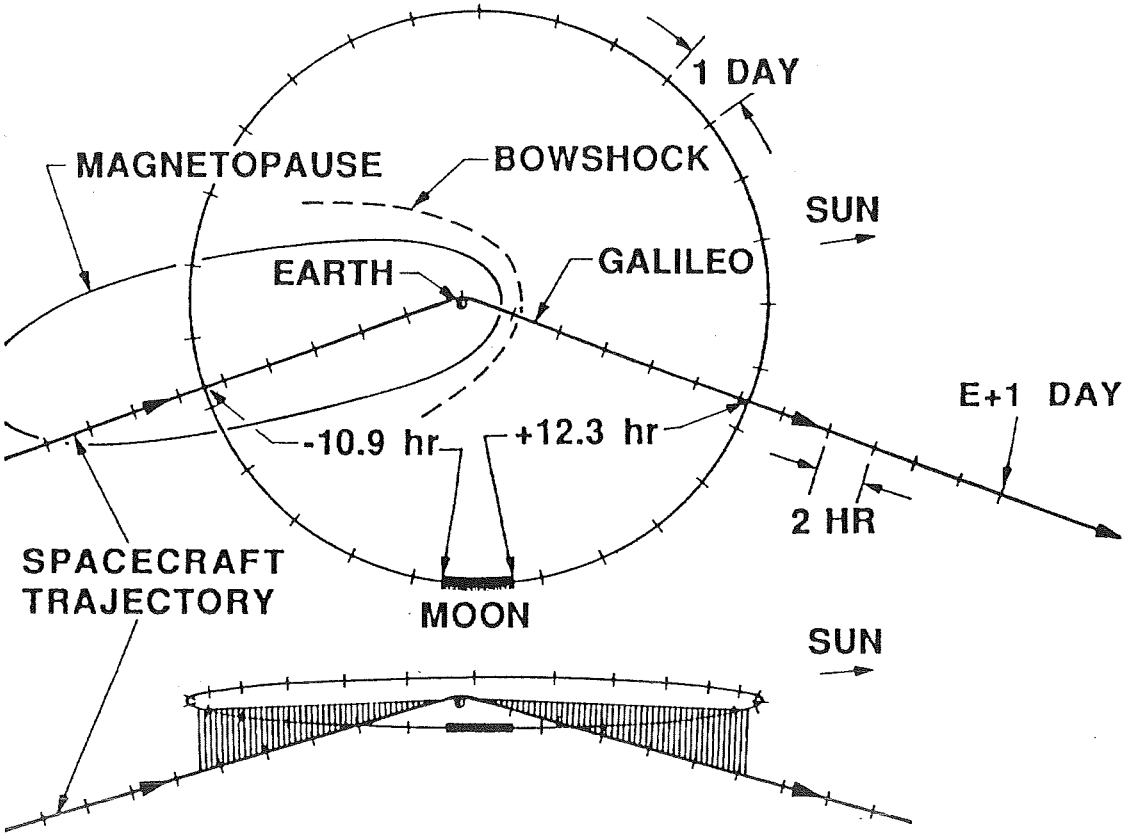


PHASE ANGLE AND CONE ANGLE OF THE EARTH DURING THE EARTH ENCOUNTERS

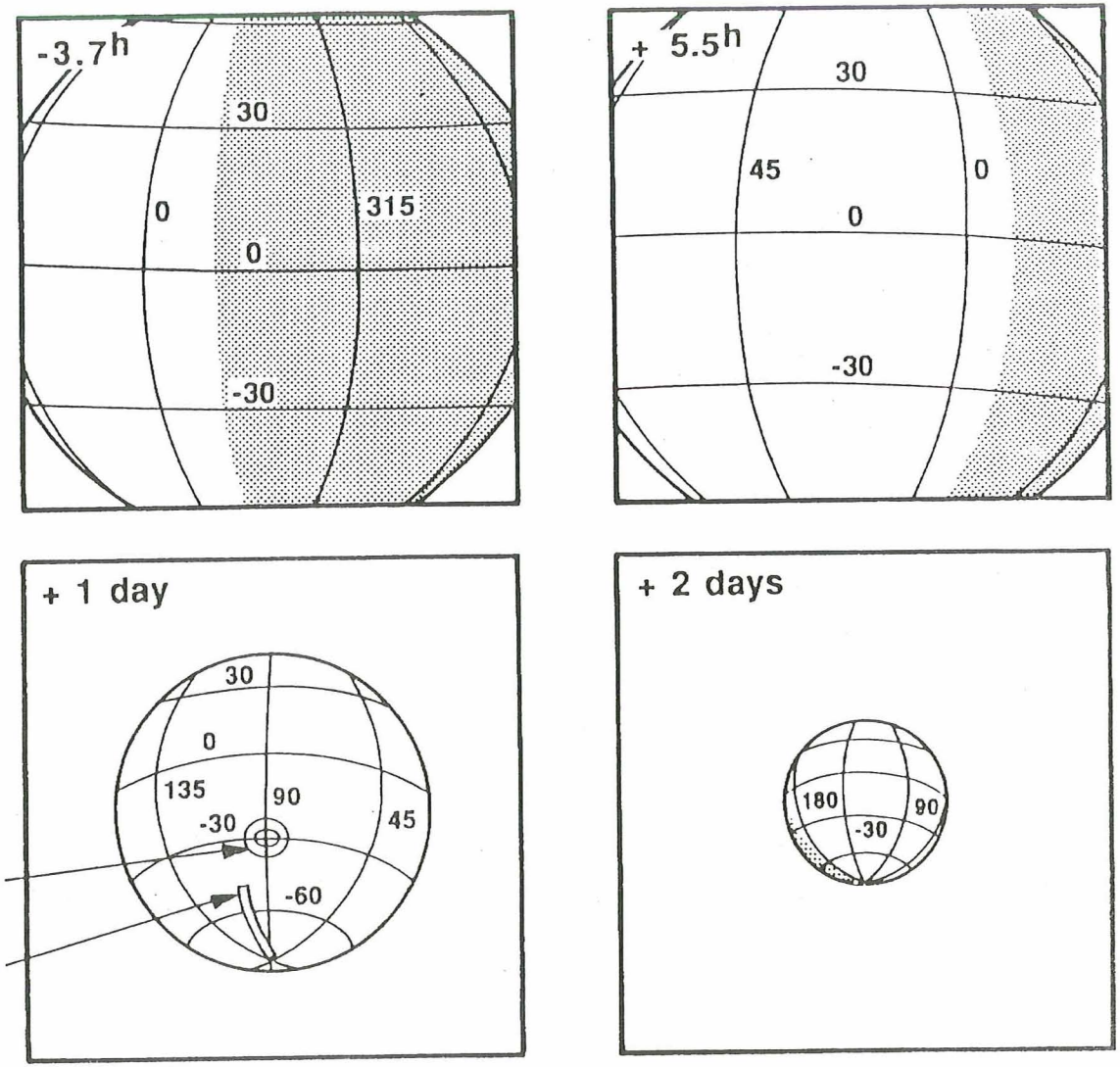


