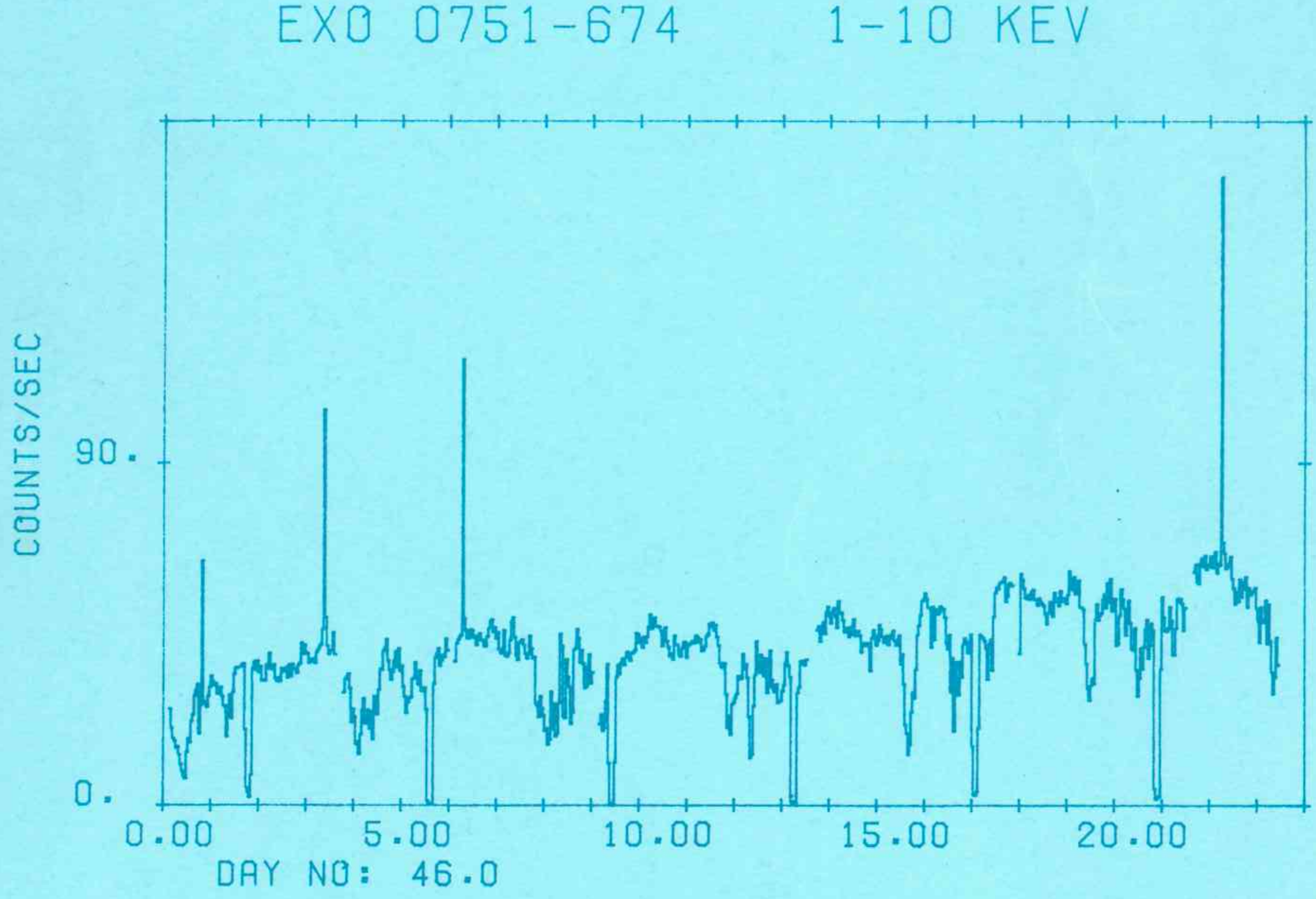
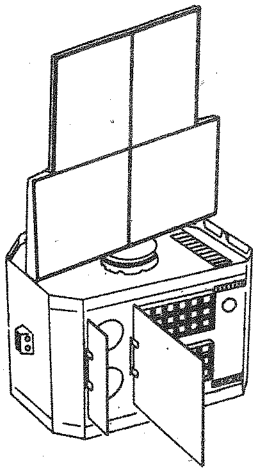
EXOSAT EXPRESS

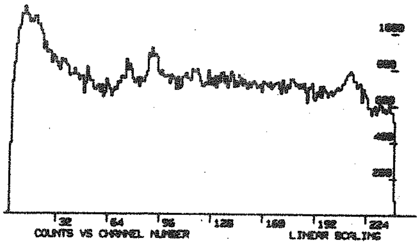


EXOSAT
EUROPEAN X-RAY ASTRONOMY SATELLITE

No. 9 February 1985



EXOSAT EXPRESS



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Front Cover

Discovered during a slew, the X-ray transient EXO 0748-676 exhibits a remarkable range of phenomena including periodic eclipses, irregular intensity dips and bursts as shown in its X-ray light curve measured in a subsequent observation. EXOSAT's precise position determination has led to an identification by astronomers at ESO with a 16th magnitude blue object.

Courtesy: A.N. Parmar

FOREWORD

Selection of the 12 month AO-3 programme of EXOSAT observations was carried out by the Committee on Observation Proposal Selection (COPS) at their meeting on 4-7th February in ESTEC. This AO elicited from the astronomical community 491 proposals requesting 6429 units (2233 pointings) of observation time, an oversubscription by approximately a factor of 5. 205 proposals were selected as the AO-3 observation programme, requiring 1375 units of observation time at 410 separate pointings.

Following the X-gyro malfunction on day 366 (ref. Express No. 8 p.2) a number of discussions have reviewed the initial data and that of further 'events' - see this issue p.2. Although the X-gyro is presently not in use, there is no concrete evidence to suggest that it could not be used at least partially should a second gyro 'fail'. Furthermore, work is in progress to define the procedures required for operation with 2 gyros only. Attention is drawn to the article on p.48 which describes the current resource budget and the implications for extension of the mission lifetime beyond its natural termination of April 1986.

In this issue of the Express, complete lists of AO-1, PV/Cal and TOO observations are given. Note that the bibliography listing has been re-arranged such that the subject is presented first. Future lists will be grouped in a general sense according to subject matter.

An announcement is made on p.58 of the intention to hold a second EXOSAT Data Analysis Workshop at ESOC from 22/5 to 24/5. Scientists active in EXOSAT data analysis and who wish to attend are urged to complete the questionnaire and return it to the Observatory as soon as possible.

EXOSAT EXPRESS

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OBSERVATORY STATUS AS OF 28.2.85

Scheduling of a number of approved AO-3 observations started immediately after the COPS approval of the programme. Approximately 70 AO-2 pointings (15% of the programme) are outstanding and will be interleaved with the AO-3 observations.

1. Hardware

Several anomalous 'events' have occurred during the period 1.1.85 - 28.2.85 following the X-gyro malfunction on day 366 (84).

During the normal recovery procedure from the safety mode event of day 366 associated with the X-gyro switch off (Express No. 8 p.2), a second safety mode was triggered on day 1 when the AOCS outer loop was closed on two axes only with the Skew(S) gyro in operation. Later analysis showed that outer loop closure must be carried out simultaneously on all three axes when the S-gyro is active in the control loop.

