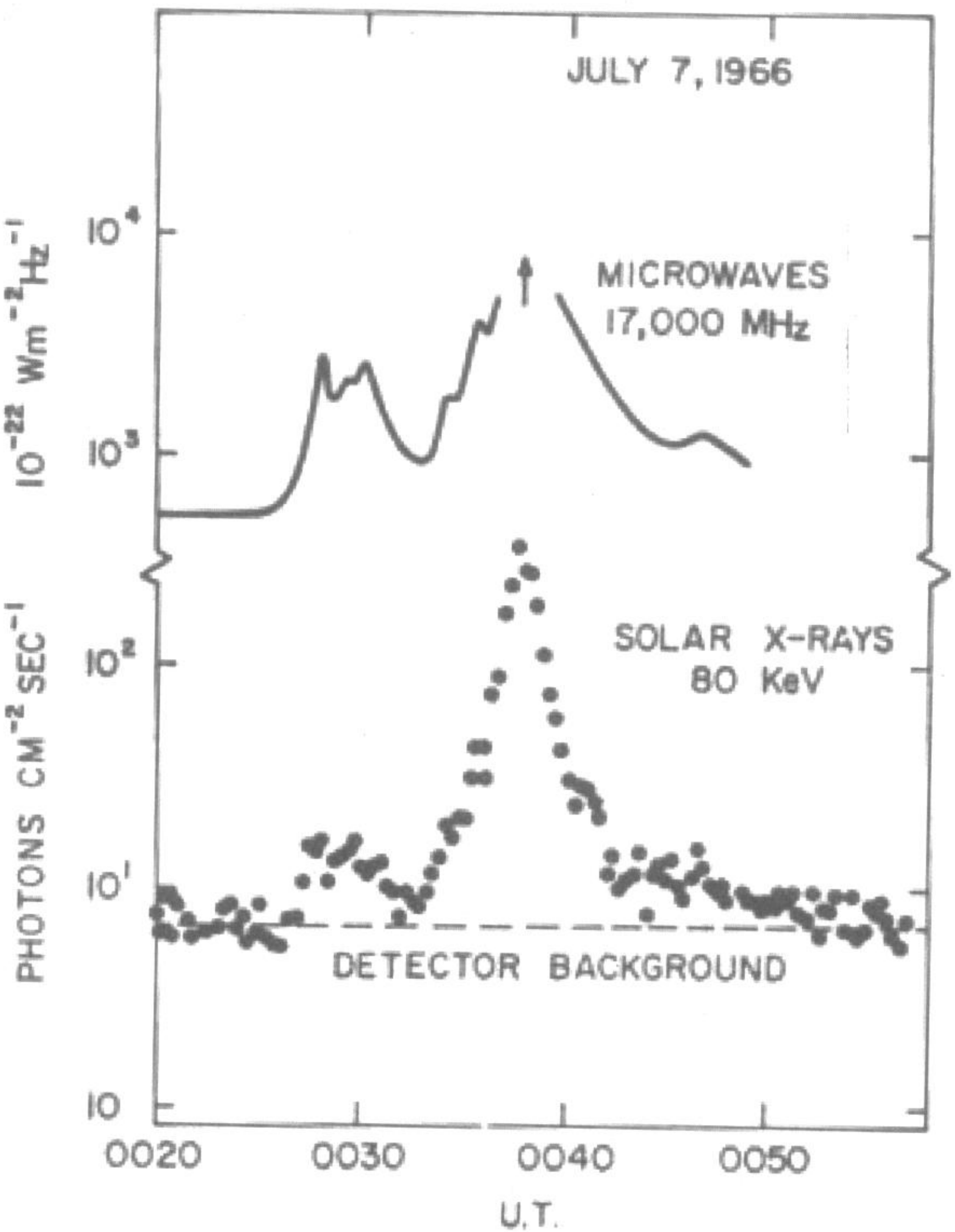
The Initial Gamma Ray Transient Studies

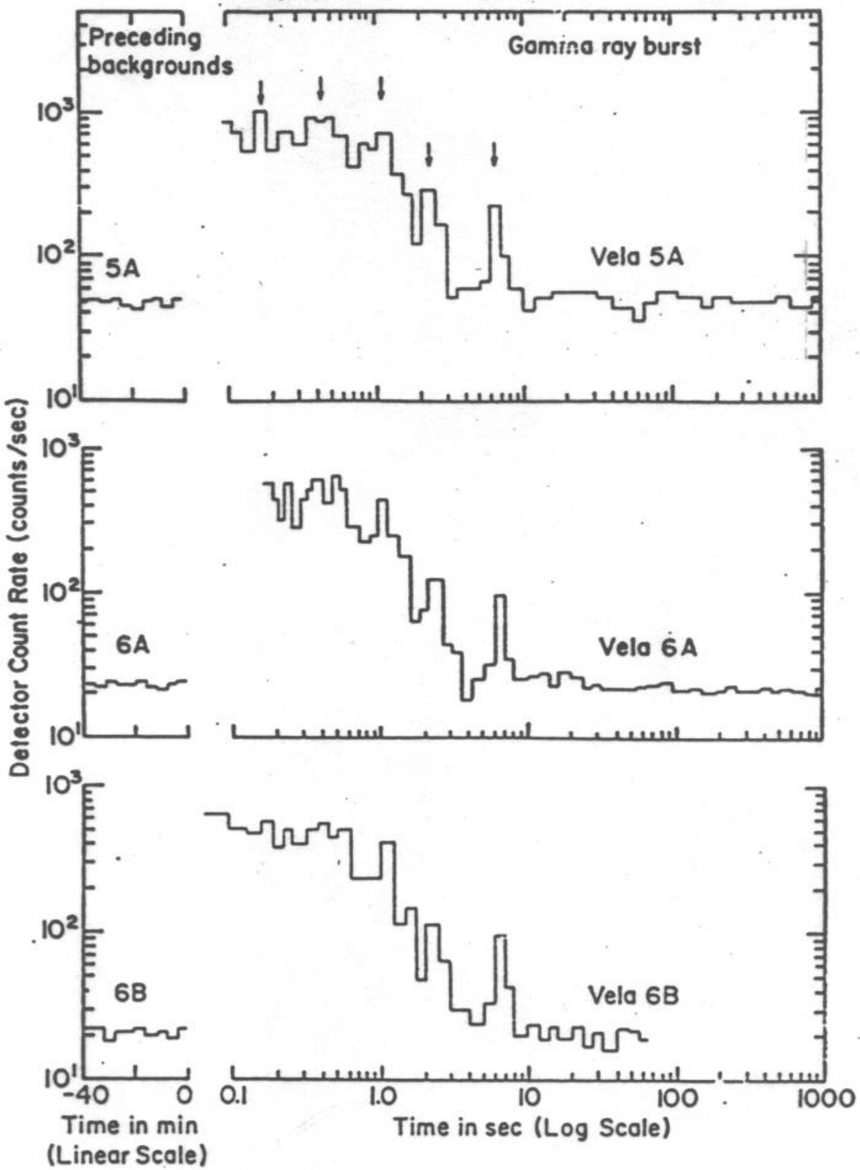
Thomas L. Cline

NASA / Goddard Space Flight Center, Emeritus



JULY 7, 1966
MICROWAVES
17,000 MHz
SOLAR X-RAYS
80 KeV
DETECTOR BACKGROUND
10^{-22} Wm^{-2}Hz^{-1}
PHOTONS CM^{-2} SEC^{-1}
10^4
10^3
10^2
10^1
10
0020
0030
0040
0050
U.T.

August 22, 1970 GRB
Vela satellites



Aliens in Outer Space Fighting Real-Life 'Star Wars'

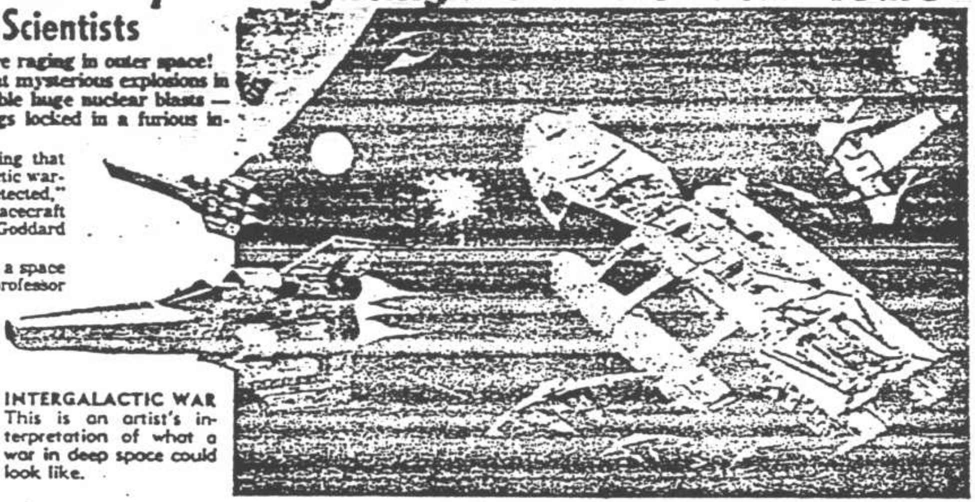
. . . Say Leading Scientists

Real-life "Star Wars" are raging in outer space!

Top scientists believe that mysterious explosions in deep space — which resemble huge nuclear blasts — are the result of alien beings locked in a furious intergalactic war.

"Frankly, I can't help feeling that there is some sort of intergalactic warfare going on that we have detected," declared William Gould, a spacecraft manager a. the government's Goddard Space Flight Center.

Dr. Willard P. Armstrong — a space authority and a retired professor of chemical engineering at Washington University in St. Louis — told The ENQUIRER: "I feel sure the explosions are caused by super races involved in 'star wars.' That's the most likely reason."



INTERGALACTIC WAR This is an artist's interpretation of what a war in deep space could look like.

The latest and most violent blast hurtled through space on March 5 and was detected by eight widely scattered space probes, including three American satellites on patrol to detect bursts of radiation from sneak nuclear weapons tests.

In the last 10 years there have been at least 80 similar unexplained explosions in deep space. Stunned scientists have ruled out the possibility that the powerful explosions are natural space phenomena known as supernovas — star explosions.

And they are certain they are not nuclear weapons launched from earth for testing in space. Other top scientists agree the blasts may be actual 'star wars.'.

."This latest explosion does not seem like a natural phenomenon," declared scientist Ray Klebesadel, a leading member of the team at the Los Alamos Scientific Laboratory in New Mexico which is analyzing information sent back from tracker satellites.

"We have definitely ruled out the thought that it was a supernova — a natural star burst. One theory that can't be ruled out is that these explosions have been caused by an alien intelligence which is highly scientifically advanced.

"Scientists even considered the possibility that a 'star wars' situation was going on deep in the uncharted regions of space."

NASA scientist Dr. Thomas Cline, at the Goddard Space Flight Center, has also been studying the mystery blasts. Although he has not yet seen sufficient evidence to convince him 'star wars' are raging, be eliminated another possibility.

"We are certain the latest explosion is not one of the major earth powers testing nuclear weapons in outer space," he told The ENQUIRER. "It was much too far away for that."

The incredible March 5 explosion occurred at a point 180,000 light-years away from earth, outside our galaxy.

Its awesome energy — in the form of lethal gamma

our technology just can't prove it . . . yet."

Nuclear physicist Stanton T. Friedman declared: "Tremendous activity of this sort could well be life out there involved in a war. When you try to come up with an explanation, you think of 'star wars.'"

Friedman — who worked on fusion propulsion systems for deep space travel — added: "They could be obliterating each other. This could represent a 'doomsday' situation out there."

Houston-based space specialist James Oberg told The ENQUIRER: "It is a reasonable suggestion by some other scientists that the blasts are being caused by intelligent life forms. It is a legitimate theory that 'star wars' may be taking place."

And top engineering physicist Dr. Henry Monteith — who works for the prestigious Sandia Laboratories in Albuquerque, N. Mex., and who has been studying space phenomena for 20 years — declared:

"It's possible a mysterious happening like this could well be something as exotic as a space war."

— MALCOLM J. NICHOLL

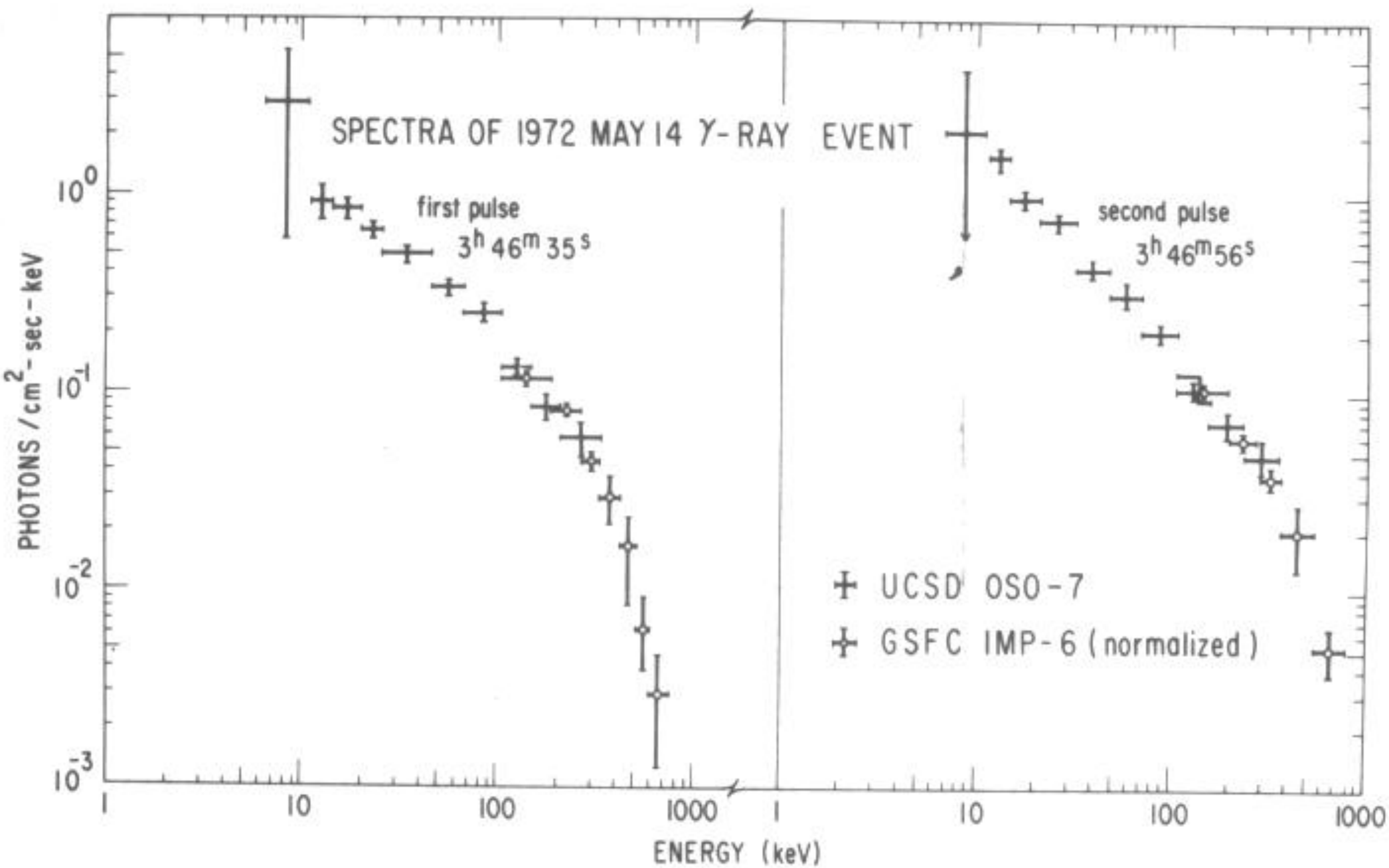


FIG. 2.—The spectra of the γ-ray event during the two pulses or peak intensity points. The open circles are GSFC IMP-6 data normalized to the data points from the UCSD OSO-7 solar X-ray telescope.