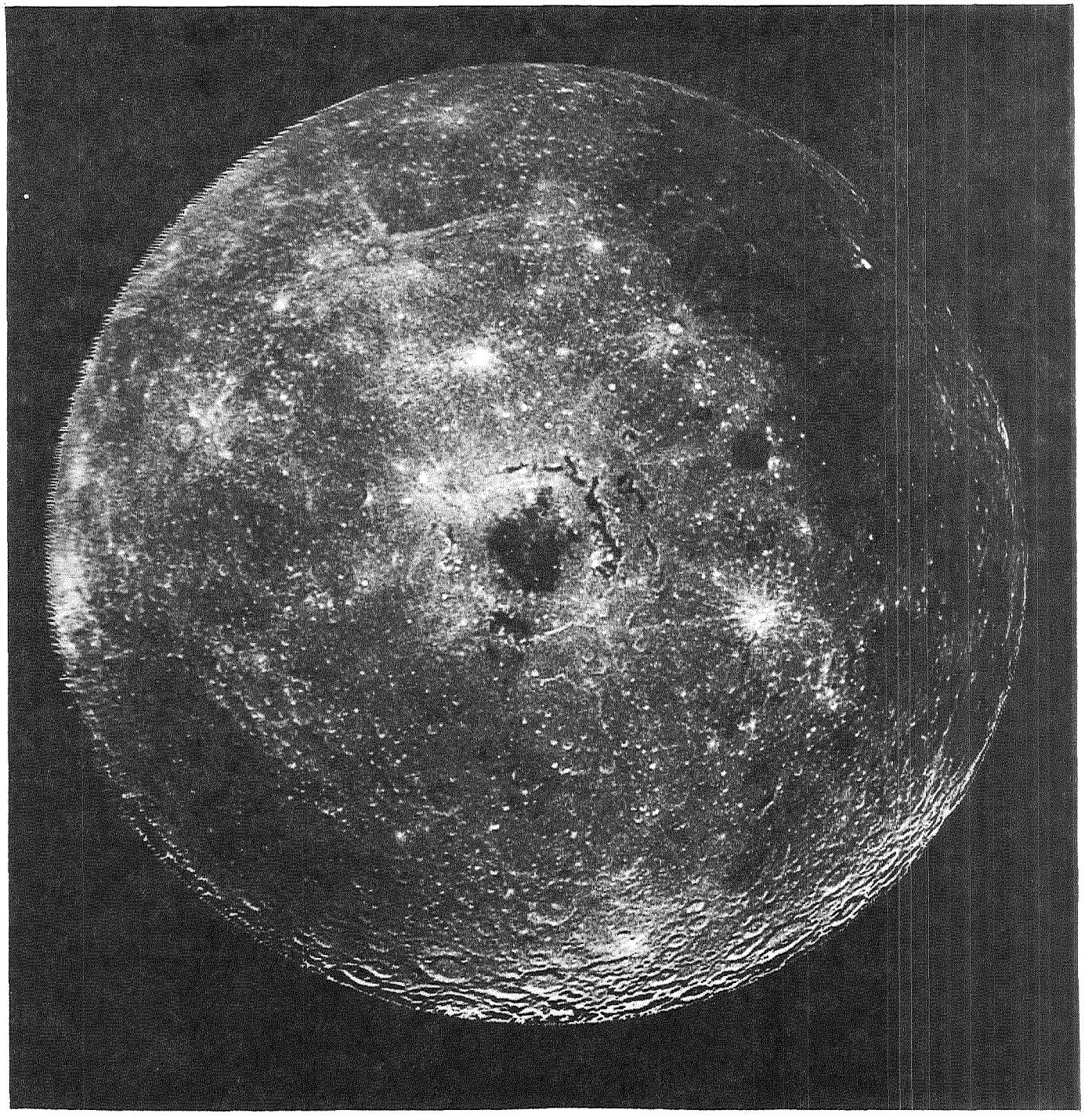
- DARKSIDE (HIGH PHASE ANGLE) APPROACH
- TERMINATOR CROSSING AT CLOSEST APPROACH
- LIGHTSIDE (LOW PHASE ANGLE) DEPARTURE
- CLOSING RATE ~ 750,000 KM/DAY
- SUN POINTED SPACECRAFT REQUIRES USE OF LOW GAIN ANTENNAS