Excessive fuel consumption (propane) has occurred between days 3 and 10 because of double-sided limit cycling on the X-axis caused by multiple firing of the thruster on both sides of the cycle. Analysis of the software flow charts suggested that this behaviour could arise if certain control parameters had an incorrect value (eg. a corruption of memory); this was verified by subsequent readout of the RAM locations and the problem 'solved' by re-writing the locations to their correct values. On two further occasions, RAM Data has been found to be corrupt and was re-written from ground.

A review of the X-gyro malfunction event was held at ESOC on 10/1 and recommended that, since the gyro appeared to function nominally in terms of spin rate etc. and that the anomaly might be related to power supply problems, the gyro should remain on continuously but not be used for control. Although the input current continued to exhibit its high anomalous state with periodic reversion to nominal, no evidence existed to suggest that the X-gyro could not be used again in the event of a further gyro failure.

Status changes of the Y-gyro health monitor have occurred in the recent past. Since the X-gyro switch-on above and associated higher temperature of the gyro box the frequency has increased giving rise to an increased probability of safety mode triggering (2 gyros 'failed' - X-gyro health monitor is always 'fail' after the event on day 366). Because of this, the hardware safety monitoring circuitry has been disabled and the relevant tasks implemented in an OBC program which essentially re-enables the hardware function should a genuine 'safety mode' condition occur.

Safety mode was, however, triggered on four separate occasions on days, 12, 19, 2 and 30 by the Y-gyro health monitor status change during the program design, implementation and testing period. A few seconds after the safety mode trigger on day 28, a 'thruster-on' condition occurred (in autonomous mode) resulting in the following sequence of events:

- spin-up about Y-axis.
- periodic telemetry lock loss
- anomalous spacecraft motion with the sun oscillating in the X-Y plane and moving away from the Y-axis to a position at $\approx 55°$ from the Y-axis in the X-Y plane.
- final spin-up to 1.4 rpm.
- sun acquisition commanded from ground.
- normal 'safety mode' configuration.

Estimates suggest that approximately 10% of the remaining propane was consumed during this one event ('thruster on' condition in safety mode).

On day 30, safety mode triggering occurred during LOS and at AOS the spacecraft was in autononous mode with AOCS control switching rapidly between RCE1 and RCE2. It is believed that the sequence of events was as follows:

- OBC program spuriously re-enabled the hardware safety mode function (specification error).
- triggering of safety mode because of X and Y-gyro health monitors indicating 'fail' (not observed in LOS).
- on detection of a safety mode condition, the OBC program continuously enabled safety mode, which apparently in autonomous mode causes CSS and RCE switching. The program has since been modified such that commands are issued once only.

It is estimated that between 400 and 700 grams of propane were consumed by this event - note that a 'normal' safety mode trigger uses between 20 and 80 grams of propane.

A further safety mode trigger on day 21 was caused by an erroneous conclusion by the automatic command program that one slew had completed (use of bad quality data despite a quality check), and initiation of a second slew whilst the first was still in progress with subsequent incorrect attitude of the spacecraft. Additional quality checking of the telemetry data has been incorporated.

On day 40, the gyro box temperature increased from 67° to 74° over a period of approximately 5 hours. Subsequently, oscillatory behaviour of both temperature and X-gyro motor current was observed, culminating in a maximum temperature of 76.6°C and 'full scale' current (255 mA = 255 counts). The X-gyro was switched off on day 42 and since then the temperature has varied between 62°C and 64°C. Note that the number of Y-gyro health monitor status changes was one in the period 12/2 to 28/2.

There have been no changes in the status of the payload hardware. CMA2 has been operated continuously for each observation since 15/2 but shows no evidence of nominal behaviour. Additional calibration data from the CRAB observation (day 36) has led to a refined adjustment procedure of the ME detector preamplifier gains to compensate for gas leakage.

2. Performance and Operations

Tables 1 and 2 on p. 7/8 give the current performance parameters of the EXOSAT instruments.

During the period 1.1.85 - 28.2.85 loss of observation time has resulted from the X-gyro malfunction (14 hrs, day 1), solar activity (4 hrs, day 4), and various safety mode triggers (days 13,19,21,28,31; 9,8,9,20,8 hrs).

Note that the Skew(S) gyro is now used instead of the X-gyro for spacecraft pointing control.

On day 15 a 'natural' occultation of the X-ray source 4U1530-44 was carried out, mainly to verify the required ground system software and operational procedures. All aspects of the system performed satisfactorily and a strategy for use of the hydrazine orbit modification facility for mission lifetime extension or occultation observations can be developed (ref. under 'Future Plans').

In order to avoid spurious safety mode triggering and the inherent danger of excessive propane loss (eg. event on day 28) when the Y-gyro health status switches from 'good' to 'fail' (X-gyro health status is always 'fail'), safety monitoring tasks have been implemented in software. The hardware safety-monitoring circuitry is disabled and an OBC program monitors continuously the status of various sun presence indicators and the rate of decrease of pressure in the plenum chambers of the RCE. If a genuine safety condition is indicated (sun in forbidden zone, thruster stuck open) the program re-enables the hardware function, which executes autonomous mode in the normal manner. The spurious 'two gyro fail' situation is therefore ignored.

A risk with this operational procedure is an OBC software halt/corruption during LOS followed by a genuine safety mode condition which would not then be recognised. Measures have been taken to reduce the likelihood of spurious OBC malfunction, and the possibility of re-enabling the hardware function, should a genuine OBC halt occur (CPU overload error), is being assessed. In any case the probability of a genuine safety mode condition during LOS is low (none since the launch); safety conditions tend to occur when operations on the satellite are in progress. Together with the low probability of a CPU halt, this risk of non-recognition of a safety mode condition during LOS is considered justifiably small, given the current hardware status.

Attention is drawn to the article (p.40) which discusses the dependence of CMA1 temperature on β-angle and integrated on-time of the A1 28V power line and the implications for the planning of long-duration observations.

3. Observation Output

Both FOT production and automatic analysis of the data are completed at the Observatory within about 20 days of the observation, with the exception of a small backlog in the analysis of ME experiment data. FOT's are typically available at ESOC some 10 days after the observation. Automatic analysis is carried out within 20 days of the observation for LE1 and GS experiments and currently, for the ME, with an additional delay of approximately 80 days, although it is expected that this will soon be eliminated. Note that all auto output is checked for scientific integrity which, together with sorting, labelling etc. is a further overhead on the time between observation and despatch of the output to the P.I.

A 'problem' has occurred with the use of the ME background monitoring program MHTR3. Data generated in this mode between day 352 (1984) and day 50 (1985) is affected whenever MHTR3 was used with a sample rate of the ME QE counter of 32 Hz (all other sample rates generate the correct data). Samples 1,3 etc. of the packet (ID = 1072) contain the correct data giving the count rate integrated over 1/32s, but samples 2,4 etc. should be ignored (usually zero, occasionally a random value). MHTR3 has been modified to eliminate this 'error'and all samples in packet 1072 can be regarded as correct after day 50 (1985). Prior to day 352 (1984), sampling at 32Hz was not available as an option.

Standard LE1 CMA background images for the four filters LEXAN 3000 Angstroms, LEXAN 4000 Angstroms, Aluminium/Parylene and Boron have been generated and are available from the Observatory on request. For the LEXAN 3000 Angstrom and Al/P filters, data from single long observations has been accumulated whilst for the Boron and LEXAN 4000 Angstrom filter a number of observations have been combined. Full FOV images, central 1 degree-square images and maximum resolution central images for all filters are available. CRAB calibration data (day 36) is also available on request.