X-ray instrument was well above the background ...

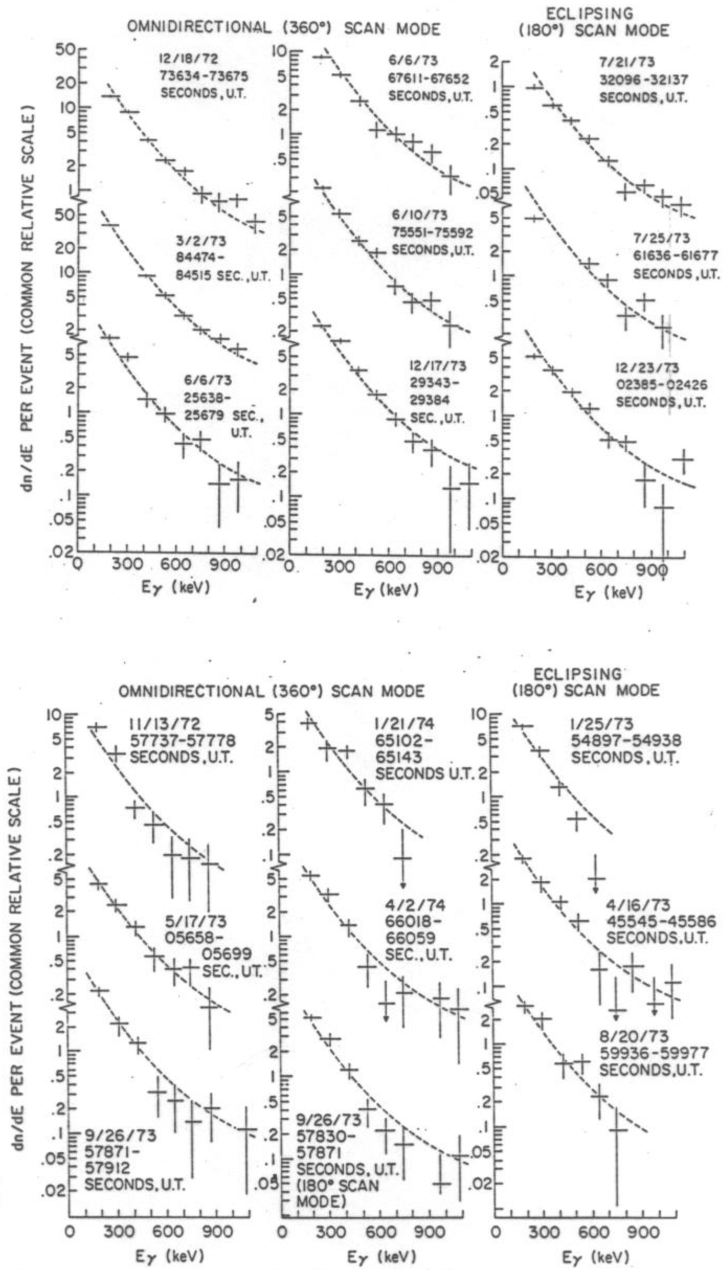


Fig. 3. IMP-7 measurements of the differential spectra of 17 gamma ray bursts, averaged over the duration of each burst event, except for one event observed in two segments. In general, each spectrum fits the common (dashed) curve. See also Fig. 4.

Distance	*Scale*	*Energy*
200 AU	*Interplanetary*	10^{27} *ergs*
100 pc	*Nearby stellar*	10^{37} *ergs*
10^{4} *pc*	*Galactic center*	10^{41} *ergs*
10^{7} *pc*	*Nearby galactic*	10^{47} *ergs*
10^{8} *pc*	*Super cluster*	10^{49} *ergs*
Hubble radius	*Cosmological*	10^{52} *ergs*

Table 1. Source energy of a 'bright' gamma ray burst vs. source location.

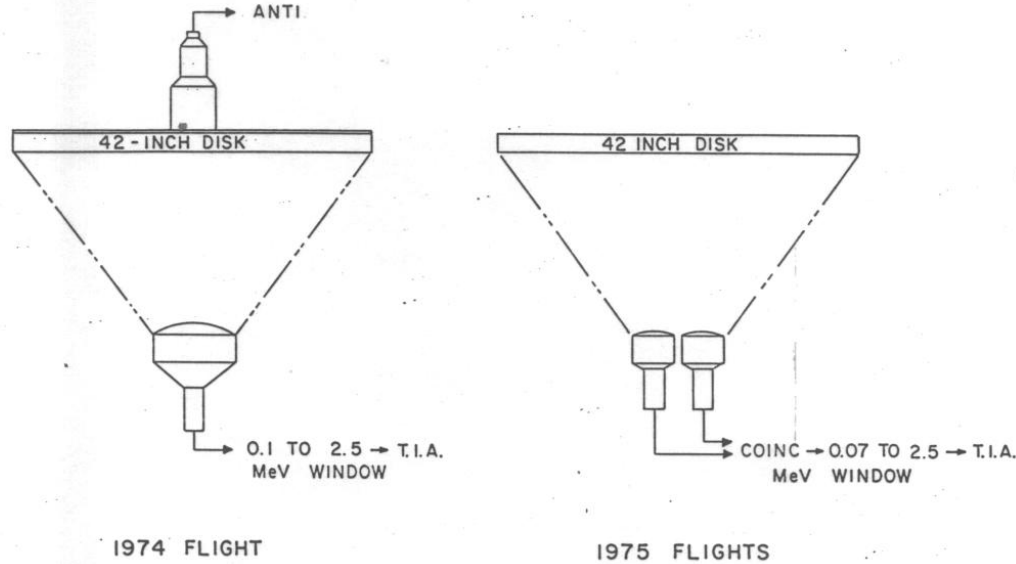
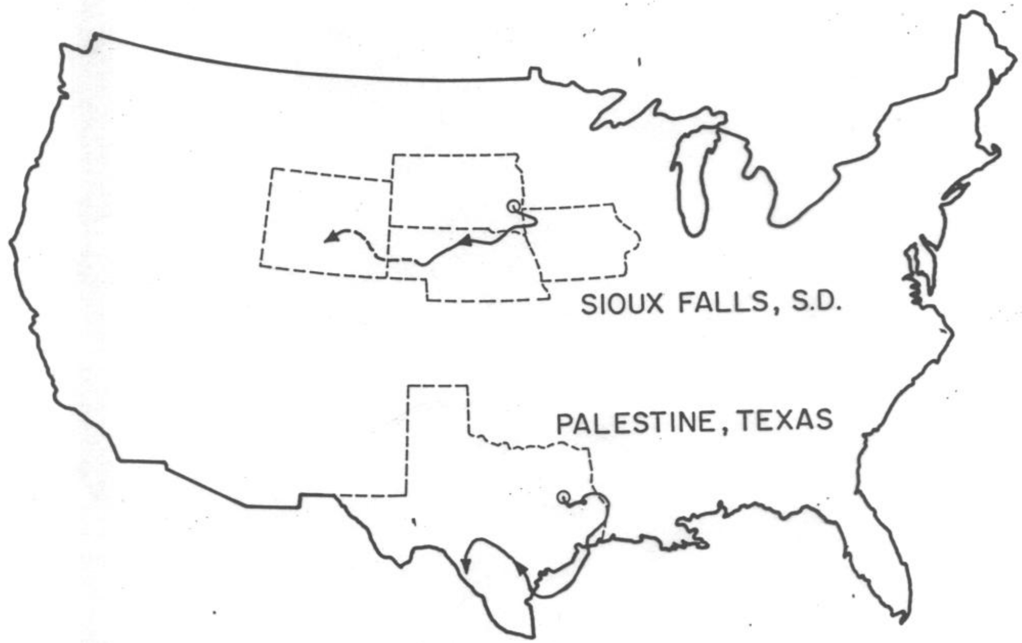
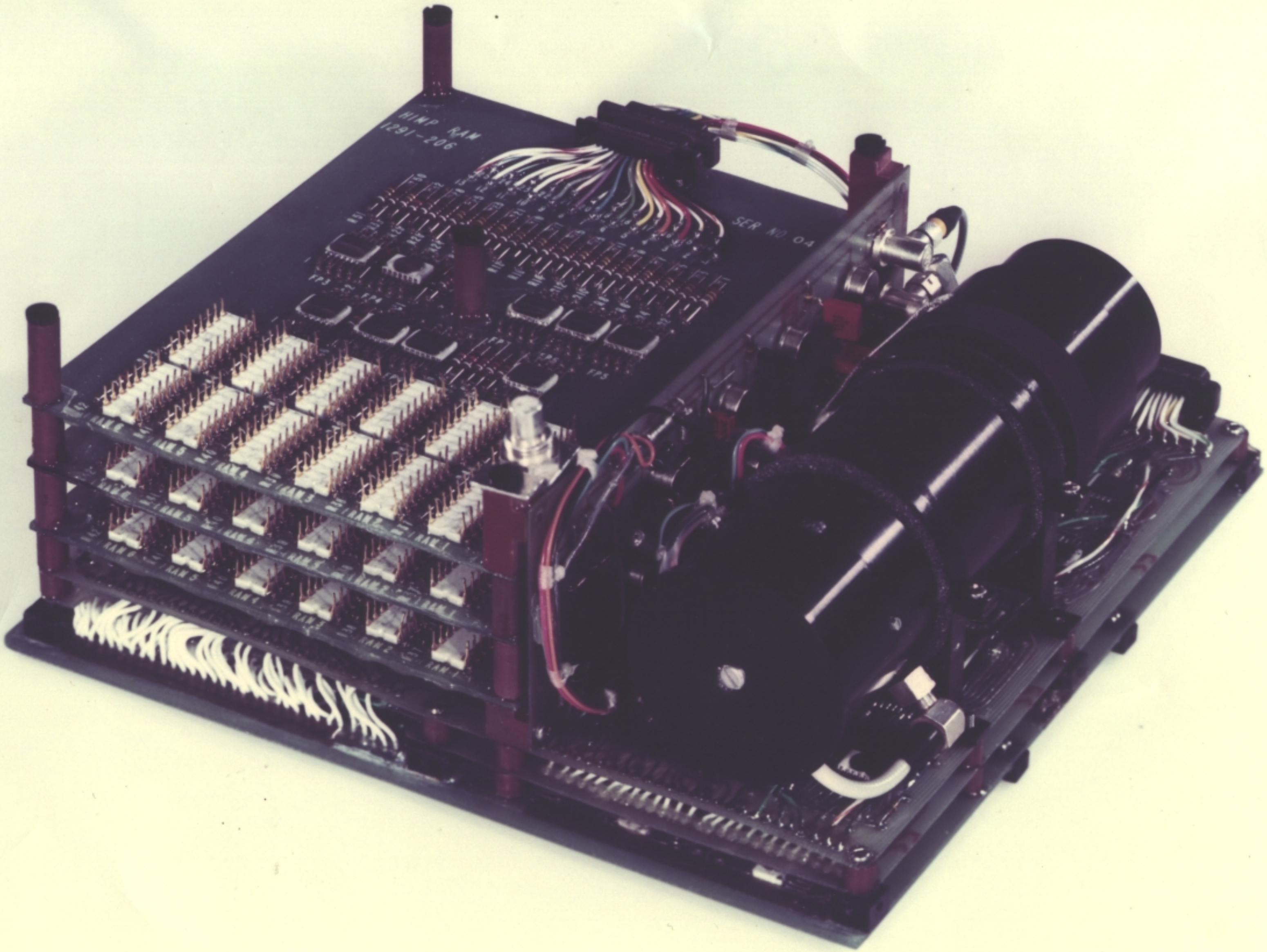
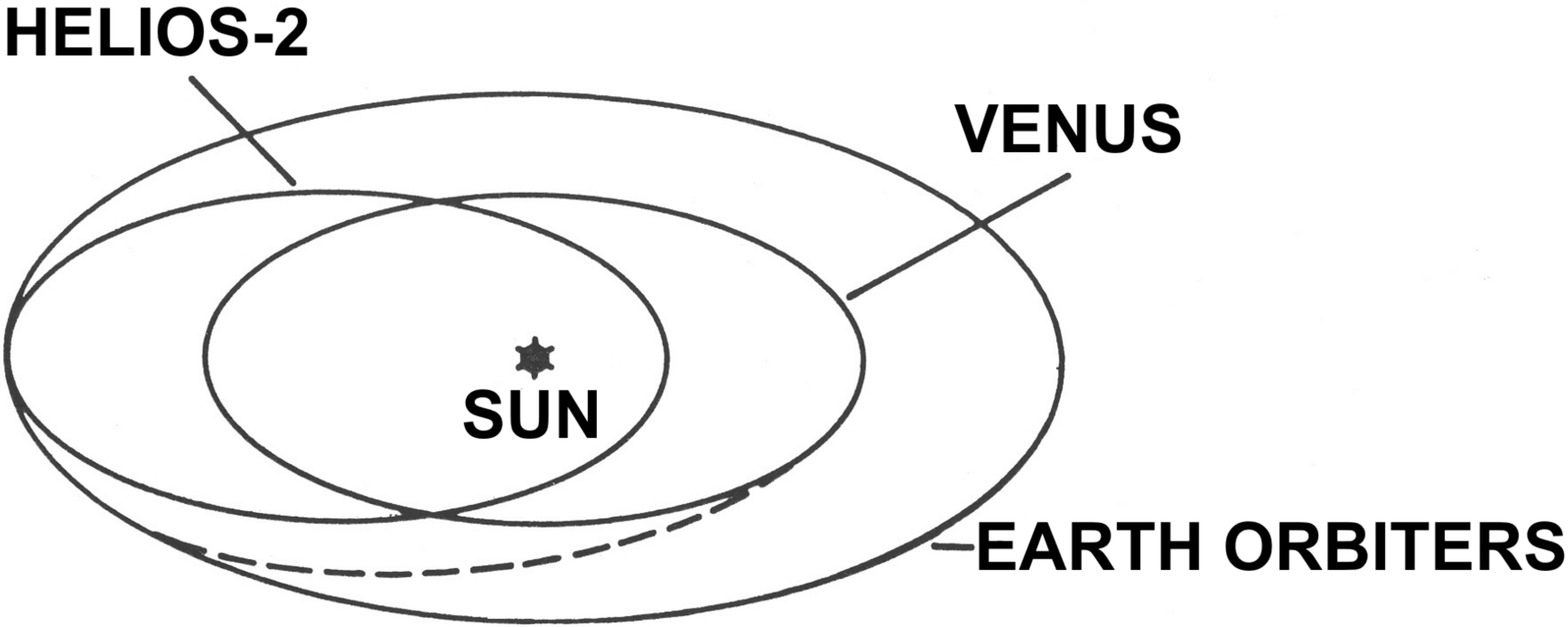


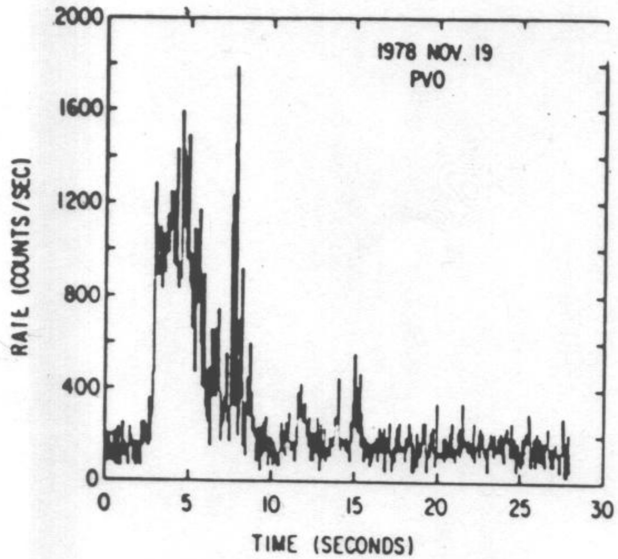
Fig. 10. The large-area detectors used in our burst balloon flight programs. Observations were successfully obtained in both years, but with insufficient sensitivity to indicate a bend in the size spectrum.