LUNAR ORBIT TRAVERSE AT EGA1



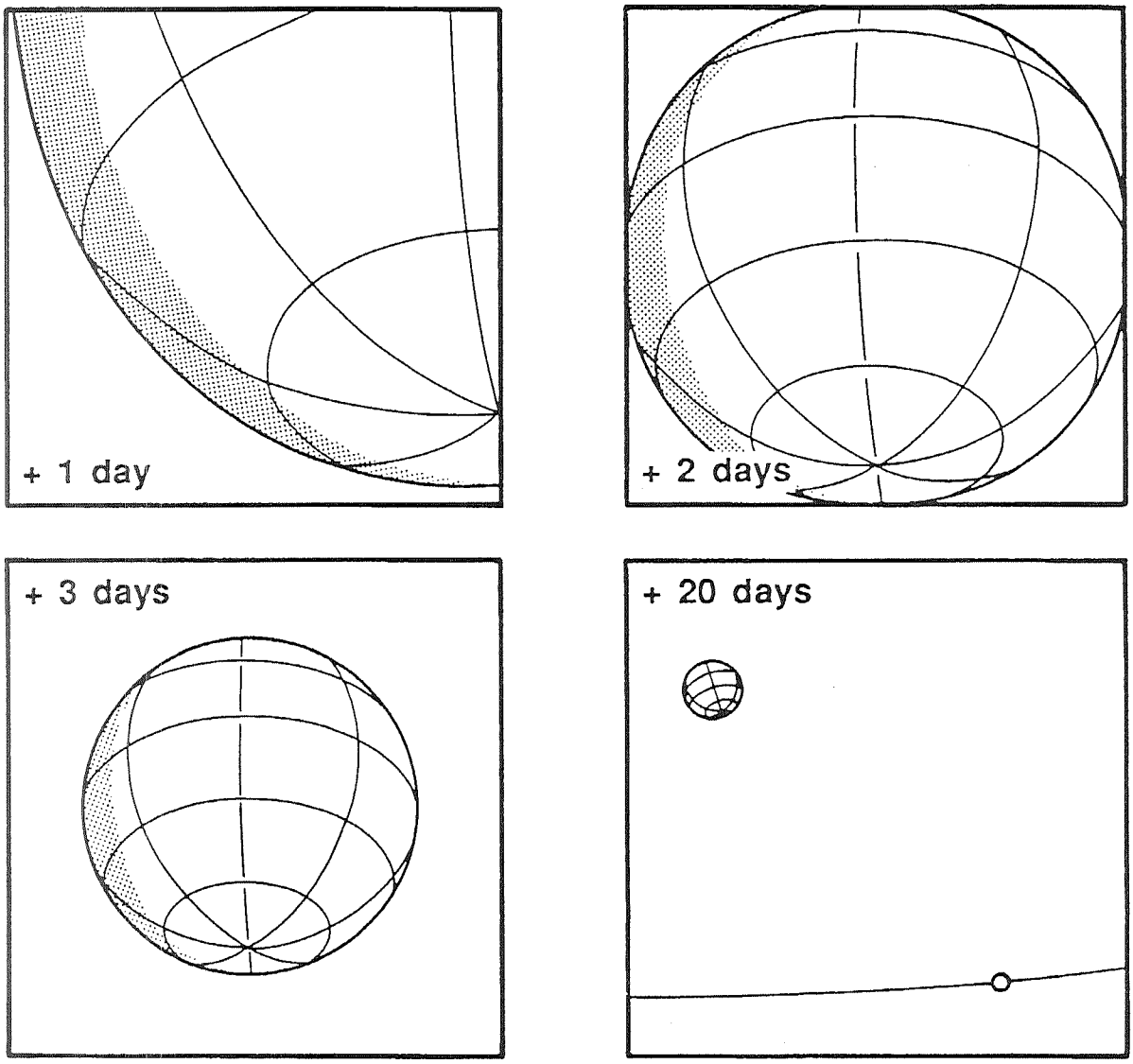
MOON IMAGING – EGA 1

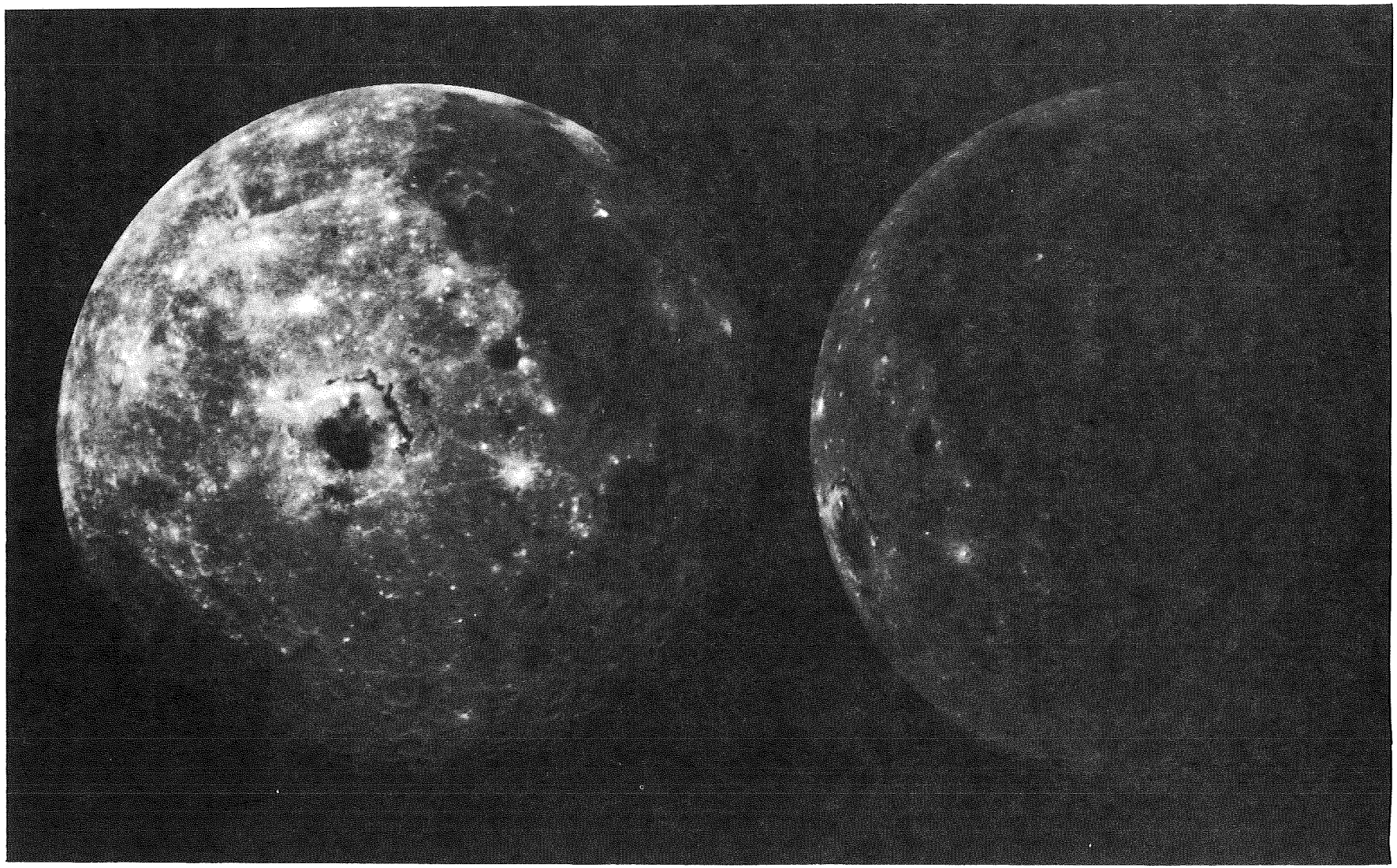




This image of the western hemisphere of the Moon was taken through a green filter by the Galileo spacecraft at 9:35 a.m. PST Dec. 9 at a range of about 350,000 miles. In the center is the Orientale Basin, 600 miles in diameter, formed about 3.8 billion years ago by the impact of an asteroid-size body. Orientale's dark center is a small mare. To the right is the lunar near side with the great, dark Oceanus Procellarum above and the small, circular, dark Mare Humorum below. Maria are broad plains formed mostly over 3 billion years ago as vast basaltic lava flows. To the left is the lunar far side with fewer maria, but, at lower left, the South-Pole-Aitken basin, about 1200 miles in diameter, which resembles Orientale but is much older and more weathered and battered by cratering. The intervening cratered highlands of both sides, as well as the maria, are dotted with bright, young craters. This image was "reprojected" so as to center the Orientale Basin, and was filtered to enhance the visibility of small features. The digital image processing was done by DLR, the German Aerospace Research Establishment near Munich, an international collaborator in the Galileo mission.