4. Future Plans

EXOSAT's natural lifetime will terminate during April 1986 if the active on-board orbit control system (hydrazine) is not used to increase the perigee height prior to entry into the dense atmosphere. A 'delta-V' capability of 170 m s^{-1} can provide a maximum mission extension of slightly in excess of 12 months. However the trade-off between remaining propane, use of extra propane during the orbit modification and/or anomalous situations, and the uncertain hardware situation as the mission progresses (particularly the gyro state-of-health) is difficult to assess. Attention is drawn to the article on p.48 which discusses the current resources and concludes that on balance, extension of the mission should not be undertaken immediately but delayed until early 1986.

Procedures for fuel saving have been implemented - most observations are now carried out with satellite roll information determined from the fine sun sensor and 1 star, and using the OBC program Sun Motion Correction. Manoeuvres are planned to be executed at 42°/hr with the exception of some long Y-slews. Naturally slew durations are longer but this is matched by increased observation times for AO-3 as a rule and observational efficiency should not decrease.

Work is in progress on the definition of operational procedures and additional software requirements for the situation of two gyros failed, the so-called 'back-up' mode. Two options are available for manoeuvres, namely 'star hopping' whereby a star is 'moved' successively from one edge of the star tracker FOV to the other ($\lesssim 4°$), and 'direct thruster demand' whereby specific impulses are given to the appropriate thruster without the normal closed-loop control of the manoeuvre by the gyros.

TABLE 1

PERFORMANCE CHARACTERISTICS (LE)

LE1	Characteristics			
Energy Range	0.04-2 keV (6-300 A) CMA* 0.3 - 2 keV PSD			
Energy resolution	Five filters are available for broad-band spectroscopy (CMA) $(\Delta E/E) = 41/E(keV)^{0.5}$ %FWHM (PSD)			
Field of view	2.2° diameter (CMA) 1.5° diameter (PSD)			
Effective area (cm^2)	Thin Lexan Filter	Al/P Filter	Boron Filter	Open position (PSD)
.05 keV	0.4	2.6	-	-
.1 keV	11.1	0.4	-	-
.5 keV	4.5	3.3	0.4	1.9
1.0 keV	3.2	2.5	2.0	13.5
1.5 keV	2.2	1.6	1.8	9.7
2.0 keV	0.6	0.5	0.6	1.9
Spatial resolution (Line spread function HEW)				
On axis :	18 arc sec (CMA) 3 arc min (PSD)			
20 arc minutes off-axis:	40 arc sec (CMA) 3.5 arc min (PSD)			
Average steady residual background**	1.8 cnts/sec/cm^2 (CMA) 0.7 cnts/sec/cm^2/kev (PSD)			

* Subject to UV contamination between 900 - 2600 A
** Background rate subject to flaring

TABLE 2

PERFORMANCE CHARACTERISTICS (ME & GSPC)

Medium Energy Experiment	Characteristics
Total effective area	1500 cm^2 (all quadrants co-aligned)
Effective energy range	1-20 keV (Argon proportional counters) 5-50 keV (Xenon proportional counters)
Energy resolution ($\Delta E/E$)	51/E $(kev)^{1/2}$ % FWHM (Argon counters) 18% for 10 keV$\leq$E$\lesssim$30 keV (Xenon counters)
Field of view	45 arc minutes FWHM, triangular response with a 3' flat top
Total residual background	4 cnts/sec/keV (2-10 keV Argon counters co-aligned)
Gas Scintillation Counter (GSPC)	
*Total effective area	100 cm^2 (ref. p. 26)
Effective energy range	2-18 keV or 2-40 keV, depending on gain setting
Energy resolution ($\Delta E/E$)	27/E $(kev)^{1/2}$ % FWHM
Field of view	45 arc minutes FWHM triangular response with a 3' flat top
Total residual background rate	1.3 cnts/sec/keV (2-10 keV)

* depends on E and burst length window setting

AO-2 OBSERVATIONS 1.1.85 - 28.02.85

Day (85)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator	
001	16.10	4U1145-619	11 45 47	-61 58 14	76	10 41	Willingale	
002	06.06	NGC 4151	12 07 49	+39 43 01	112	7 24	Perola	
002	18.18	4U1145-619	11 45 47	-61 58 15	77	6 18	Willingale	
003	02.27	BURST WATCH	05 25 29	-66 08 28	89	14 14	Staubert	
004	14.26	MKN 421	11 01 27	+38 28 54	126	3 37	Bowyer	
004	21.24	4U1145-619	11 45 51	-61 57 29	78	6 13	Willingale	
005	05.38	NGC 3783	11 36 42	-37 29 42	91	6 28	Bell-Burnell	
005	15.30	2A1219+305	12 18 41	+30 28 41	110	3 4	Warwick	
005	21.50	4U1145-619	11 45 51	-61 57 29	89	5 46	Willingale	
006	06.18	IH1055+299	10 55 05	+29 55 06	128	3 31	Wood	
006	12.20	PG1346+082	13 46 26	+08 12 26	84	3 9	TOO	
006	18.00	NGC 2992	09 43 13	-14 08 16	127	3 39	Pounds	
007	00.23	X0512-40	05 12 30	-40 08 37	111	5 37	Ecran	
007	08.45	PKS0349-14	03 49 02	-14 40 02	118	2 25	Bradt	
008	03.23	NGC 1068	02 39 58	-00 15 45	109	14 32	Lawrence	
008	21.05	4U1145-619	11 45 51	-61 58 05	80	6 32	Willingale	
009	05.05	HD 88661	10 10 07	-57 51 50	92	3 58	Henrichs	
009	12.15	FORNAX	02 37 33	-34 44 53	92	8 7	Markert	
009	23.10	GK Per	03 27 44	+43 40 55	127	18 19	Watson	
010	21.30	44 BOO	15 02 07	+47 53 59	91	7 56	Heise	AO-1
012	03.00	RZ LEO	11 34 48	+02 06 00	118	3 0	TOO	
012	10.10	A376	02 42 32	+36 37 37	116	8 15	Mushotzky	
012	21.15	IH1430+423	14 26 36	+42 56 11	95	2 10	Schwartz	
013	02.45	A400	02 54 52	+05 48 22	110	14 11	Morini	
014	09.11	NGC5548	14 15 44	+25 24 22	91	5 56	Branduardi	
014	17.20	HD108767	12 27 24	-16 15 44	101	6 6	Gamm	
015	16.42	4U1530-44	15 30 57	-44 15 52	57	18 57	Occ. Cal.	
016	20.48	HT Cas	01 06 51	+59 45 59	102	4 12	TOO	
017	03.36	3A1346+259	13 46 48	+26 51 27	100	13 80	Perola	
017	21.50	Puppis A	08 21 16	-42 47 19	116	10 31	Aschenbach	AO-1
018	11.55	TT Ari	02 03 03	+14 55 18	95	7 22	Beuermann	
019	09.28	G292.0+1.8	11 22 41	-58 58 43	90	10 2	Peacock	AO-1
020	02.55	2A1219+305	12 19 01	+30 29 08	122	2 34	Warwick	
020	06.41	HZ43	13 14 04	+29 22 13	111	6 90	LE Cal.	
020	18.50	Perseus East	03 19 01	+41 17 43	116	8 50	Branduardi	AO-1
021	04.50	NGC 1275	03 16 21	+41 17 43	115	14 21	Branduardi	AO-1
023	08.00	NGC5506	14 10 52	-02 56 26	91	4 30	McHardy	AO-1
023	13.27	A1837	13 59 17	-10 54 27	91	5 18	McKechnie	
023	22.06	H0323+022	03 23 33	+02 11 52	105	8 0	Bradt	
024	08.40	AKN 120	05 13 34	-00 15 16	129	5 56	Pounds	AO-1
024	17.26	H0452+51B	05 00 21	+51 58 27	128	2 61	Tuohy	
025	00.48	H0323+022	03 23 33	+02 11 52	104	5 18	Bradt	
025	07.45	0235+164	02 35 58	+16 21 30	96	5 56	McHardy	
025	14.44	NRAO 140	03 33 14	+32 06 45	111	18 19	Marscher	
027	02.12	1E1207+39	12 08 26	+39 43 25	129	25 24	TOO	
029	09.24	2A1219+305	12 18 52	+30 27 14	130	4 23	Warwick	
029	16.45	GL 569	14 52 17	+16 19 16	93	2 55	De Korte	