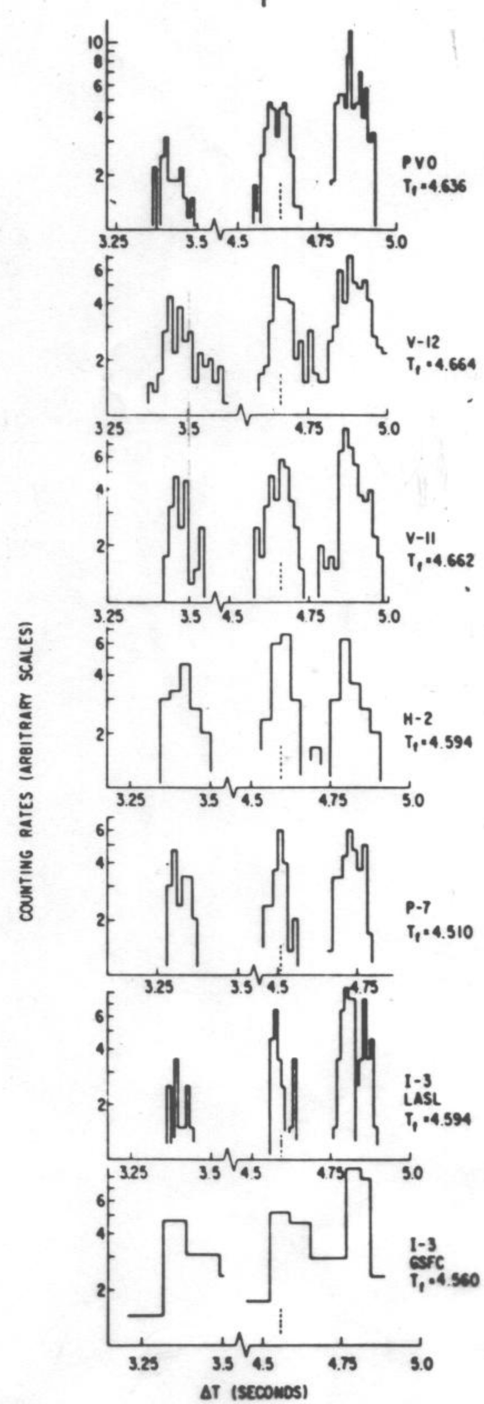


-. 11. The trajectories of our 1975 dual balloon flights, which obtained 20 hours of imultaneous data out of 40 hours on consecutive operation.


HIMP RAM
1291-206
SER NO 04


HELIOS-2
VENUS
SUN
EARTH ORBITERS


1978 NOV. 19
PVO
RATE (COUNTS/SEC)
TIME (SECONDS)


PVO
T_f =4.636
V-12
T_f =4.664
V-11
T_f =4.662
H-2
T_f =4.594
P-7
T_f =4.510
I-3
LASL
T_f =4.594
I-3
GSFC
T_f =4.560
COUNTING RATES (ARBITRARY SCALES)
ΔT (SECONDS)

the square arc minute in size.

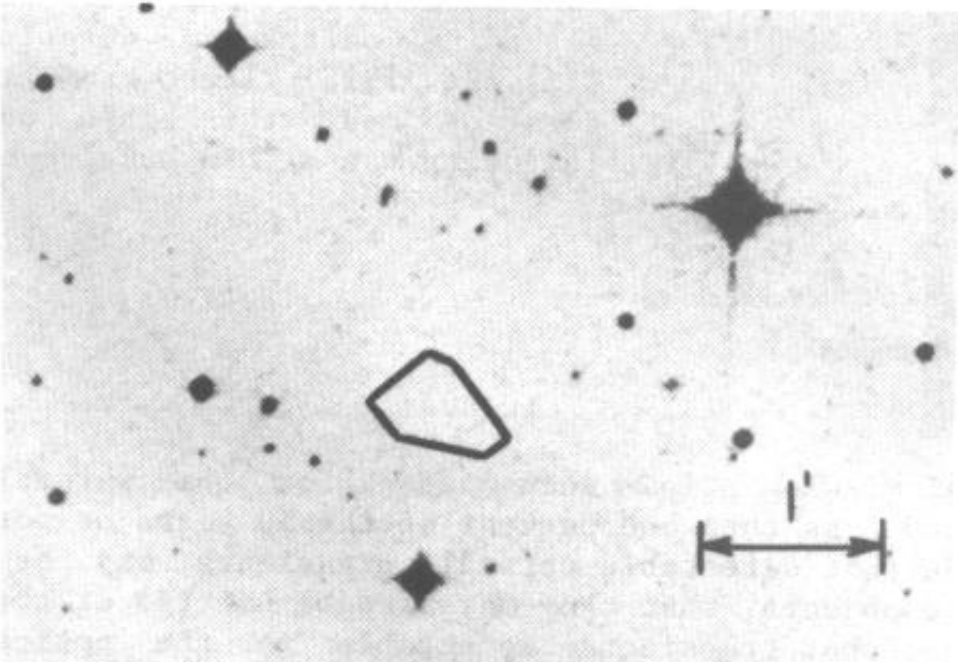


Figure 3a. The source region of the 1979 April 6 event, indicating the absence of ESO catalogued objects to ~ 22nd. magnitude, direct evidence that both a classical gamma-ray burst source object and its binary companion, if any, are of low intrinsic luminosity [14].

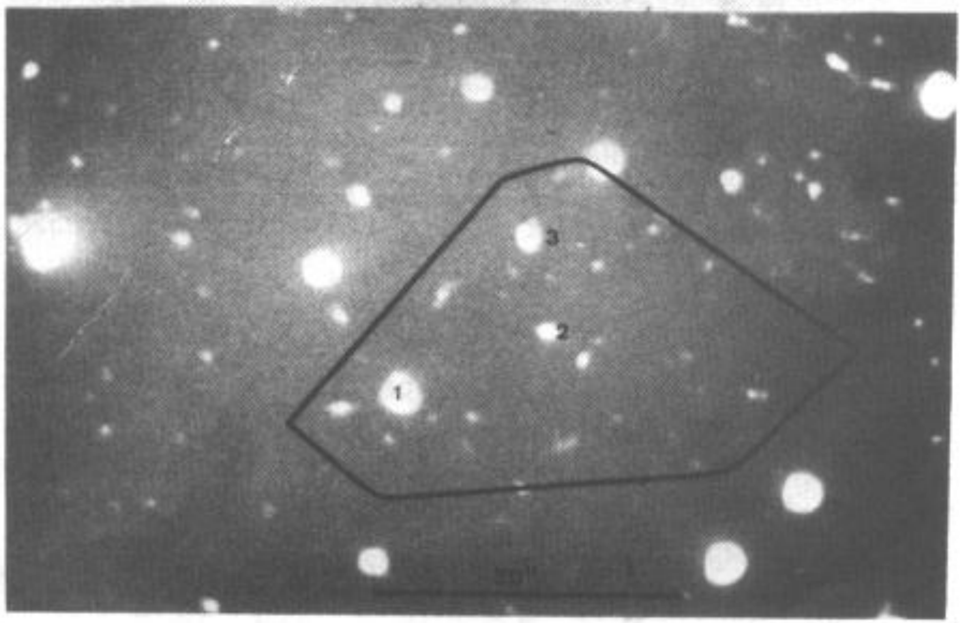
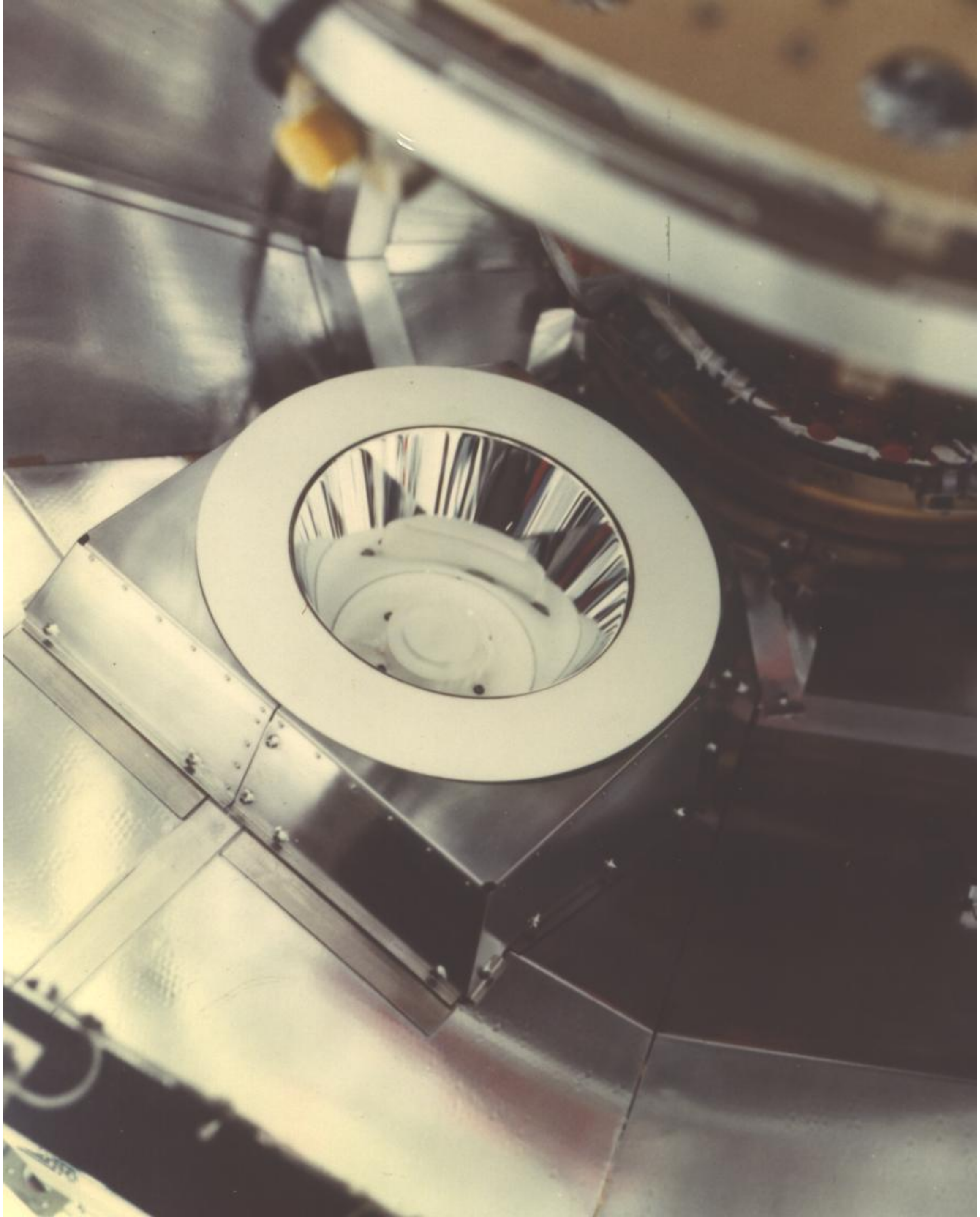


Figure 3b. A recent, more sensitive study of the same region, showing three faint but above noise-level sources within and several more close to the error box: most of these can be assumed, on statistical grounds, to be of extragalactic nature [29]. (Photo courtesy K. Hurley; Figures a and b reversed in east-west sense.)