GALILEO IMAGING EARTH AFTER EGA 1

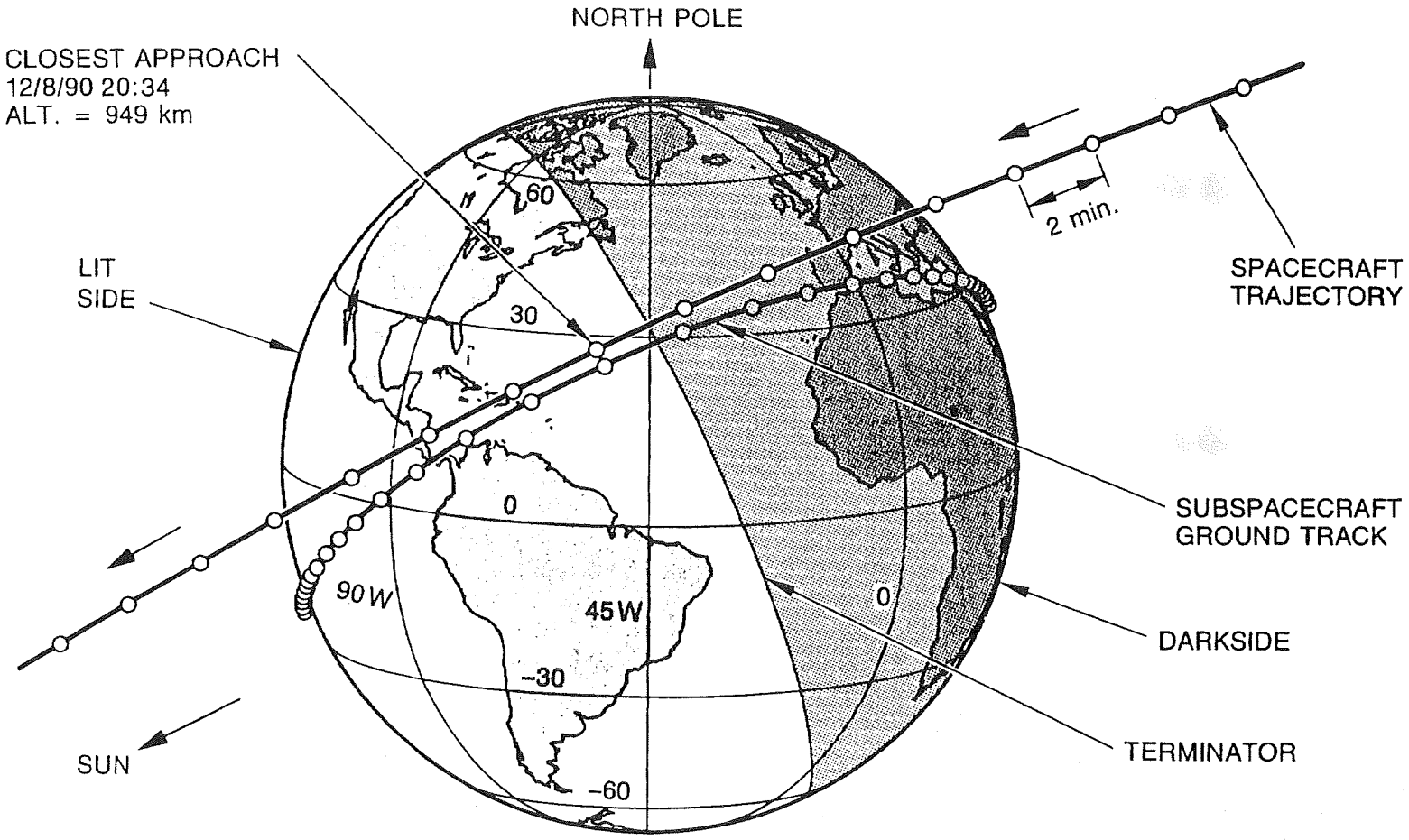


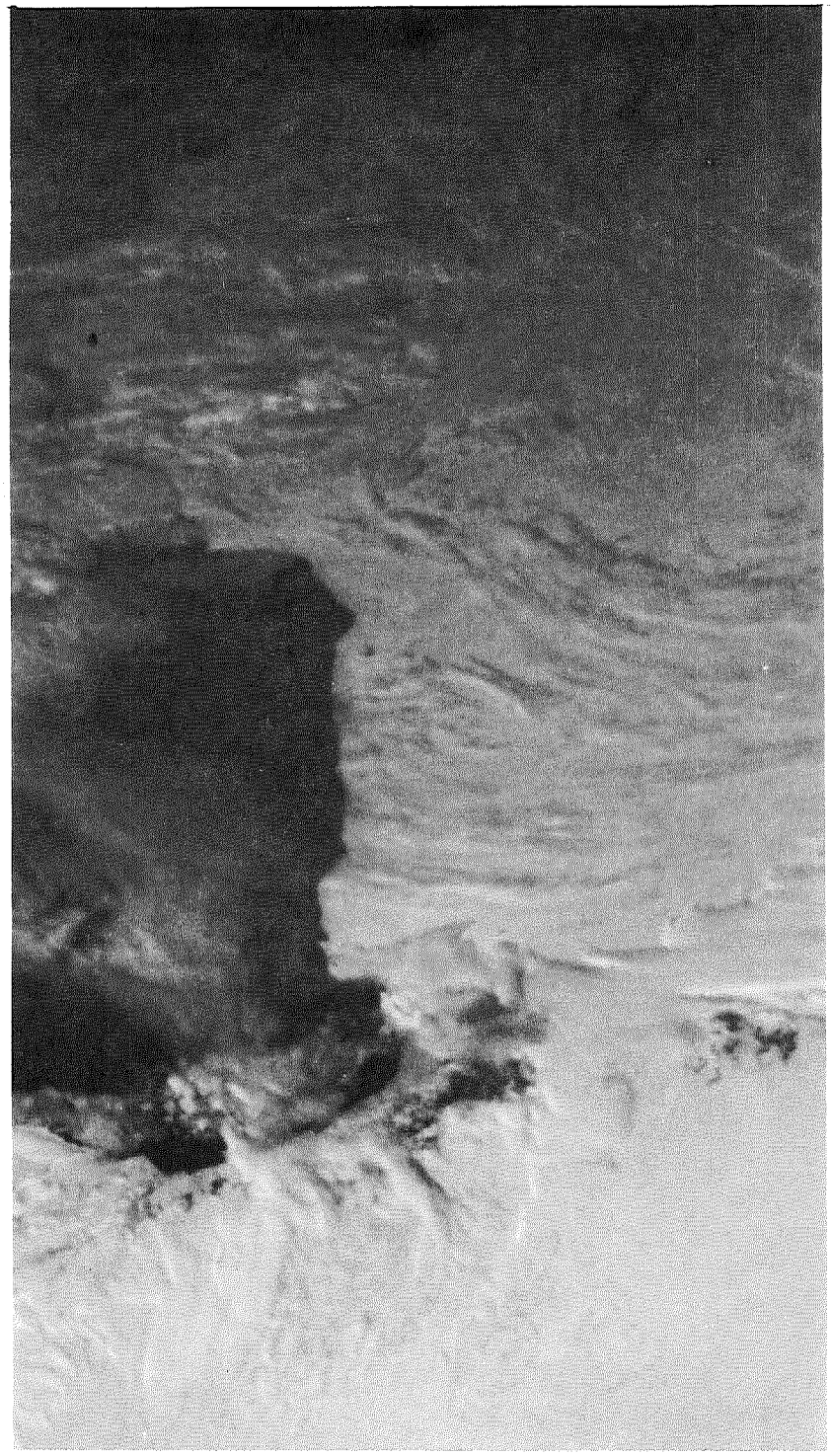


These pictures of the Moon were taken by the Galileo spacecraft at (right photo) 6:47 p.m. PST Dec 8, 1990 from a distance of almost 220,000 miles, and at (left photo) 9:35 a.m. PST Dec 9, 1990 at a range of more than 350,000 miles. The picture on the right shows the dark Oceanus Procellarum in the upper center, with Mare Imbrium above it and the smaller circular Mare Humorum below. The Orientale Basin, with a small mare in its center, is on the lower left near the limb or edge. Between stretches the cratered highland terrain, with scattered bright young craters on highlands and maria alike. The picture at left shows the globe of the Moon rotated, putting Mare Imbrium on the eastern limb and moving the Orientale Basin almost to the center. The extent of the cratered highlands on the far side is very apparent. At lower left, near the limb, is the South-Pole-Aitken basin, similar to Orientale but very much older and some 1,200 miles in diameter. This feature was previously known as a large depression in the southern far side; this image shows its Orientale-like structure and darkness relative to surrounding highlands.

Galileo

EARTH 1 FLYBY GEOMETRY





This color picture of Antarctica is one part of a mosaic of pictures covering the entire polar continent taken during the hours following Galileo's historic first encounter with its home planet. The view shows the Ross Ice Shelf to the right and its border with the sea. An occasional mountain can be seen poking through the ice near the McMurdo Station. It is late spring in Antarctica, so the sun never sets on the frigid, icy continent. This picture was taken about 6:20 p.m. PST on December 8, 1990. From top to bottom, the frame looks across about half of Antarctica.