Day (85)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
031	09.00	PG1346+082	13 46 36	+08 13 56	108	5 36	TOO
031	16.06	1402+04	14 02 28	+04 17 20	103	18 13	LE CAL
032	13.35	3C273	12 26 41	+02 20 19	126	5 25	Turner AO-1
032	21.37	NGC5506	14 10 47	-02 57 29	100	5 51	McHardy AO-1
033	09.32	3C390.3	18 46 45	+79 42 44	98	15 30	TOO
034	11.56	3A1239-59	12 39 27	-59 54 50	92	8 28	Trümper
035	01.48	1308+326	13 08 14	+32 39 10	123	2 0	McHardy
035	07.50	PKS0537-441	05 37 21	-44 06 47	102	3 54	Mushotzky
035	15.17	MKN 478	14 40 13	+35 41 06	105	5 43	Bergeron
035	22.15	MK 464	13 53 52	+38 51 06	115	6 19	Bell-Burnell
036	08.45	Crab	05 31 25	+21 56 33	127	23 22	GS/ME CAL
037	12.24	1402+04	14 02 29	+04 17 33	109	4 22	TOO
038	06.40	IH0628-609	06 29 28	-61 05 06	96	9 25	Schwartz
038	18.25	GX301-2	12 24 15	-62 29 54	94	25 12	TOO
039	22.09	0317+18	03 16 53	+18 32 55	92	4 55	Maccagni
040	04.56	4U0404+47	04 03 47	+47 38 23	106	3 23	Van Paradijs
040	10.48	4U0322+59	03 22 20	+59 30 42	101	2 57	Van Paradijs
040	17.58	GL 494	12 59 49	+12 40 16	129	2 31	De Korte
040	23.00	GL 526	13 43 26	+15 10 33	119	2 50	Schmitt
041	04.35	NGC5506	14 10 49	-02 57 12	109	5 52	McHardy AO-1
042	01.35	PK303+40.1	12 51 10	-22 35 09	119	3 45	De Korte
042	08.20	Vela X-1	09 00 19	-40 23 37	124	7 30	Peacock AO-1
042	19.18	1323-62	13 23 27	-61 47 48	92	35 52	Van der Klis
044	06.59	Vela X-1	09 00 19	-40 23 39	125	13 40	Peacock AO-1
044	23.35	3C120	04 29 52	+05 12 57	101	5 56	Pounds
046	02.52	EXO 0748-673	07 48 26	-67 37 19	96	19 58	TOO
047	00.40	GX301-2	12 24 11	-62 29 51	99	12 46	TOO
047	14.17	1244-588	12 46 55	-58 47 59	101	6 43	TOO
048	00.20	H0900-42	08 50 24	-47 00 00	118	3 9	TOO
048	04.44	Vela X-1	09 00 19	-40 23 33	125	11 20	Peacock AO-1
048	20.18	IH0422-086	04 23 12	-08 44 17	93	2 2	Schwartz
049	22.37	EXO 0748-673	07 48 24	-67 37 23	97	16 8	TOO
050	17.25	GX301-2	12 23 48	-62 49 36	101	23 5	White AO-3
051	21.53	M81	09 51 42	+69 05 10	121	14 56	Barr AO-3
053	08.22	NGC5506	14 10 48	-02 57 11	121	6 48	McHardy AO-1
053	18.38	NGC3783	11 36 45	-37 28 43	129	5 24	Bell-Burnell
054	03.00	H0542-407	05 41 38	-41 05 34	97	11 36	Tuohy AO-3
054	17.36	MKN376	07 10 21	+45 46 24	125	5 16	Pounds AO-1
055	02.28	PKS0539-44	05 37 21	-44 06 47	95	3 7	TOO
055	11.45	1H 1430+423	14 30 11	+42 23 29	118	5 19	TOO
055	21.02	LX Ser	15 35 52	+19 03 05	105	2 26	TOO
056	03.00	Sco X-1	16 17 05	-15 31 14	90	10 52	Priedhorsky
057	11.26	EXO 0748-673	07 48 24	-67 37 24	89	8 18	TOO
057	22.20	Abell 7	05 00 46	-15 42 26	93	3 6	Wolf-Mathies
058	03.40	GX301-2	12 24 10	-62 30 22	107	46 10	White AO-3
060	03.50	2S1417-624	14 17 45	-62 17 45	99	4 12	Corbet

COMPLETE AO-1 OBSERVATION PROGRAMME

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
198	01.42	GX339-4	16 59 02	-48 43 06	137	6 19	Illovaisky
213	02.40	Jupiter	15 53 50	-19 42 05	113	14 40	Schnopper
221	03.22	GK Per	03 27 46	+43 44 24	76	7 0	Watson
228	08.47	3C120	04 29 59	+05 15 00	76	23 53	Chiappetti
229	21.45	1514-241	15 14 45	-24 11 22	89	9 28	Maccagni
230	09.25	Algol	03 04 53	+40 46 00	90	34 0	White
231	21.40	4U1223-62	12 23 50	-62 29 37	80	8 15	Re
232	07.51	NGC1316	03 23 00	-37 12 00	103	4 45	Machetto
232	14.18	NGC1360	03 31 07	-26 02 20	100	3 27	De Korte
232	19.32	Hyades Field	04 19 09	+14 19 30	81	5 59	Schnopper
233	15.00	T Tau	04 19 04	+19 25 04	81	2 52	Brown
233	18.58	Hyades Field	04 25 29	+15 46 29	80	4 38	Schopper
234	02.00	Feige 24	02 32 30	+03 30 59	110	9 43	Heise
234	13.00	Feige 31	03 01 59	+02 45 59	104	3 57	Heise
234	17.56	NGC 1068	02 40 07	-00 13 31	110	12 37	Lawrence
235	07.28	NGC 1090	02 43 59	-00 27 24	109	2 9	Fricke
235	11.45	FA 71	20 14 48	-57 43 00	129	5 23	Fricke
235	19.29	NGC 5506	14 10 42	-02 58 00	62	9 7	McHardy
238	23.35	MKN 506	17 20 42	+30 55 59	97	3 30	Bleeker
239	04.26	2S1957+115	19 57 02	+11 34 15	138	6 59	Pakull
239	13.13	MSH 15-22	15 09 59	-58 56 57	90	3 49	Aschenbach
239	18.02	RCW 86	14 29 26	-62 01 59	87	4 25	Peacock
239	22.57	RCW 86	14 40 01	-62 12 00	87	5 19	Peacock
241	05.09	G191 828	05 48 46	+00 11 12	69	2 42	Heise
241	10.37	MSH 15-52	15 09 59	-58 56 57	99	4 28	Aschenbach
241	17.39	HD 149499B	16 34 19	-57 22 13	99	2 13	Heise
241	22.20	1617-155	16 17 04	-15 31 15	90	6 10	Peacock
242	05.05	1617-155	16 17 05	-15 29 16	90	4 55	Peacock
242	10.35	1617-155	16 17 05	-15 27 15	90	5 24	Peacock
242	16.30	1617-155	16 16 57	-15 26 54	90	2 24	Peacock
242	21.14	4U1626-67	16 27 14	-67 21 16	98	7 52	Mason
243	09.05	3A1246-588	12 46 38	-58 51 00	73	4 0	Warwick
243	14.51	40 Eri-B	04 13 00	-07 44 00	96	5 57	Heise
243	22.27	2A0316+413	03 19 10	+41 20 00	98	7 06	Branduardi
244	23.40	NGC 1685	04 50 03	-03 01 00	98	4 39	Pounds
245	07.10	MKN 1040	02 25 17	+31 05 21	114	1 33	Pounds
245	09.46	MKN 1040	02 20 20	+31 57 43	114	1 22	Pounds
245	13.55	0241+622	02 41 01	+62 15 27	96	5 9	Warwick
246	06.55	Roph (C)	16 24 00	-24 20 00	88	17 46	Montmerle
247	03.14	NGC 6814	19 39 54	-10 26 59	133	5 50	Branduardi
247	11.47	ESO141-G55	19 16 57	-58 45 52	115	3 32	Branduardi
247	17.02	ESO103-G35	18 33 22	-65 28 17	107	8 06	Pounds
248	18.51	NGC 7314	22 33 01	-26 18 00	160	3 58	Pounds
249	01.58	Fairall 9	01 21 51	-59 03 59	121	2 51	Scarsi
249	07.35	3A0234-526	02 36 41	-52 24 30	116	3 14	Pye
249	13.16	NGC 526A	01 22 00	-35 18 00	136	6 20	Turner
249	22.40	1978 Nov 19	01 16 32	-28 53 00	140	22 53	Hurley