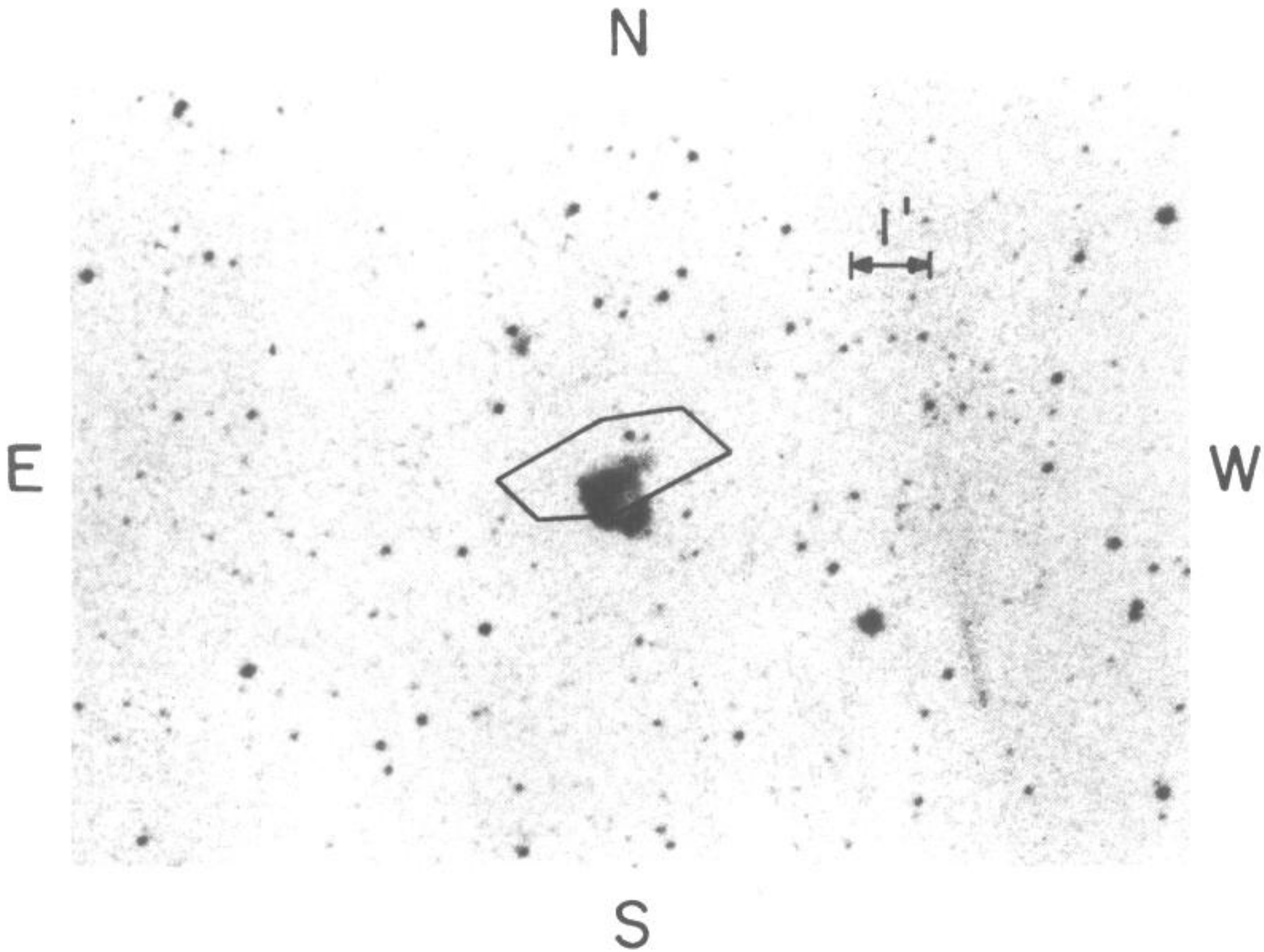
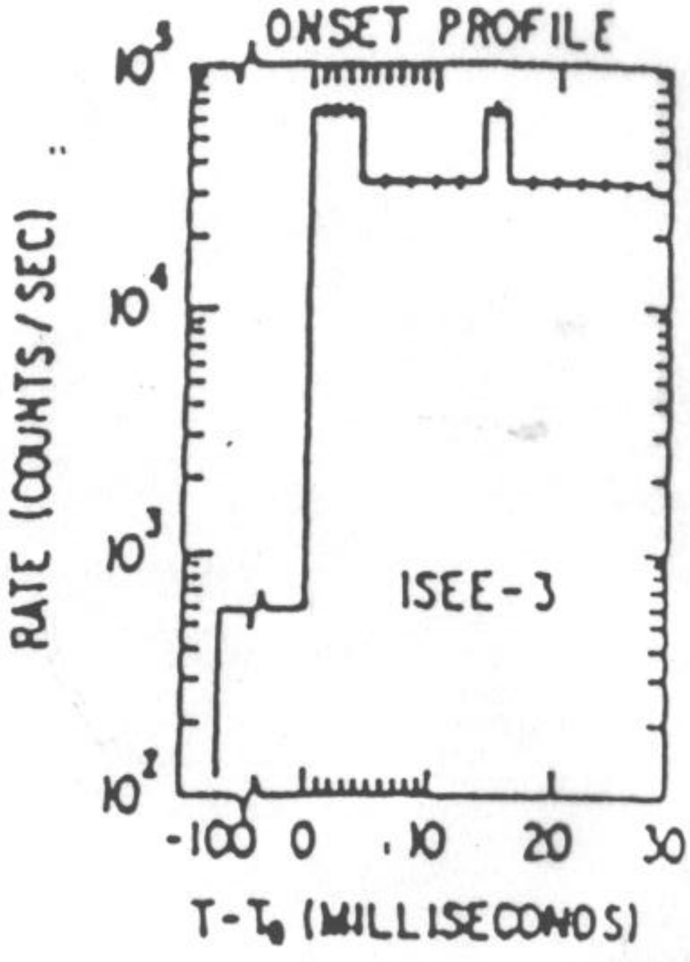
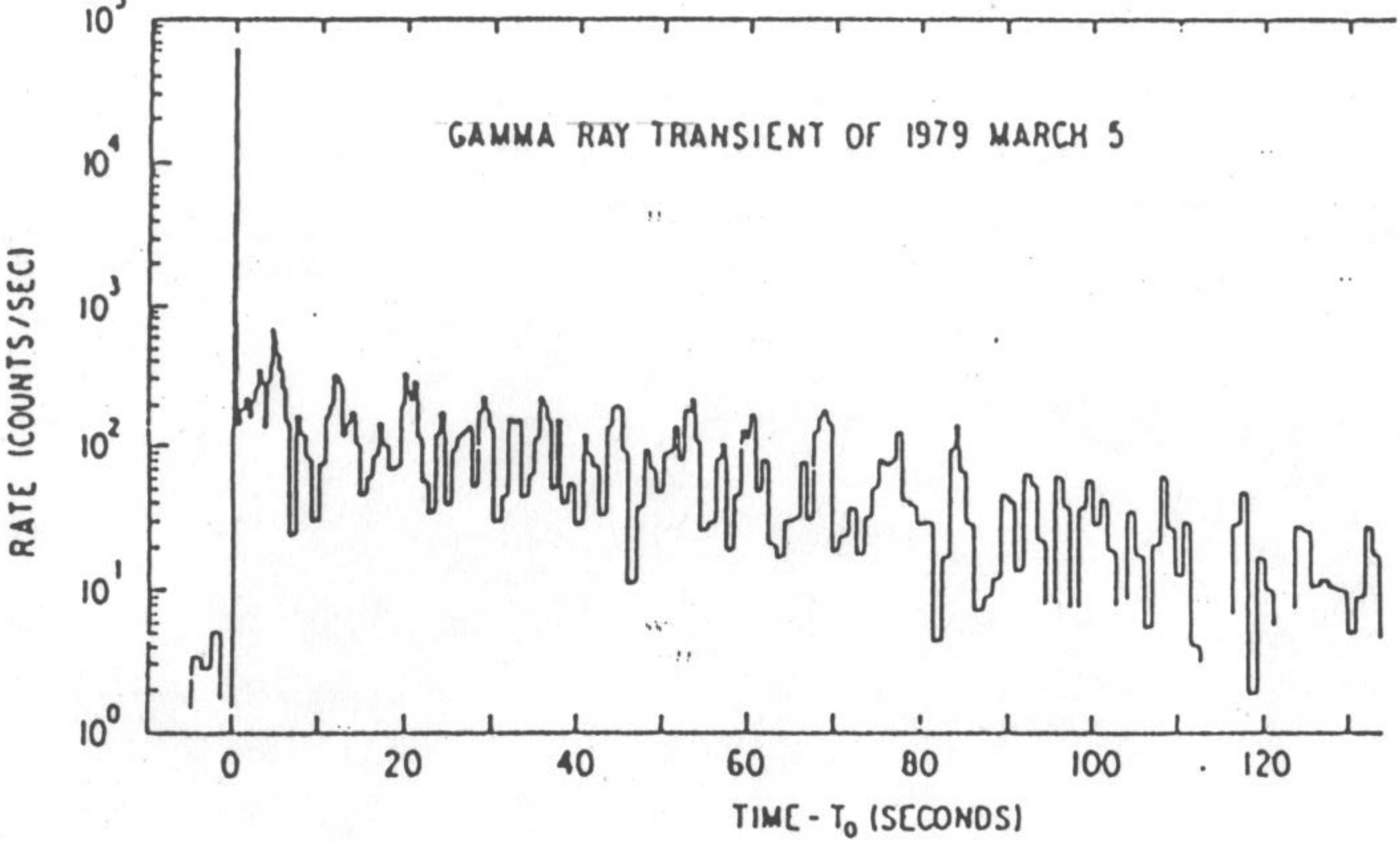


FIGURE 5. The initial 5 March 1979 source determination,[20] illustrating compatability with the supernova remnant N49 located at a distance of ~55 kpc in the Large Magellanic Cloud.



ONSET PROFILE
RATE (COUNTS/SEC)
10^5
10^4
10^3
10^2
ISEE-3
-100
0
10
20
30
T-T_0 (MILLISECONDS)


GAMMA RAY TRANSIENT OF 1979 MARCH 5
RATE (COUNTS/SEC)
10^5
10^4
10^3
10^2
10^1
10^0
0
20
40
60
80
100
120
TIME - T0 (SECONDS)

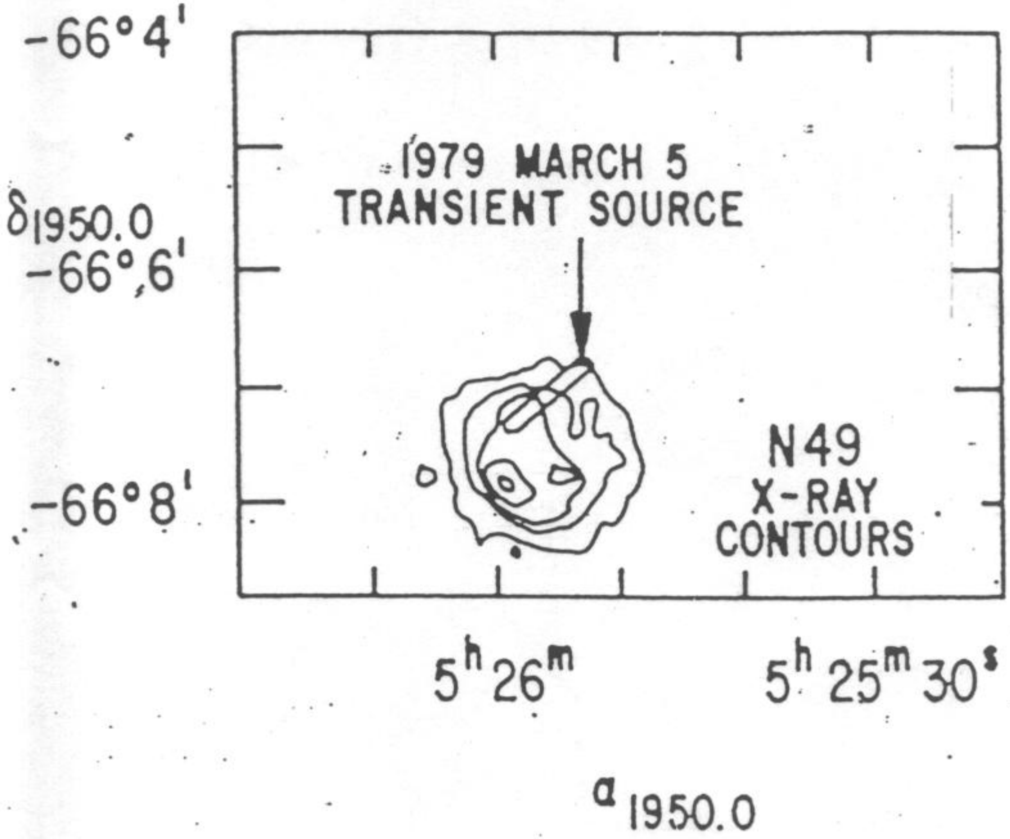


Figure 4. The precise source position of the March 5, 1979 event [Cline et al., 1982], plotted on the contours of the N49 supernova remnant, as measured with the Einstein X-ray telescope [Helfand and Long, 1979].

The Unique Cosmic Event of 1979 March 5

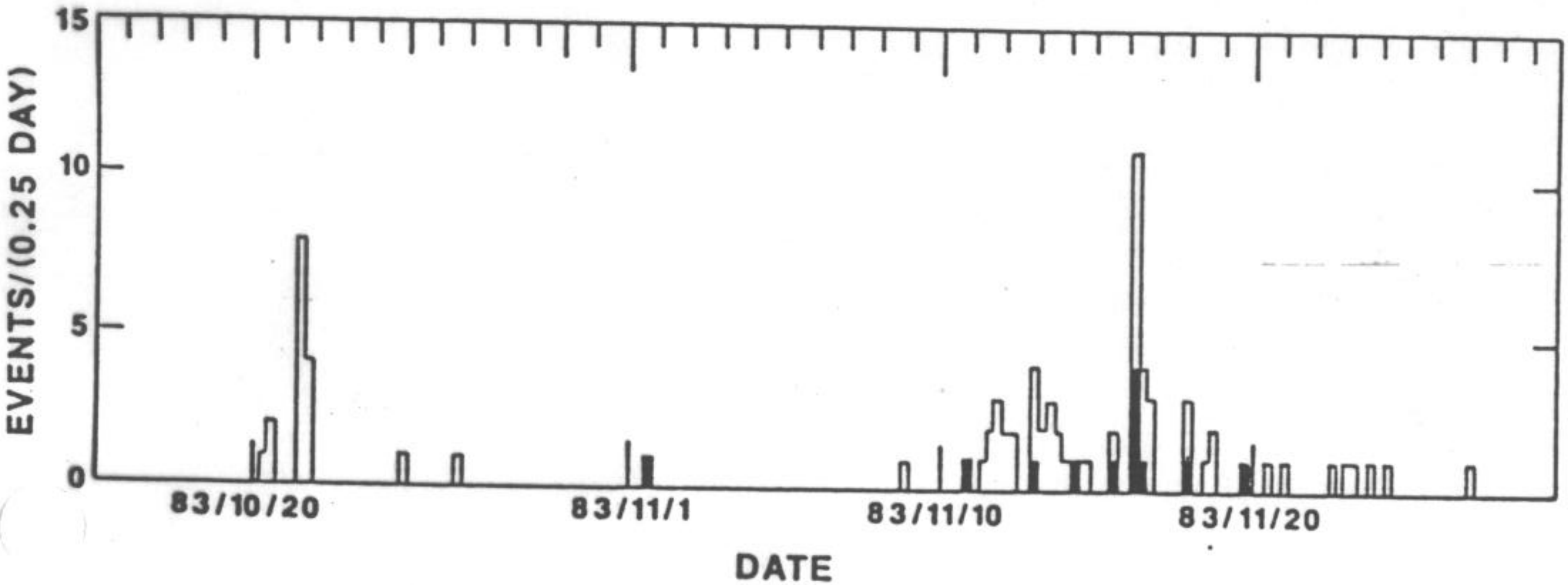
A spectacular transient that appears to be neither a typical γ-ray burst nor an x-ray burster has been found to possess a variety of unusual properties that would seem to be mutually inconsistent. These observed parameters include an onset time of less than 200 μs, a subsequent temporal intensity oscillation with an 8-s period, a spectral feature consistent with a moderately red-shifted positron annihilation line, a maximum photon flux greater than any known γ-ray or x-ray transient, and a very accurate source-location measurement consistent with that of the N49 supernova remnant associated with the Large Magellanic Cloud at 55-kpc distance. In addition, the ratio of x-ray point-source steady state to transient emission is $< 10^{-9}$, independent of distance. Given the accuracy of the observations (made possible by a γ-ray-burst network of nine spacecraft, complemented by data from five additional instruments), this phenomenon prompts both more theoretical examination of nonequilibrium high-energy processes and more experimental study, with greater spectral, temporal and directional resolution, devoted to transient γ-ray phenomena in astrophysics.