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
251	00.20	1803+78	18 03 39	+78 27 54	87	7 18	Biermann
251	09.16	AKN 120	05 13 38	-00 12 16	87	2 44	Pounds
251	13.20	NGC 2110	05 49 47	-07 28 06	78	3 48	Pounds
251	19.43	VW Cep	20 38 03	+75 24 52	96	5 06	Heise
252	15.3	IC 443	06 13 45	+22 40 00	73	5 40	Bleeker
252	22.19	IE0630+1748	06 30 00	+17 47 59	68	9 49	Caraveo
253	10.23	NGC 2264	06 38 17	+09 42 19	67	14 17	Charles
254	02.51	LP658-2	05 52 42	-04 09 00	80	5 54	Heise
254	11.30	4U1715-39	17 15 07	-39 19 12	93	1 21	Van Paradijs
254	14.13	HR 5999	16 05 12	-38 58 22	79	7 8	Brown
254	22.46	4U1705-32	17 05 40	-32 13 12	90	1 30	Van Paradijs
255	03.17	3C 382	18 33 12	+32 39 15	103	5 56	Perryman
256	07.44	SU Uma	08 08 04	+62 45 36	68	3 15	Evans
256	18.12	BD 75-325	08 04 44	+75 06 48	76	2 17	De Korte
256	22.50	Cyg X-2	21 42 37	+38 05 28	132	2 27	Treves
257	04.18	WW Cet	00 08 52	-11 45 27	166	4 22	Beuermann
257	11.15	RCW 86	14 36 48	-62 23 33	76	3 54	Peacock
257	17.04	GX5-1	17 58 03	-25 04 39	99	1 54	Kendziorra
257	21.40	H2252-035	22 52 43	-03 26 40	171	7 19	Pietsch
258	07.48	3U1809+50	18 15 08	+50 00 55	95	1 30	Heise
258	10.05	3U1809+50	18 15 08	+49 30 55	95	6 19	Heise
258	19.20	Cyg X-2	21 42 37	+38 05 28	132	2 3	Treves
258	23.46	GR 372	17 48 53	+70 52 42	89	7 55	Heise
260	04.25	H2252-035	22 52 43	-03 26 40	169	6 17	Pietsch
260	12.58	XB1916-05	19 16 00	-05 19 51	115	7 57	White
260	22.38	V 566 Oph	17 54 23	+04 59 31	94	3 18	Heise
261	04.03	MKN 504	16 59 12	+29 29 00	80	2 43	Bleeker
261	09.13	4U1909+07	19 09 12	+07 37 30	112	1 10	Van Paradijs
261	12.41	4U1812-12	18 12 26	-12 07 48	98	1 25	Van Paradijs
261	16.26	Cyg X-2	21 42 37	+38 05 28	131	1 55	Treves
261	20.46	HD 209943	22 00 13	+82 37 51	95	2 4	Heise
262	09.00	Tau-C1 F1	04 26 14	+26 03 30	106	5 18	Bleeker
262	16.37	3A0656-072	06 56 00	-07 12 00	72	2 33	Warwick
262	23.15	NGC 1535	04 11 48	-12 51 33	105	8 16	Osborne
263	23.35	Cyg X-2	21 42 37	+38 05 28	131	1 10	Treves
264	03.29	NGC 1832	05 09 47	-15 44 48	100	2 5	Fricke
264	07.44	HD 497985	06 47 29	-43 59 55	81	1 51	De Korte
264	12.04	AM Her	18 14 57	+49 50 54	93	1 46	Heise
264	14.22	AM Her	18 15 35	+49 50 19	93	7 10	Heise
265	00.03	0A01653-40	16 57 16	-41 34 45	80	8 18	Parmar
265	09.48	G357.7-0.1	17 36 59	-30 57 00	87	3 19	Aschenbach
265	16.12	Cyg X-2	21 42 37	+38 05 28	130	2 17	Treves
265	20.40	GX13+1	18 11 37	-17 10 16	94	3 1	Taylor
266	03.12	1803+78	18 03 39	+78 27 54	90	7 59	Biermann
266	13.02	4U1744-26	17 44 49	-26 32 49	87	10 39	D'Amico
267	13.03	GX1+4	17 28 58	-24 42 44	83	12 52	Hall
268	04.15	Cyg X-1	19 56 28	+35 03 55	117	5 40	Page
268	12.20	Tycho SNR	22 29 59	+63 51 38	114	3 0	Davelaar
268	17.47	Tycho SNR	00 22 30	+63 51 38	114	10 8	Davelaar

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
269	06.01	3C58	02 01 51	+64 35 23	122	4 10	Davelaar
269	12.55	TAU-C2F1	04 52 39	+30 31 12	106	8 38	Bleeker
270	00.15	4U1728-16	17 28 49	-16 55 32	81	12 21	Charles
271	11.20	D143631	16 12 48	+33 59 03	66	27 32	Brinkman
272	20.21	4U2129+47	21 29 35	+47 04 08	122	3 13	Pietsch
273	02.11	NGC 3031	09 48 29	+69 00 00	75	4 24	Bleeker
273	08.50	PSR 0833-45	08 33 39	-45 00 19	66	9 36	Zimmermann
273	18.49	PSR 0833-45	08 33 28	-45 01 04	66	5 21	Zimmermann
274	03.13	G21.5-0.9	18 30 47	-10 36 55	91	3 56	Davelaar
275	12.23	Crab Nebula	05 31 31	+21 58 54	105	12 37	Brinkmann
276	02.13	1st Pnt ME Raster	05 24 26	+23 38 20	107	0 47	Brinkmann
277	14.15	End Pnt ME Raster	05 31 46	+20 25 29	107	0 47	Brinkmann
277	15.46	Crab Nebula	05 31 31	+21 58 54	107	2 11	Brinkmann
277	19.58	4U2129+47	21 29 35	+47 04 08	121	9 32	Pietsch
279	02.06	EY Cygni	19 52 40	+32 13 39	107	7 39	Beuermann
280	15.17	1822-371	18 22 22	-37 08 03	81	5 32	Mason
280	23.20	CN Ori	05 49 39	-05 25 34	93	3 51	Mason
281	14.40	1803+78	18 03 38	+78 27 54	64	6 25	Biermann
281	23.26	0851+202	08 51 57	+20 17 57	65	2 04	Willmore
282	16.34	Fairall 9	01 21 47	-58 59 00	114	3 21	Scarsi
282	21.21	WX Hyi	02 08 17	-63 28 13	109	4 0	Mason
283	03.53	1928+73	19 27 37	+73 51 14	98	8 6	Biermann
283	14.35	MK509	20 41 12	-10 50 34	113	4 21	Molteni
283	21.50	H0850+13	08 41 31	+12 59 15	67	1 25	Sims
284	04.11	H225-086	22 15 21	-08 31 38	135	5 32	Maraschi
284	12.45	Fairall 9	01 21 47	-58 59 00	114	2 3	Scarsi
284	16.50	V1223 SGR	18 52 02	-31 17 50	84	7 14	Osborne
285	02.59	H2003+22	20 03 09	+22 31 39	106	6 15	Maraschi
285	11.50	W Uma	09 40 42	+56 07 40	76	7 20	Heise
286	12.16	Fairall 9	01 21 47	-58 59 00	113	7 25	Scarsi
286	22.40	SS433	19 09 02	+04 52 00	89	12 19	Watson
288	03.10	SS433	19 09 32	+04 52 00	89	10 49	Watson
288	16.15	Fairall 9	01 21 47	-58 58 59	112	3 26	Scarsi
288	21.48	MR2251-179	22 51 21	-17 46 00	135	2 54	Pounds
289	02.50	SS433	19 09 32	+04 52 00	88	12 17	Watson
290	09.05	V410TAU	04 16 15	+28 22 43	135	3 7	Brown
290	14.34	Fairall 9	01 21 47	-58 59 00	112	3 1	Scarsi
290	20.35	HR1009	03 34 05	+00 30 14	147	3 4	Barstow
291	18.21	LMC X-4	05 32 04	-66 21 31	92	6 39	Pakull
292	03.25	Sirius B	06 43 44	-16 38 45	98	25 29	Heise
293	21.40	HD37128	05 33 28	-01 98 50	120	14 3	Bianchi
294	19.07	Alpha CM	07 36 21	+05 22 28	92	5 3	Mewe
295	03.00	4U2030+40	20 30 11	+40 48 04	106	0 40	Van der Klis
295	05.57	4C59.08	07 03 37	+59 33 34	104	2 41	Strom
295	12.10	MK509	20 41 12	-10 50 34	102	2 7	Molteni
295	16.57	Her X-1	16 55 44	+35 21 35	65	3 20	Trumper
295	22.10	3A1954+319	19 53 38	+31 57 37	97	3 15	Warwick
296	02.37	NGC 6853	19 57 04	+22 34 53	97	3 44	Osborne
296	08.08	GR 288	20 32 37	+18 50 20	104	5 57	Heise
296	16.22	1803+78	18 02 09	+78 25 42	96	10 42	Biermann

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
299	01.24	Cygnus X-3	20 30 03	+40 47 57	104	10 13	Peacock
299	14.22	IC 4997	20 17 30	+16 35 16	97	2 13	Parmar
300	01.40	YZ CNC	08 07 51	+28 17 24	95	2 11	Heise
300	05.56	E0135.1-7122	01 35 10	-71 27 14	96	2 50	Pye
300	10.17	E0121.9-7335	01 21 52	-73 40 45	94	3 8	Pye
300	15.45	MR 2251-179	22 51 21	-17 46 00	124	5 54	Pounds
301	14.15	H0850+13	08 49 48	+12 36 00	83	5 45	Sims
301	21.31	YZ CNC	08 07 51	+28 17 24	96	2 16	Heise
302	02.45	E0112.0-7059	01 12 02	-70 59 46	95	2 1	Pye
302	05.54	E0101-3-7301	01 01 20	-73 01 23	93	3 17	Pye
302	10.20	E0101.5-7226	01 01 33	-72 26 34	94	3 21	Pye
302	14.14	E0059.0-7228	00 59 04	-72 28 56	93	3 52	Pye
302	18.26	E0057.6-7228	00 57 39	-72 28 02	93	5 34	Pye
303	01.27	LMC X-4	05 32 47	-66 24 13	92	4 35	Pakull
303	08.30	SU Uma	08 08 04	+62 45 36	103	3 21	Evans
303	14.04	E0049.4-7339	00 49 26	-73 39 27	92	2 51	Pye
303	19.37	YZ CNC	08 07 51	+28 17 23	98	1 40	Heise
304	00.45	PKS2155-304	21 55 58	-30 27 52	103	15 27	Maccagni
305	08.21	3C120	04 29 59	+05 15 00	147	5 29	Tanzi
305	16.28	4U0033+58	00 33 12	+58 50 59	131	3 47	Horstmann
305	22.41	YZ CNC	08 07 51	+28 17 24	100	2 14	Heise
306	03.28	ES0141-G55	19 16 56	-58 45 52	69	4 26	Branduardi
306	10.30	PKS0521-365	05 21 14	-36 30 12	114	4 30	Maccagni
306	16.52	PKS0548-322	05 48 49	-32 16 56	113	3 8	Maccagni
306	22.13	NGC 6814	19 30 53	-10 27 00	74	10 52	Branduardi
307	07.25	MK 509	20 41 26	-10 54 17	90	4 14	Molteni
307	14.25	AM Her	18 14 57	+49 50 55	82	5 1	Heise
307	21.56	YZ CNC	08 07 51	+28 17 24	102	2 4	Heise
308	04.26	NGC 6853	19 57 25	+22 34 45	88	2 30	Pakull
309	00.02	4U2030+40	20 30 38	+40 47 13	99	3 7	Van der Klis
309	05.25	MKN 335	00 03 45	+19 55 30	143	3 24	Pounds
309	11.48	NGC 7469	23 00 44	+08 36 18	126	3 4	Pounds
309	23.13	YZ CNC	08 07 51	+28 17 24	104	1 34	Heise
310	02.59	NGC 7213	22 06 14	-47 25 00	92	3 50	Pounds
310	09.06	NGC 526A	01 21 39	-35 19 00	125	6 28	Turner
310	18.26	MR 2251-179	22 51 26	-17 50 54	114	1 58	Pounds
310	22.49	MCG2-58-22	23 02 07	-08 57 19	120	3 23	Pounds
311	03.56	PHL 380	22 40 12	-04 30 00	116	1 53	Heise
311	11.08	NGC 4151	12 08 00	+39 40 50	67	6 34	Perola
312	02.15	YZ CNC	08 07 51	+28 17 24	106	1 11	Heise
312	21.04	MCG8-11-11	05 51 10	+46 25 55	132	1 42	Maraschi
313	01.40	Ton 524A	10 28 47	+29 02 27	78	8 5	Fink
313	11.38	Praesepe	08 37 00	+20 10 00	99	7 35	Schnopper
313	21.25	YZ CNC	08 07 51	+28 17 24	108	11 57	Heise
314	11.57	Abell 78	21 33 20	+31 28 13	106	3 4	Osborne
314	18.01	MKN 205	12 19 34	+75 35 15	96	2 55	Zimmermann
314	23.31	MKN 618	04 34 00	-10 28 36	144	4 40	Fink
315	06.43	SS Cygni	21 40 44	+43 21 18	109	1 13	Watson
315	10.56	NGC 4151	12 08 00	+39 40 50	70	3 51	Perola
311	20.18	PG0026+129	00 26 38	+12 59 29	146	3 7	Maraschi