Introduction

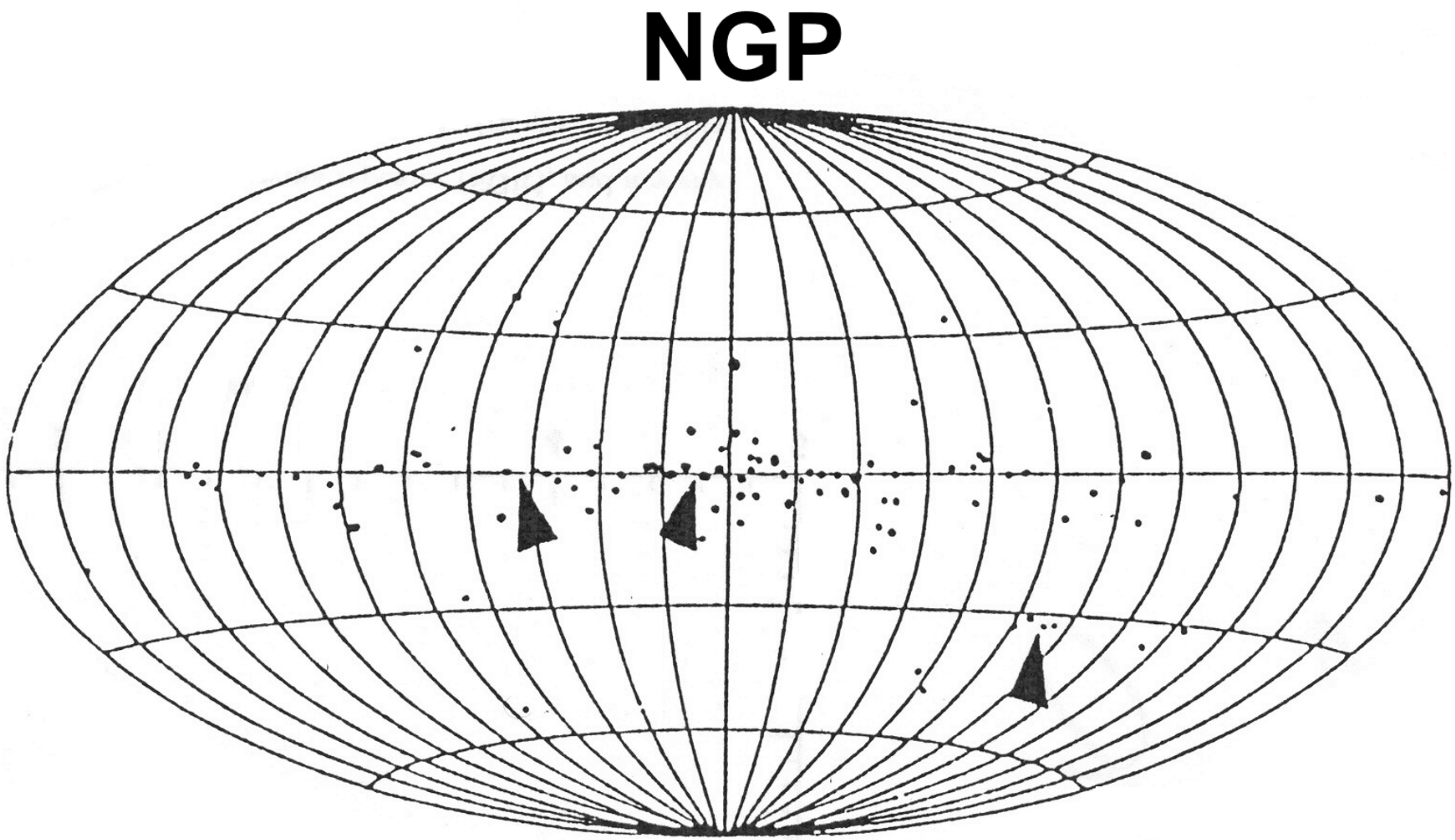
The experimental data regarding the 1979 March 5 transient can be reviewed briefly as follows. First, the time history is shown in its large-scale features in Figure 1, illustrating the relative intensity of the initial narrow maximum and the subsequent complex but regular oscillation. What is not evident on this time scale is the rise time of the intensity onset (< 200 μs and possibly much shorter) and the width of the initial spike (~120 μs). The observations plotted here were made with our Goddard instruments on the ISEE-3 spacecraft[1] and are confirmed in their general features by data from the other contributing sensors that form the interplanetary γ-ray-burst network: Helios-2, Pioneer-Venus Orbiter, Venera-11 and -12, Prognoz-7 and the three Vela spacecraft,[1,2,3] and by other instruments on Venera-11 and -12.[4] The γ-ray-burst network is presently used to define γ-ray transient-source positions by triangulation over great distances, and performed the accurate and redundantly determined source location of this transient. The maximum intensity is greater than several $\times 10^{-3}$ erg cm^{-2} s^{-1}, an unsure and probably minimum value due both to the unknown fluxes below the ≥50-keV thresholds and to the problems of pulse-pile-up effects at these energies. The intensity above about 100 keV is thus *at least* one order of magnitude greater than that of any γ-ray burst observed

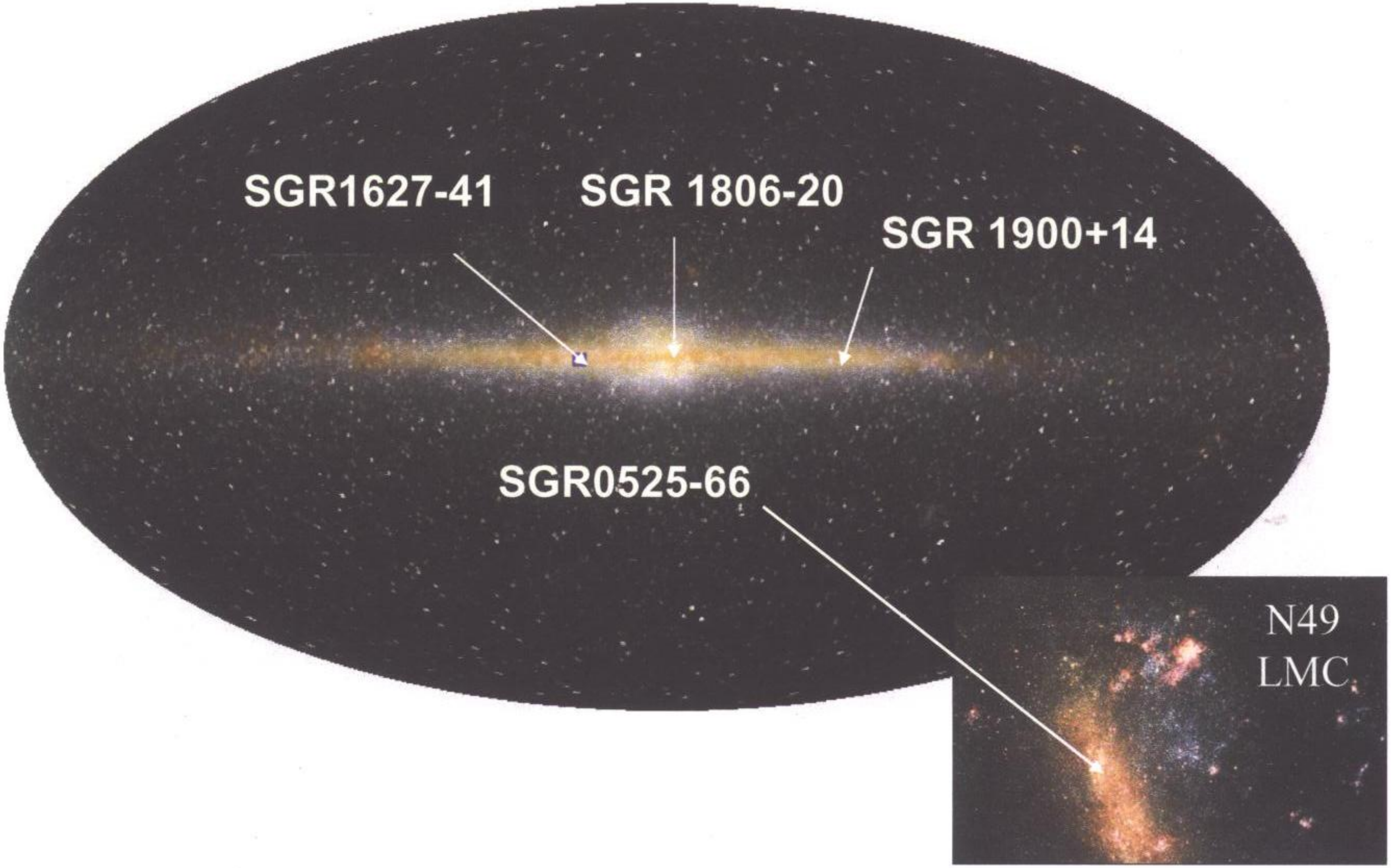
Comments on Astrophysics
1980, Vol. 9, No. 1, pp. 13–22
0146-2970/80/0901-0013 $06.50/0

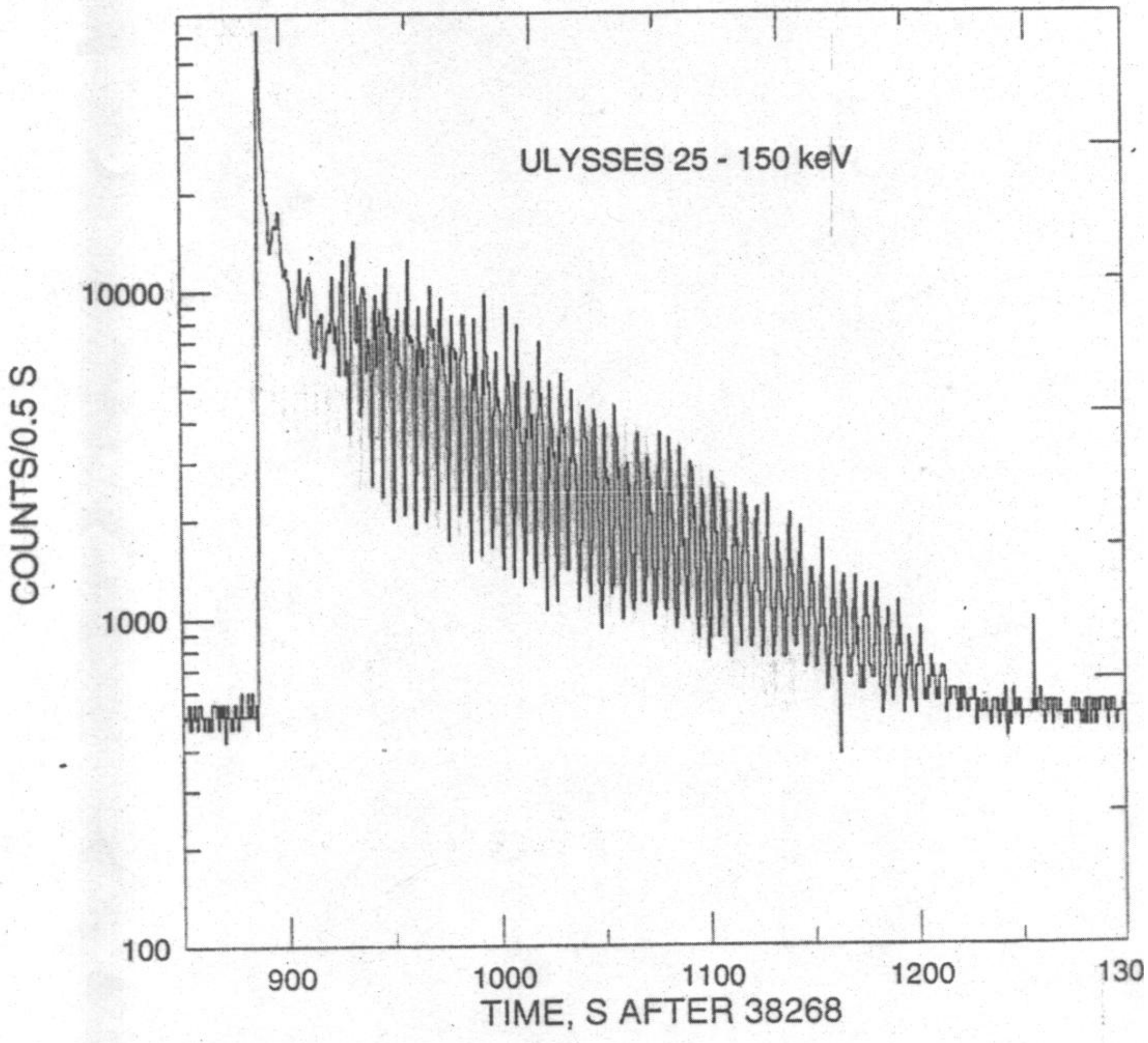
The most remarkable event took place on March 5, 1979 (Fig. 1.15). In less than 1 ms, the flux rose to 10^{-3} erg/cm^2 s. If such a burst had occurred in the optical range, it could have been observed by the naked eye even in day time. But what is more important is that periodic variations in the radiation with a period of about 8 s were observed. This at once made the neutron star model more favorable than other models (e.g., the black hole model). The pulse shape and the emission spectrum, especially in the pulsating component, were reminiscent of the radiation emitted by X-ray pulsars. The position of this burst was determined with an extremely high degree of accuracy. The burst was superimposed on the remnant of the supernova explosion in the Small Magellanic Cloud. However, this was apparently a coincidence. At a distance of ~ 50 kiloparsec from the Magellanic Cloud, the luminosity of the source is found to be ~ 10^{44} erg/s, which is comparable with the luminosity of the whole galaxy. This result is absolutely incompatible with the fact that somewhat weaker bursts were also registered subsequently from this source. However, if the superposition on the remnant is just accidental, it means that the burst occurred from nowhere!



15
10
5
0
EVENTS/(0.25 DAY)
83/10/20
83/11/1
83/11/10
83/11/20
DATE


NGP


SGR1627-41
SGR 1806-20
SGR 1900+14
SGR0525-66
N49
LMC


ULYSSES 25 - 150 keV
COUNTS/0.5 S
10000
1000
100
900
1000
1100
1200
130
TIME, S AFTER 38268

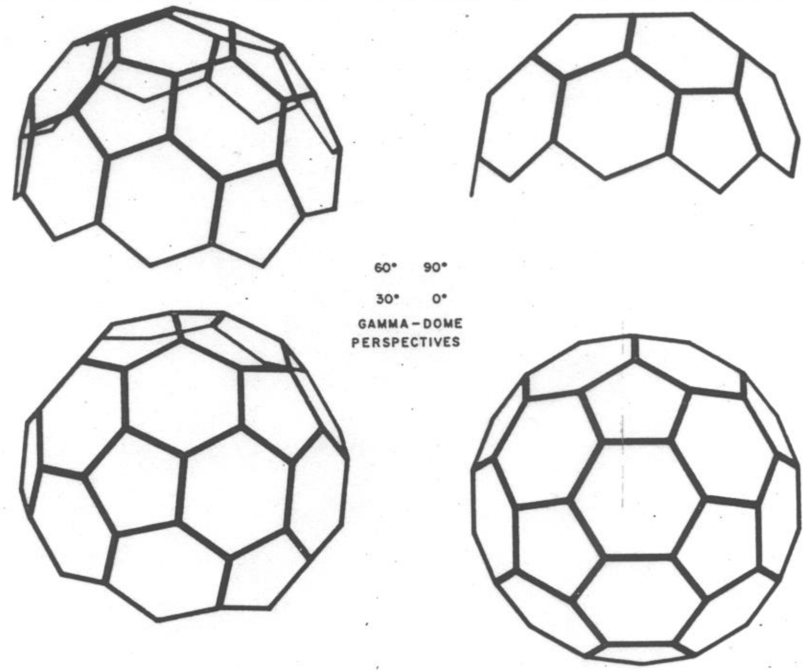
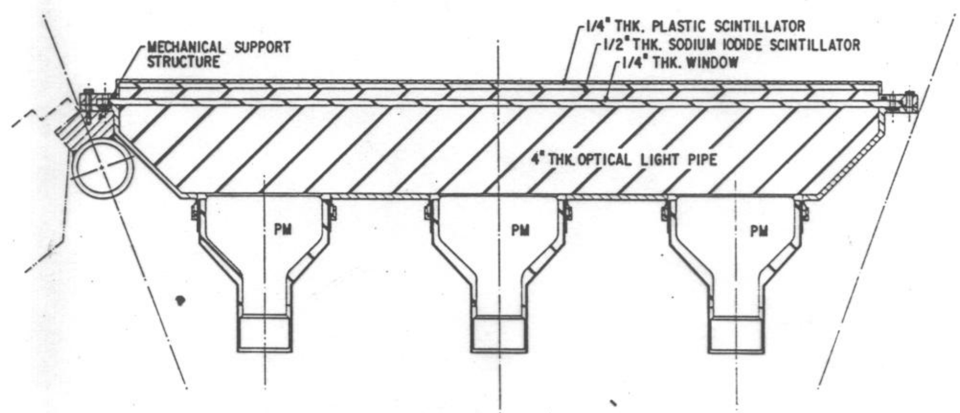
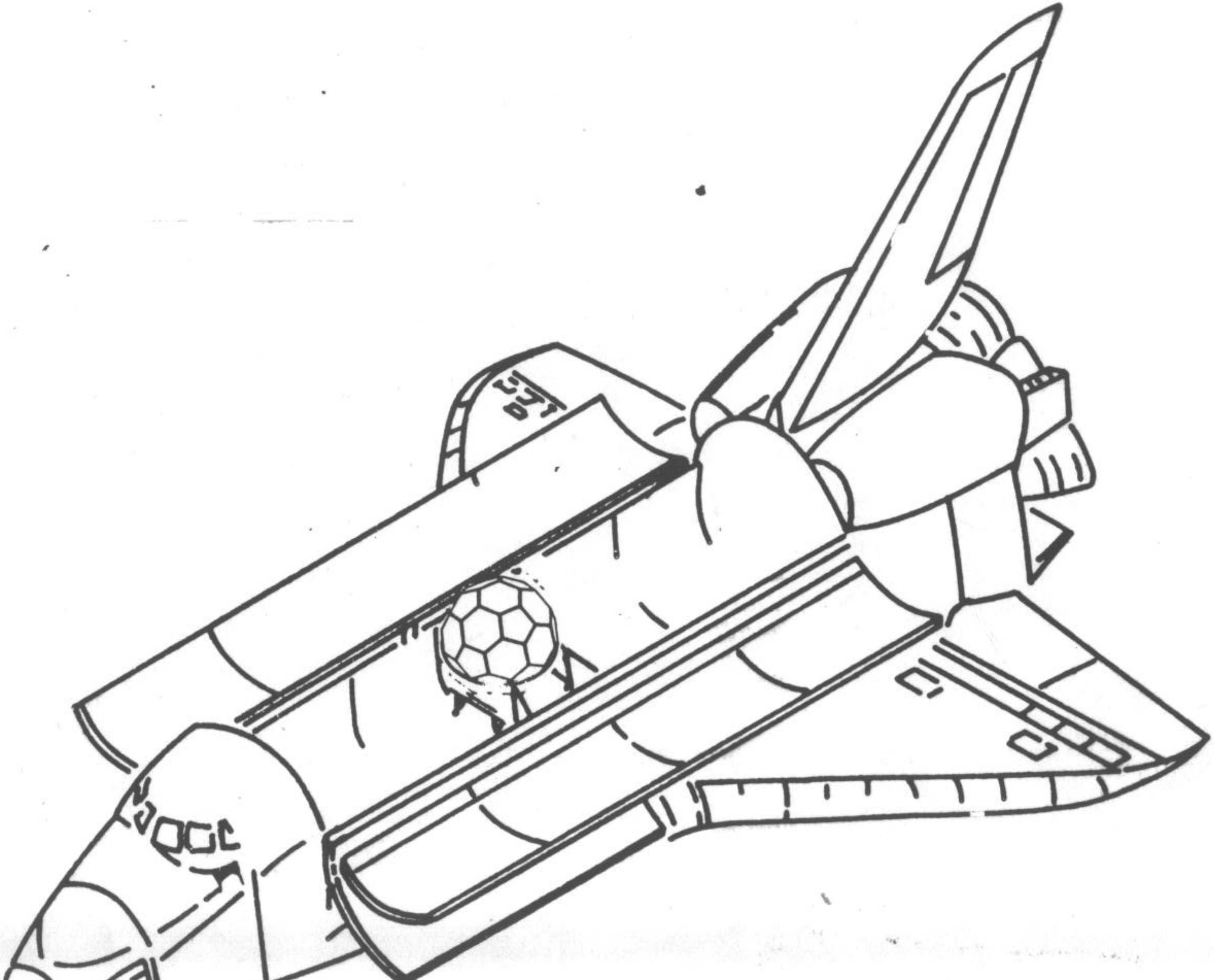