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
315	17.31	YZ CNC	08 07 51	+28 17 24	110	2 24	Heise
316	13.57	PKS0735+178	07 35 14	+17 49 09	116	5 22	Willmore
316	21.50	1928+73	19 28 49	+73 51 44	100	7 38	Biermann
317	07.17	3A2056+493	20 56 00	+49 19 48	101	3 21	Warwick
317	14.32	PKS0735+178	07 35 14	+17 49 09	117	3 54	Willmore
317	21.10	YZ CNC	08 07 51	+28 17 24	112	1 11	Heise
318	05.04	LMC X-4	05 34 47	-66 24 13	91	1 43	Pakull
318	09.34	PKS0735+178	07 35 13	+17 49 09	118	4 23	Willmore
318	22.30	3C111	04 15 01	+37 54 20	156	1 19	Briel
319	02.46	MKN 352	00 57 08	+31 33 30	146	1 2	Fink
319	06.03	VW Hyi	04 09 28	-71 25 23	90	2 4	Heise
319	11.16	NGC 4151	12 08 00	+39 40 50	73	6 29	Perola
320	08.21	G0921+06	09 22 02	+06 20 45	92	5 28	Pounds
320	16.53	2A1348+700	13 51 52	+69 33 16	90	3 55	Fink
320	23.17	RU Peg	22 11 36	+12 27 11	105	2 42	Beuermann
321	04.20	MR2251-179	22 51 26	-17 50 54	103	1 33	Pounds
321	08.22	KT Per	01 33 48	+50 41 25	141	1 26	Heise
321	12.45	LMC X-4	05 34 15	-66 38 56	92	32 58	Pakull
323	01.17	NGC 4151	12 08 00	+39 40 50	76	5 58	Perola
324	12.36	NGC 3587	11 11 54	+55 17 31	94	2 54	De Korte
324	16.44	EG 71	10 38 33	+43 12 38	93	2 20	De Korte
324	20.25	Ton 524A	10 28 48	+29 06 00	90	3 31	Bleeker
325	01.11	XY Leo	09 58 57	+17 40 00	92	1 50	Heise
325	04.46	NGC 2811	09 13 48	-16 06 12	91	3 40	Fricke
325	10.15	Vela SNR	08 16 00	-44 00 00	91	3 0	Smith
325	21.20	VW Hyi	04 09 29	-71 25 23	89	3 1	Heise
326	01.44	NGC 7293	22 26 55	-21 05 40	92	2 27	Van der Klis
326	06.00	BPM 97859	23 09 48	+10 31 00	113	1 10	Heise
326	10.00	A0543-68	05 43 49	-68 23 40	89	6 36	Pakull
326	17.28	LMC X-4	05 32 46	-66 24 13	91	5 11	Pakull
327	01.15	KT Per	01 33 48	+50 41 24	139	1 15	Heise
327	21.53	PHL 5200	22 25 54	-05 34 17	96	14 2	Schnopper
329	14.23	OX 169	21 41 13	+17 29 49	91	5 4	Perryman
329	21.38	VW Hyi	04 09 28	-71 25 23	88	6 21	Heise
330	06.20	3A0020-260	00 18 12	-25 59 00	108	3 33	Pye
330	12.10	OX 169	21 41 13	+17 29 49	91	4 58	Perryman
330	19.16	0A0526-328	05 27 33	-32 51 19	123	5 59	Brinkmann
331	14.45	MR 2251-179	22 51 26	-17 59 54	93	2 30	Pounds
331	18.47	OX 169	21 41 13	+17 29 49	90	4 32	Perryman
332	01.33	2A0526-328	05 27 33	-32 51 19	123	6 16	Brinkman
332	09.50	MR 2251-178	22 51 26	-17 50 54	92	5 55	Pounds
333	02.32	2A0311-227	03 12 00	-22 46 49	133	4 7	Watson
333	08.11	HD 22049	03 30 34	-09 37 34	147	7 8	Horstmann
333	18.47	PKS2155-304	21 55 58	-30 37 52	75	2 49	Maccagni
333	23.39	VW Hyi	04 09 29	-71 25 23	87	7 57	Heise
334	10.06	PKS0521-365	05 21 14	-36 30 11	120	4 52	Maccagni
334	16.56	PKS0548-322	05 48 50	-32 16 56	122	2 44	Maccagni

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
336	08.40	1156+295	11 56 57	+29 33 24	83	3 58	McHardy
336	14.48	2223-05	22 23 10	-05 12 23	86	3 37	McHardy
336	20.04	TT Ari	02 03 09	+14 58 00	144	2 31	Beuermann
337	00.56	4U2030+40	20 30 38	+40 47 13	83	1 39	Van der Klis
337	05.21	VW Hyi	04 09 29	-71 25 23	86	1 24	Heise
337	07.55	A0538-66	05 36 44	-67 17 56	90	9 58	McKay
338	01.49	SS Cygni	21 40 44	+43 21 18	95	6 35	Watson
338	10.52	PG1012-029	10 12 37	-02 53 34	95	6 00	Mason
339	07.01	PG1257+279	12 57 03	+27 54 23	74	2 23	Mason
339	11.02	BE Uma	11 55 10	+49 13 06	96	5 36	Schrijver
339	19.04	Lamda AND	23 35 05	+46 11 14	114	1 51	Gronenschild
339	23.50	Feige 4	00 17 24	+13 36 00	116	2 40	Heise
340	05.25	1156+295	11 56 17	+29 33 24	87	3 23	McHardy
340	11.19	VW Hyi	04 09 29	-71 25 23	86	1 33	Heise
340	15.00	2223-05	22 23 10	-05 12 23	82	3 41	McHardy
340	21.01	TT Ari	02 03 09	+14 58 00	140	2 42	Beuermann
341	00.46	0235+164	02 35 53	+16 24 03	148	5 9	McHardy
341	08.11	2200+420	22 00 39	+42 02 09	96	9 12	Maccagni
341	19.48	0851+202	08 51 57	+20 17 57	124	6 47	Willmore
342	22.34	1156+295	11 56 17	+29 33 24	89	3 16	McHardy
343	05.25	MR2251-179	22 51 26	-17 50 54	81	1 14	Pounds
343	09.01	0235+104	02 35 53	+16 24 05	145	3 19	McHardy
343	14.53	2223-05	22 23 10	-05 12 22	79	3 28	McHardy
343	20.44	CW1103+253	11 02 58	+25 22 42	99	4 41	Beuermann
344	04.08	1928+73	19 28 49	+73 51 44	99	7 21	Biermann
344	13.52	MKN 382	07 52 03	+39 19 10	141	7 57	Fink
345	01.06	LMC X-3	05 38 40	-64 06 34	93	6 3	Treves
345	09.25	0235+164	02 35 53	+16 24 05	143	3 26	McHardy
345	16.07	2223-05	22 23 10	-05 12 22	77	2 45	McHardy
345	21.09	1156+295	11 56 57	+29 33 24	92	3 00	McHardy
346	18.20	2S0921-630	09 21 25	-63 04 45	81	8 19	Corbet
347	05.05	PSR0031-07	00 31 36	-07 36 33	104	2 55	Bell-Burnell
347	10.45	NGC3783	11 36 33	-37 37 41	73	7 57	Bell-Burnell
347	19.58	MCG5-23-16	09 45 24	-30 43 00	97	4 13	Pounds
348	05.09	0235+164	02 35 53	+16 24 05	141	2 36	McHardy
348	08.53	HT Cas	01 07 01	+59 48 26	123	5 49	Mason
348	17.09	A1202+31	12 02 05	+31 27 00	95	3 41	Pye
348	23.25	NGC 246	00 44 32	-12 08 44	102	3 5	De Korte
349	03.44	II ZW 1	01 19 30	-01 17 59	116	4 31	Bleeker
349	11.42	NGC 3227	10 20 46	+20 07 08	112	5 44	Lawrence
350	17.44	0241+622	02 41 01	+62 15 27	132	5 50	Warwick
351	02.02	NGC 4151	12 08 01	+39 41 01	98	6 29	Pounds
351	09.47	HZ 21	12 11 24	+33 12 00	96	2 15	Heise
351	13.14	HZ 34	12 53 00	+37 34 00	90	2 2	Heise
351	17.10	3C273	12 26 33	+02 19 2	20	7 50	Turner
352	03.13	4U2030+40	20 30 38	+40 47 13	15	1 23	Van der Klis
352	07.20	MR2251-179	22 51 26	-17 50 54	72	2 9	Pounds
352	11.02	III ZW 2	00 08 00	+10 42 00	100	3 55	Bleeker
352	17.45	NGC2922	09 43 17	-14 05 42	110	6 4	Turner