Fig. 13. Perspectives of the detector arrangement, as if transparent, to indicate the projected area from 0, 30, 60 and 90 degrees from zenith.

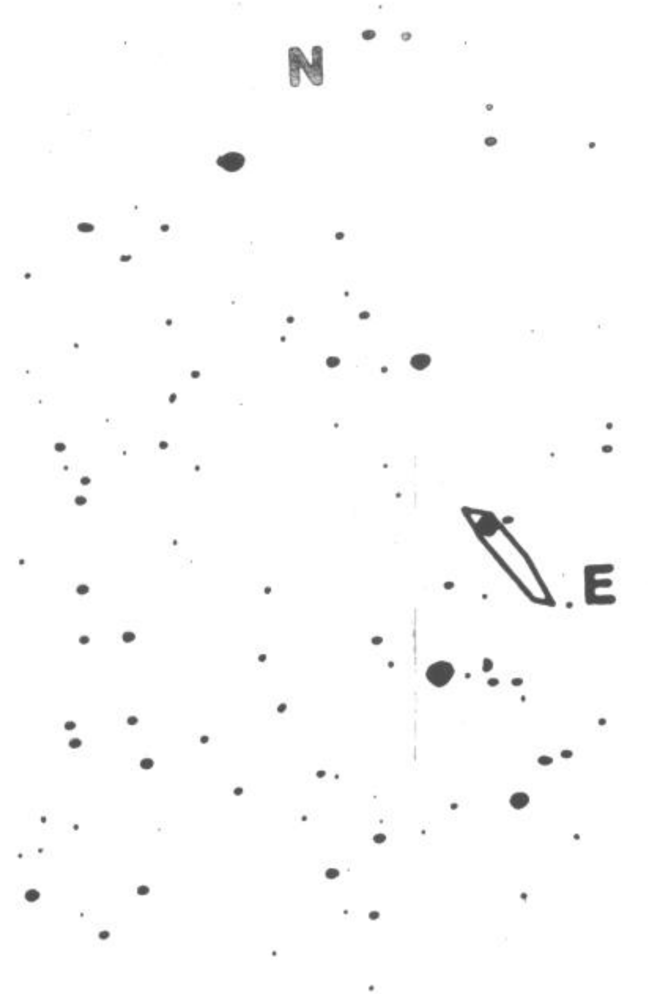


TYPICAL DETECTOR CROSS SECTION

Fig. 14

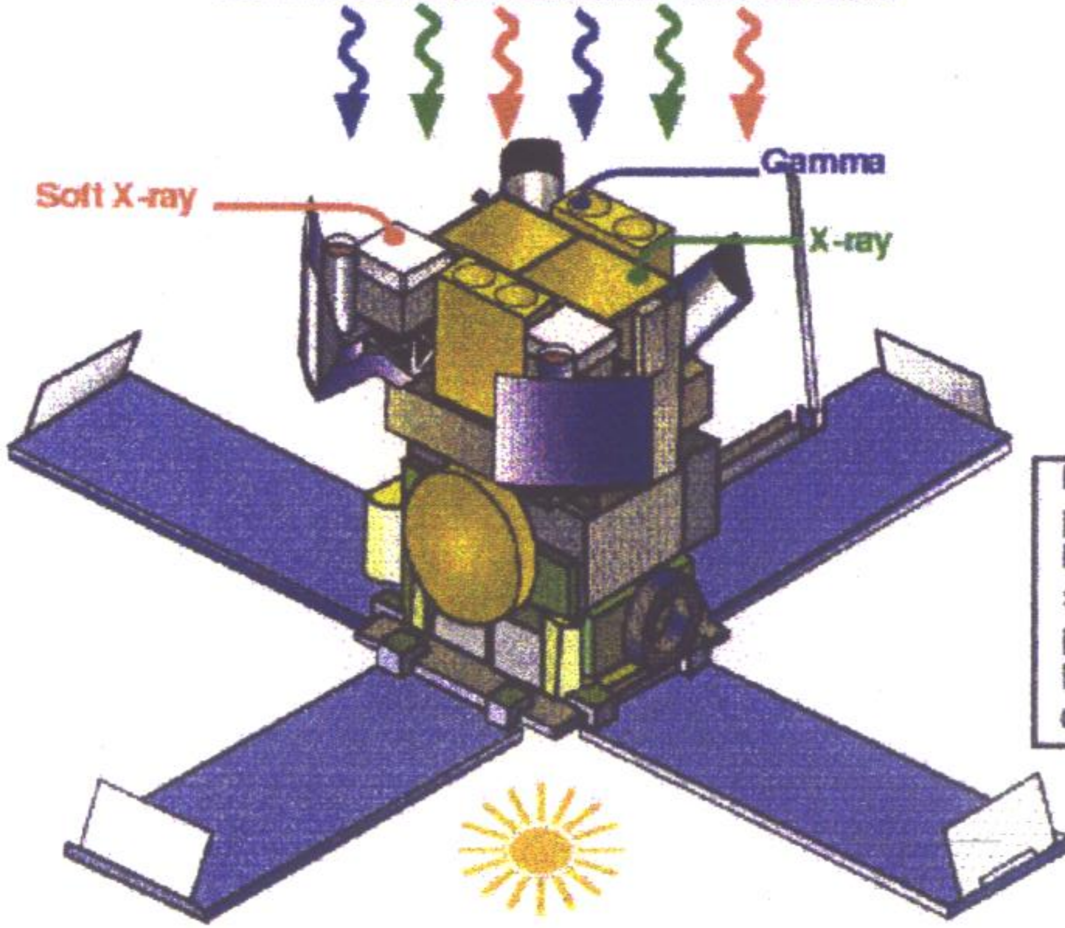



N
E
5'


N
E

HETE

Payload: Gamma ray Detectors
X-ray Monitor
Soft X-ray CCD



Structure: Instrument housing and boxes provide mechanical structure; passive thermal control.

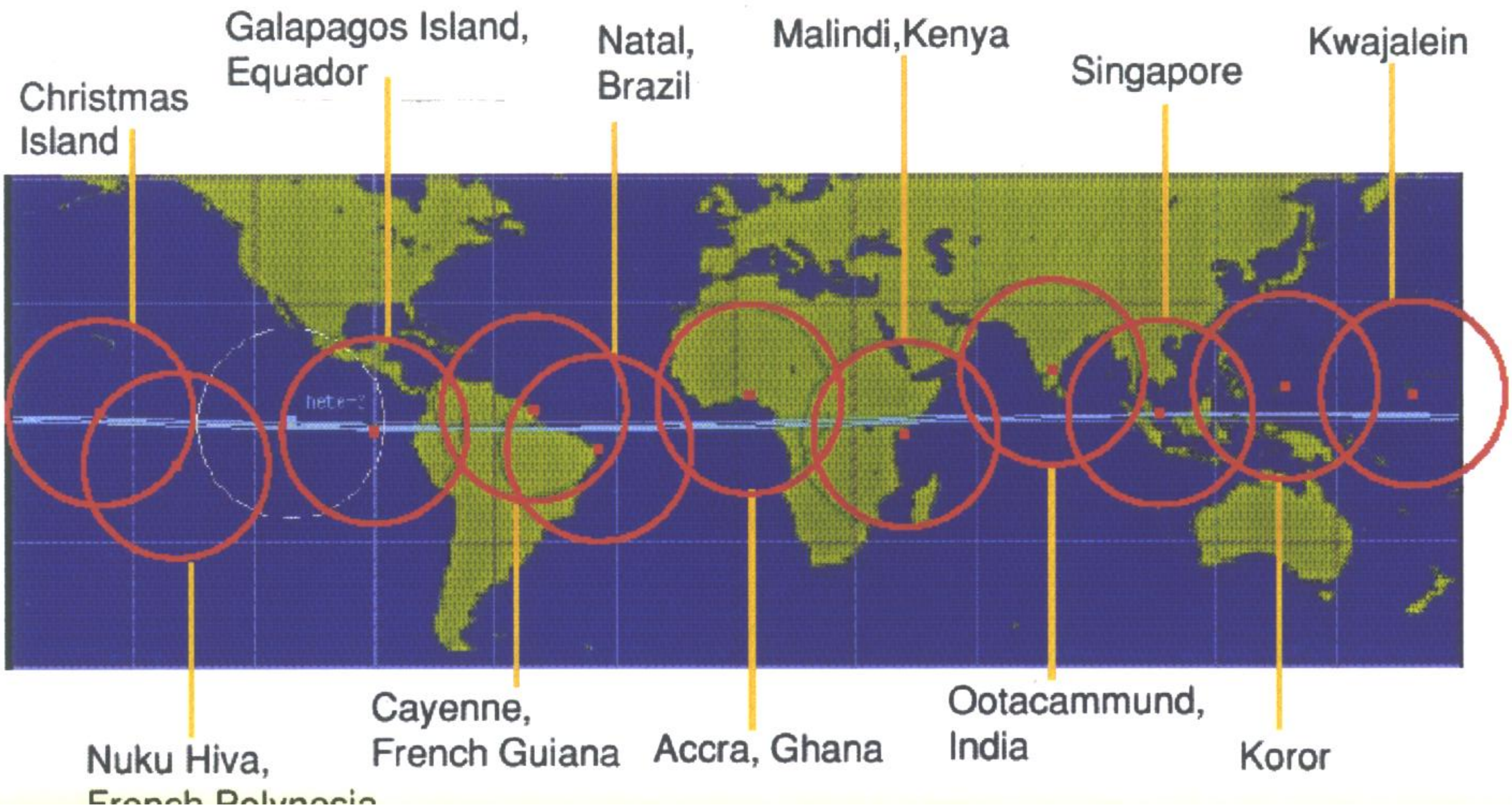
Attitude Control System: 3 torque coils, one coarse sun sensor array, medium and fine sun sensors, one momentum wheel.

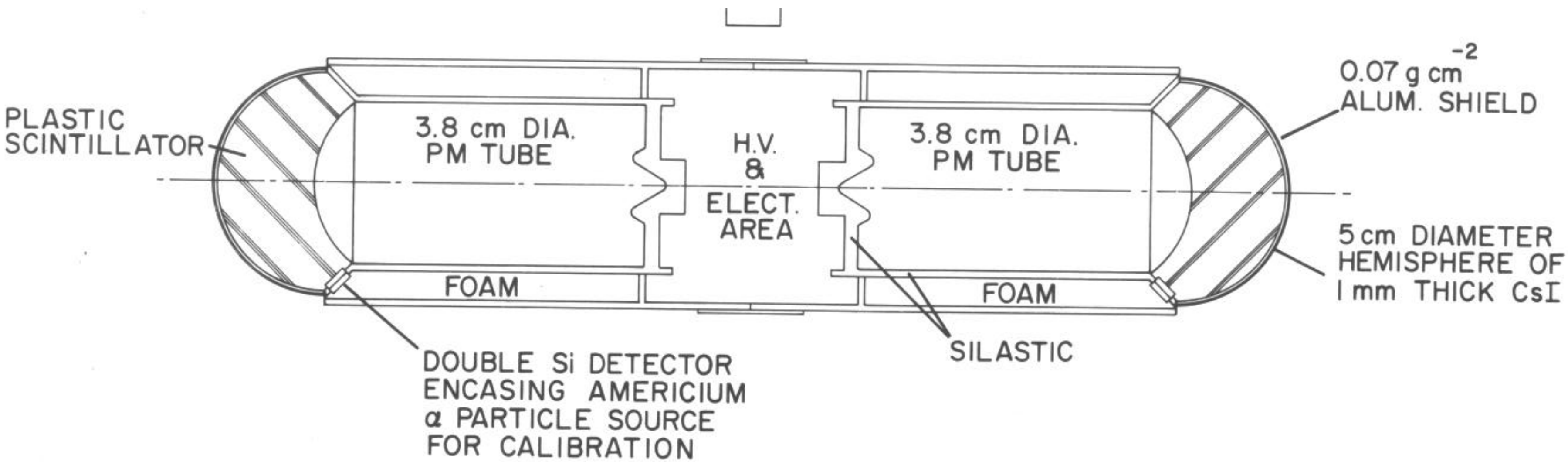
Central electronics box: Microprocessors (100 Mips), mass memory (96 Mbytes), interface cards.

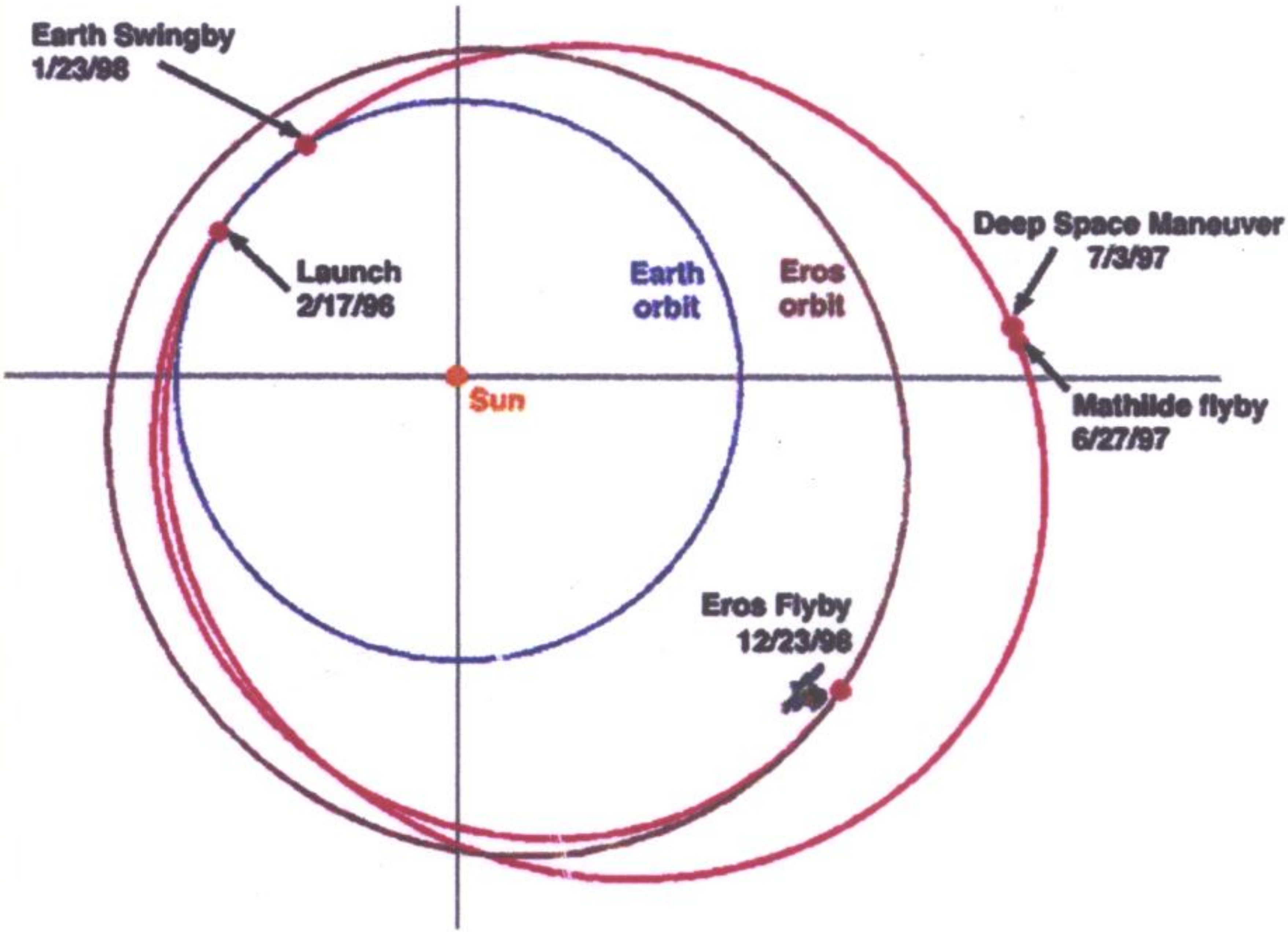
Power System: 4 panels, Aluminum honeycomb structures, silicon solar cells; power point tracker; NiCd batteries; digital control.

Communication system: 5 S band hemispheric antennas; S-band 250 kbit/sec transmitter ; S band receiver; VHF 300 bit/sec transmitter; GPS receiver.

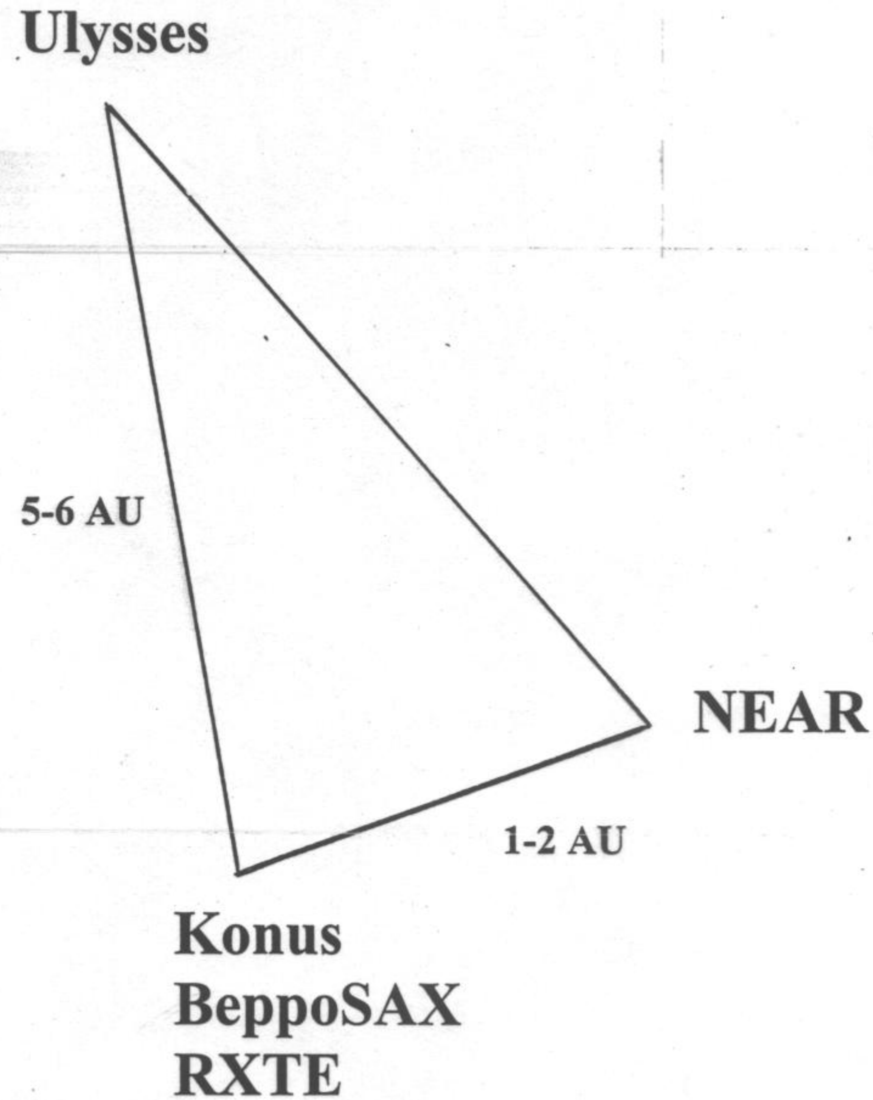
HETE-2 Secondary Ground Stations

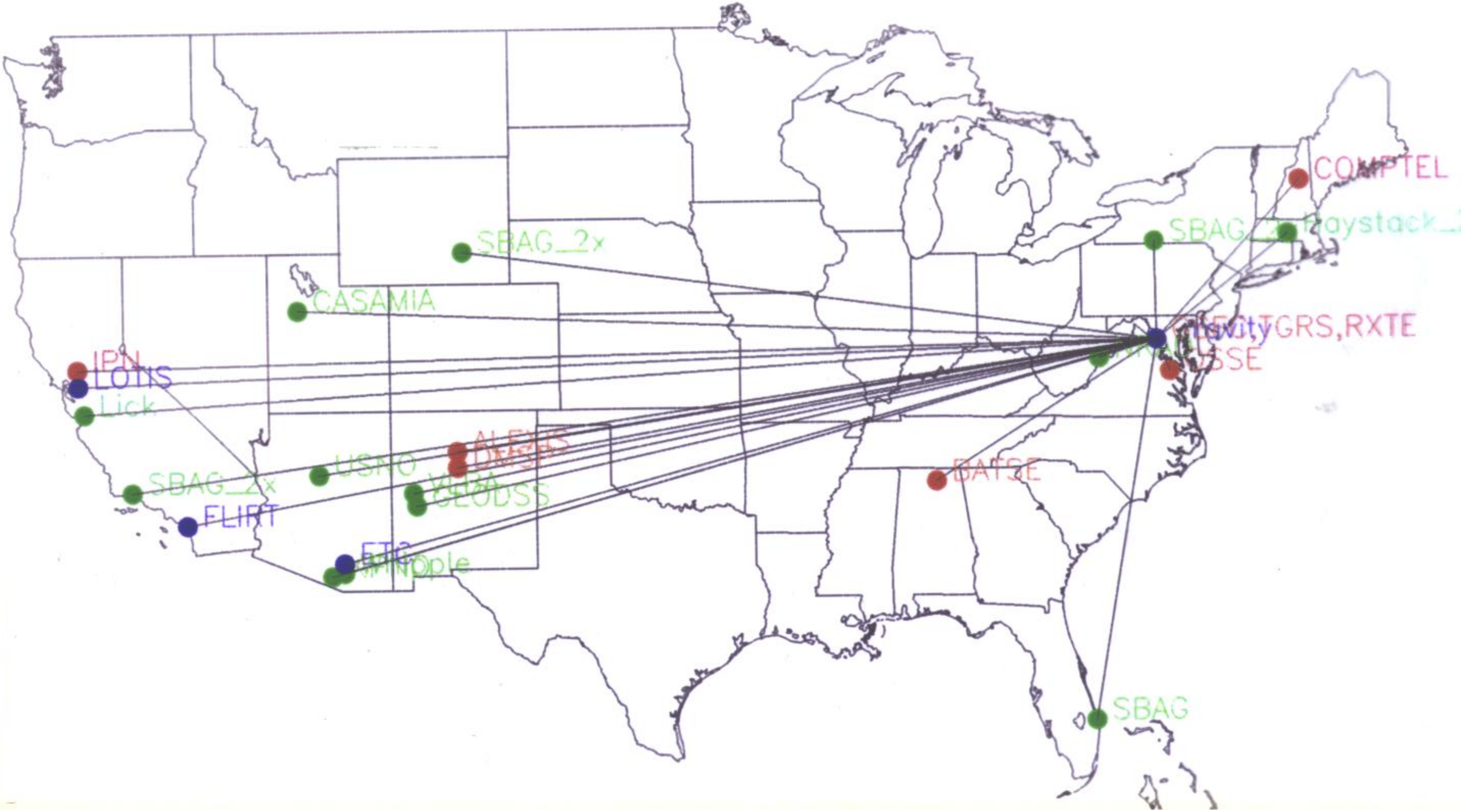



PLASTIC SCINTILLATOR
3.8 cm DIA. PM TUBE
H.V. & ELECT. AREA
3.8 cm DIA. PM TUBE
0.07 g cm^{-2} ALUM. SHIELD
5 cm DIAMETER HEMISPHERE OF 1 mm THICK CsI
FOAM
FOAM
SILASTIC
DOUBLE Si DETECTOR ENCASING AMERICIUM α PARTICLE SOURCE FOR CALIBRATION

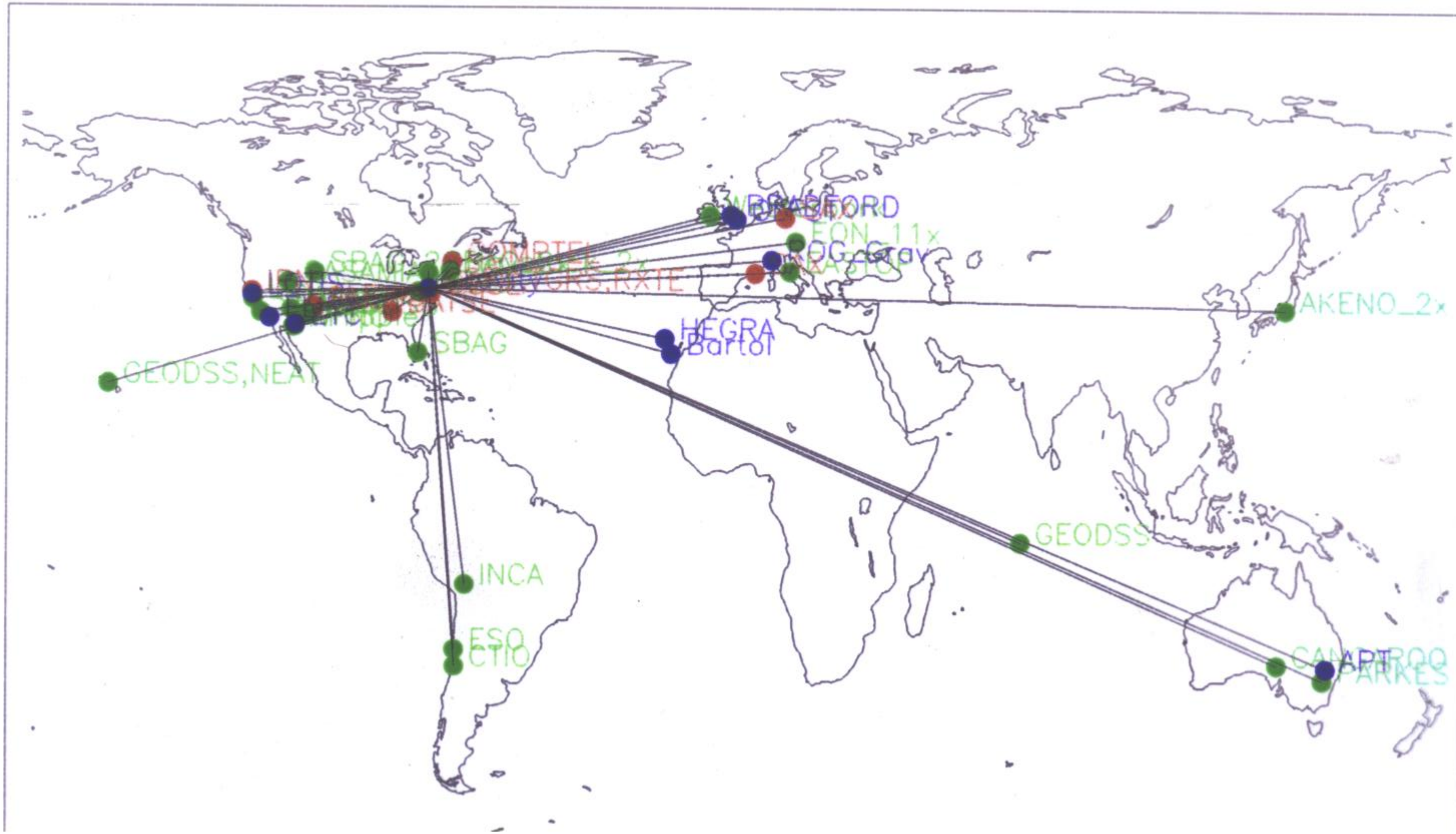


Earth Swingby
1/23/98
Launch
2/17/96
Earth
orbit
Eros
orbit
Deep Space Maneuver
7/3/97
Mathilde flyby
6/27/97
Sun
Eros Flyby
12/23/98

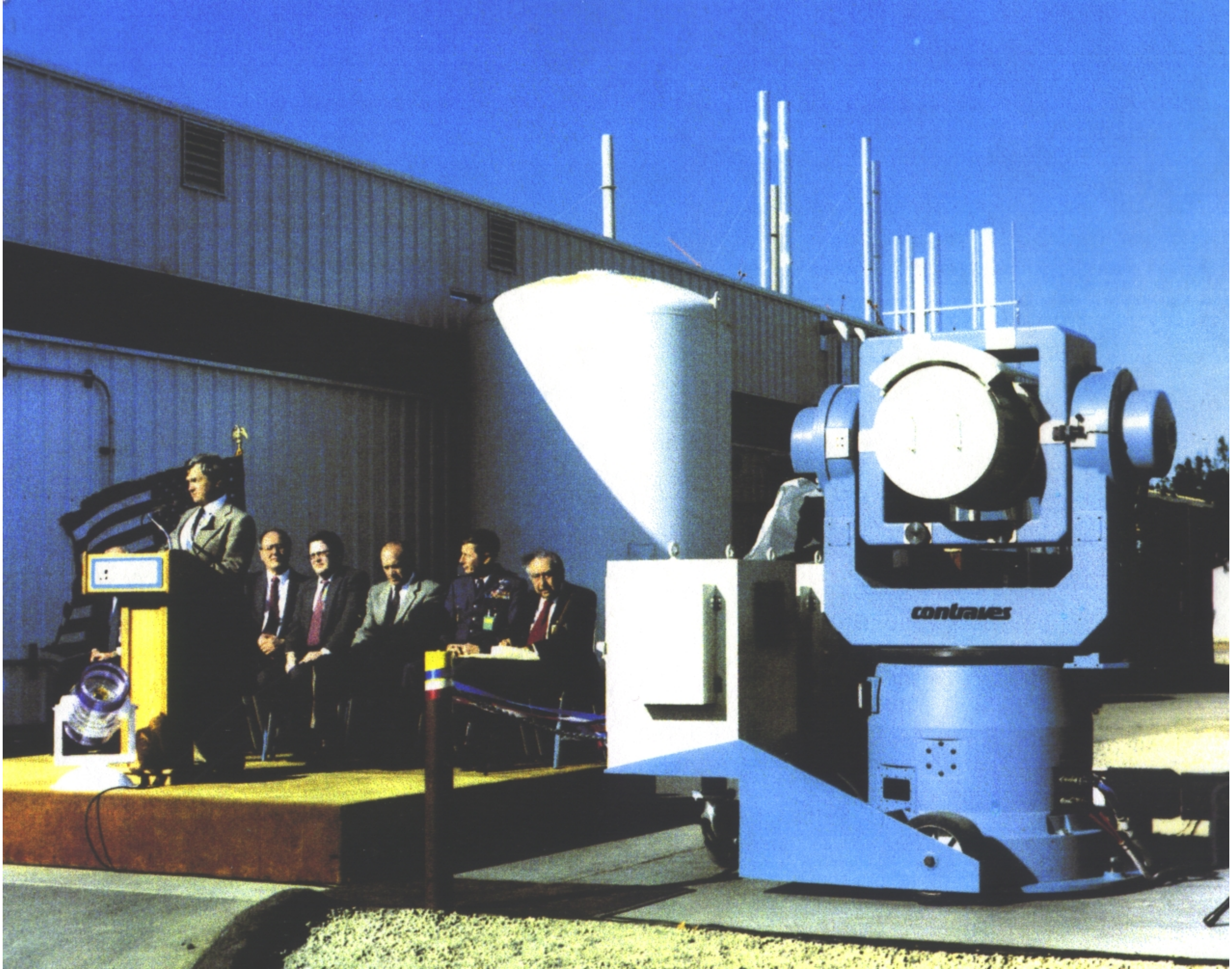

Ulysses
5-6 AU
NEAR
1-2 AU
Konus
BeppoSAX
RXTE


COMPTEL
SBAG_2x
CASAMIA
IPN
LOTIS
Lick
USNO
SBAG_2x
FLIRT
BATSE
SBAG

GCN Sites



BRADFORD
EON_11x
HEGRA
Bartol
AKENO_2x
SBAG
GEODSS,NEAT
GEODSS
INCA
ESO
CTIO
APT
PARKES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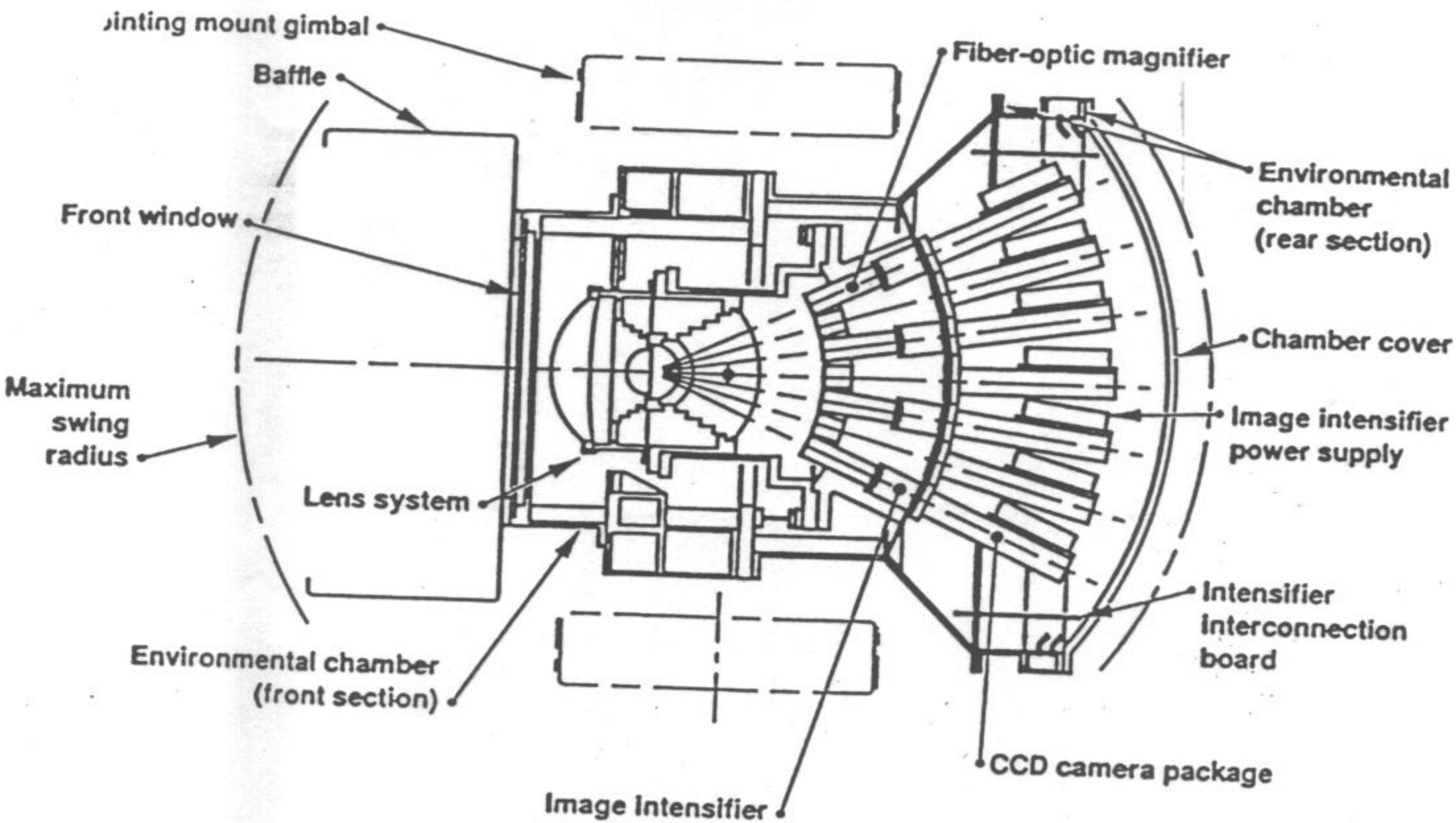
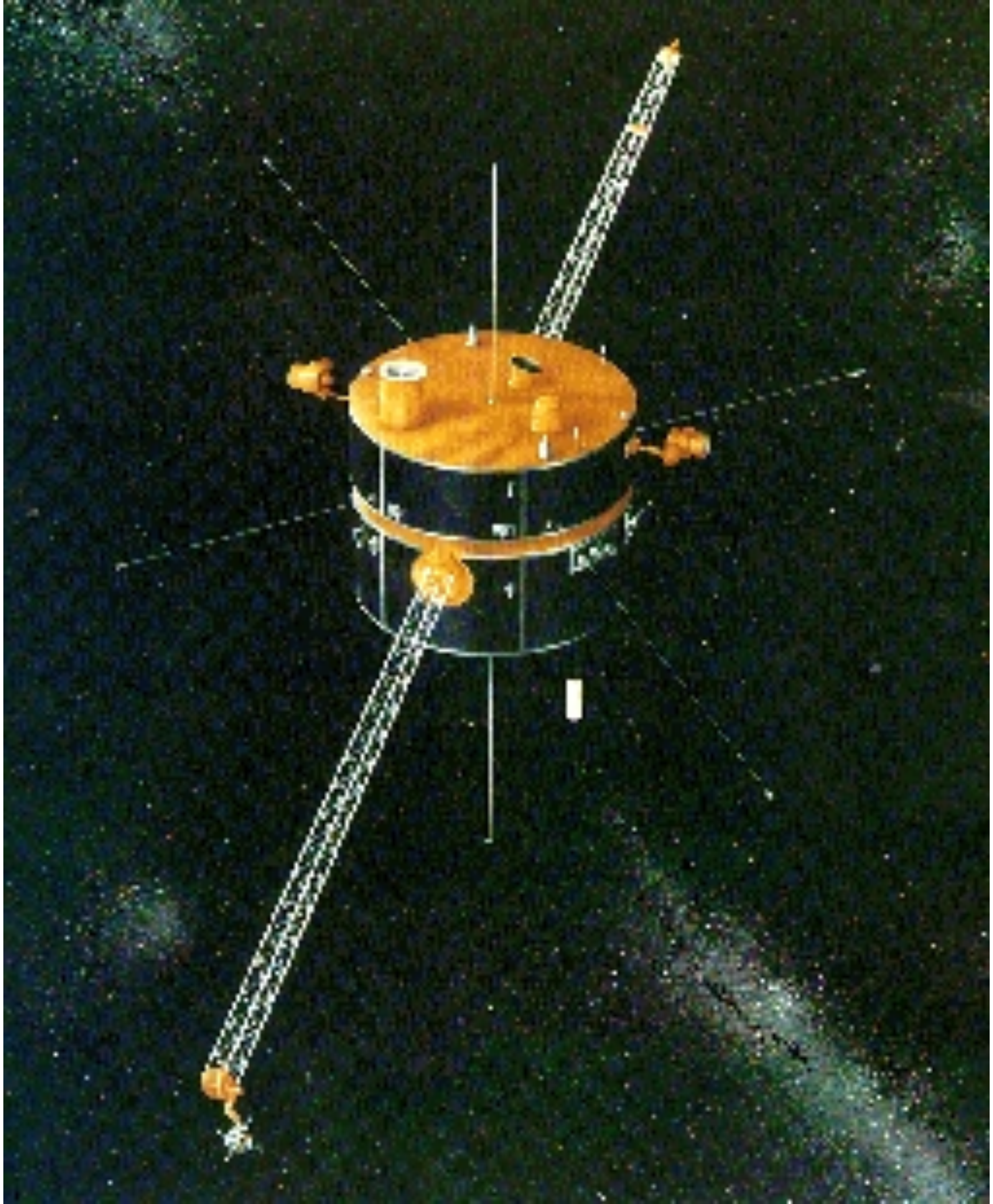
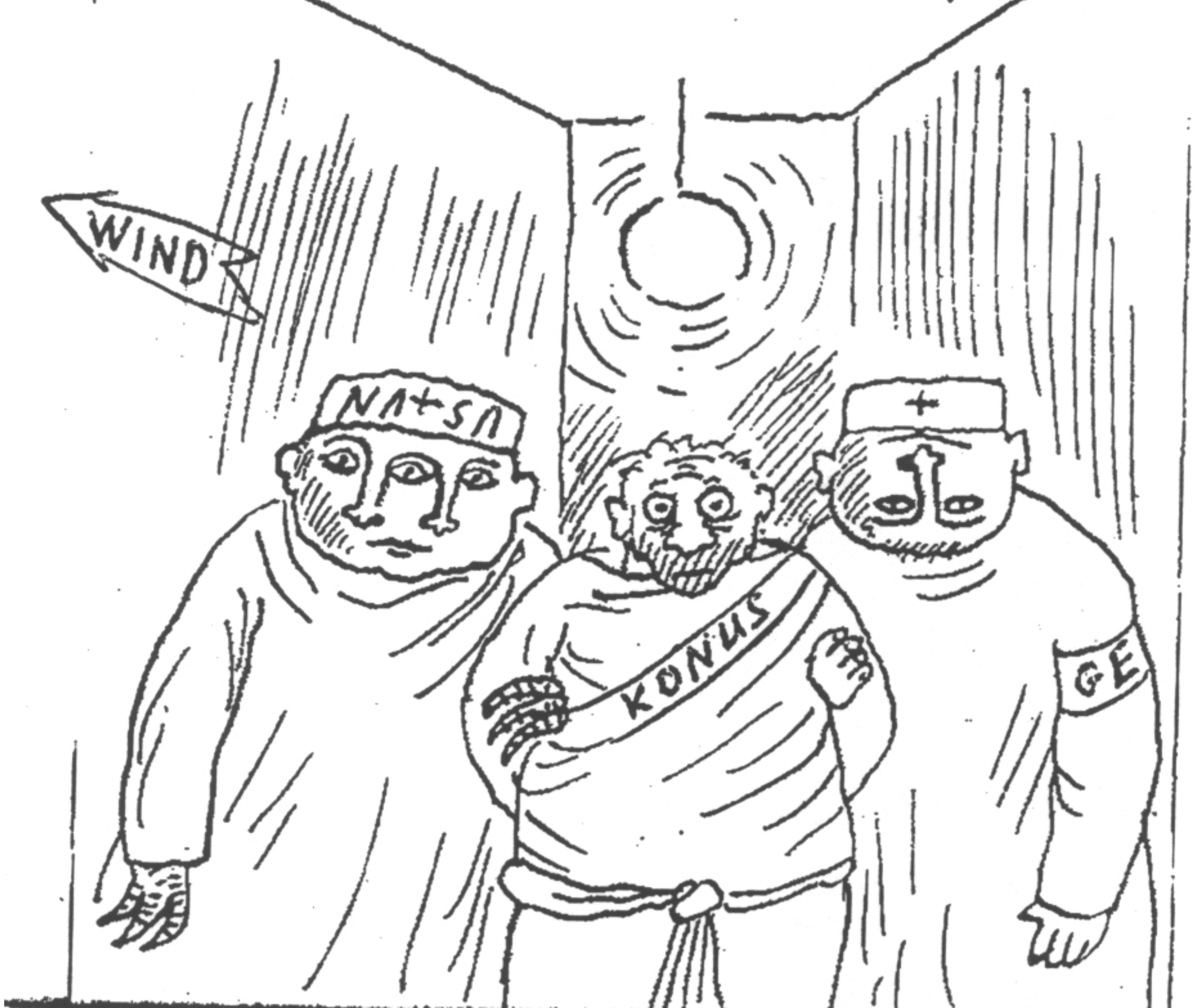


ointing mount gimbal
Baffle
Front window
Maximum swing radius
Lens system
Environmental chamber (front section)
Image intensifier
Fiber-optic magnifier
Environmental chamber (rear section)
Chamber cover
Image intensifier power supply
Intensifier interconnection board
CCD camera package





WIND
NA+SA
+
KONUS
GE