Day (83)	Time	Target	RA	Dec	SAA	Duration h m		Principal Investigator
353	01.58	1215+303	12 15 21	+30 23 40	95	7	57	Maccagni
353	12.35	NGC 6888	20 10 17	+38 12 15	70	3	00	Wendker
354	01.53	NGC 6888	20 10 17	+38 12 15	70	8	02	Wendker
355	02.33	4U0115+634	01 15 14	+63 38 38	120	11	1	Staubert
356	09.30	X Per	03 51 15	+30 54 01	151	2	4	Robba
356	13.55	HD 121130	13 49 58	+64 58 11	100	3	7	Bedford
356	19.01	NGC 4096	12 03 29	+47 45 13	107	3	3	Gioia
356	23.34	NGC 4490	12 26 09	+41 54 56	100	3	37	Gioia
358	19.08	M82	09 51 52	+69 54 58	123	20	44	Biermann
360	00.37	NGC 5005	13 08 38	+37 19 25	94	2	55	Gioia
360	05.17	NGC 4244	12 14 59	+38 05 06	104	1	58	Gioia
360	08.46	NGC 4656	12 41 33	+32 27 00	97	1	54	Gioia
360	11.52	NGC 4395	12 23 21	+33 49 22	101	3	13	Gioia
360	16.19	HD 111812	12 49 16	+27 48 44	94	1	28	Zwaan
360	18.51	NGC 4559	12 33 29	+28 14 23	97	4	01	Gioia
361	19.20	MR 2251-179	22 51 26	-17 50 54	63	1	32	Pounds
361	22.56	NGC 693	01 47 54	+05 54 53	112	3	9	Peacock
362	03.04	PG0134+070	01 34 28	+07 01 09	109	2	51	Mason
362	08.26	EG 187	12 54 36	+22 18 00	92	5	6	Heise
362	17.20	NGC 3991/4/5	11 54 57	+32 37 39	109	11	30	Gavazzi
363	07.40	HT Cas	01 07 01	+59 48 26	115	4	50	Osborne
363	14.49	NGC 4725	12 48 00	+25 47 20	96	1	27	Gioia
363	17.27	NGC 4565	12 33 52	+26 15 50	99	2	3	Gioia
364	03.22	3A1146-118	11 46 29	-11 51 22	96	3	10	Pye
364	07.29	3A1030-346	10 33 36	-35 42 00	99	7	30	Pye
364	19.53	SU UMA	08 08 05	+62 45 36	135	3	07	Evans
365	12.56	MKN 290	15 34 45	+58 04 00	89	1	52	Bleeker
365	16.07	MKN 474	14 53 05	+48 52 47	90	2	51	Bleeker
365	20.56	SA57	13 06 00	+29 30 00	96	28	2	McKechnie
(84)								
002	03.25	II ZW I	01 19 30	-01 18 00	98	2	20	Bleeker
002	13.20	HD 224801	23 58 12	+44 58 00	98	4	2	Ferrari
002	19.05	3A0316-442	03 16 12	-44 16 34	97	2	44	Pye
003	00.11	NGC 988	02 33 00	-09 34 30	100	2	59	Fricke
003	05.43	MKN 590	02 12 05	-00 59 57	108	3	29	Bleeker
003	13.06	4U2030+40	20 30 38	+40 47 13	68	4	26	Van der Klis
004	08.52	A1060	10 34 30	-27 16 00	107	7	8	Schnopper
004	18.47	3A0729+103	07 28 43	+10 02 46	165	5	48	Pye
005	02.32	NGC 4361	12 21 55	-18 30 31	90	3	17	Osborne
005	08.08	A1367	11 41 53	+20 06 59	115	8	51	Schnopper
005	18.35	HD 115383	13 14 18	+09 41 06	90	2	49	Pallavicini
005	23.01	3C273	12 26 33	+02 19 43	99	14	16	Grewing
006	15.32	4U0033+58	00 33 12	+58 51 00	105	1	2	Van Paradijs
006	21.34	CW 1103+253	11 02 58	+25 22 42	128	8	5	Beuermann
008	02.19	3C120	04 30 31	+05 15 00	137	1	33	Tanzi
008	05.55	Lamda AND	23 35 06	+46 11 14	91	6	31	Gronenschild
008	23.55	CW 1103+253	11 02 58	+25 22 42	128	7	12	Beuermann
009	09.40	NGC 4581	12 35 36	+01 43 00	100	6	15	Peacock
009	18.46	4U0352+309	03 52 15	+30 54 01	133	1	40	Robba
009	23.01	1928+73	19 28 49	+73 51 44	96	7	30	Biermann

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
010	19.15	4U0352+309	03 52 15	+30 54 01	132	1 8	Robba
010	22.55	HD 127762	14 30 04	+38 31 34	91	2 03	Zwaan
011	20.54	0109+49	01 09 05	+49 12 40	103	1 23	Miller
012	01.31	HD 4614	00 46 03	+57 33 03	103	2 16	Pallavicini
012	08.08	4U1036-56	10 36 10	-56 33 00	93	0 35	Van Paradijs
012	10.51	E0336-358	03 36 54	-35 41 00	100	7 35	Mason
012	20.53	HD133029A	14 58 54	+47 38 00	92	2 24	Ferrari
013	00.37	OQ 208	14 04 46	+28 41 29	94	4 29	Cavaliere
013	07.36	Puppis A	08 21 39	-42 49 00	115	11 31	Aschenbach
013	21.46	1309-057	13 09 02	-05 36 07	94	13 34	Schnopper
014	13.00	HD 115521	13 15 04	+05 43 58	98	9 25	Bedford
015	18.51	HD 13174	02 06 34	+25 42 15	104	0 54	Zwaan
015	22.18	4U0115+63	01 15 14	+63 28 38	106	4 45	Staubert
016	06.44	1147+245	11 47 44	+24 34 34	125	8 51	Willmore
016	17.26	E1352.2+1830	13 52 12	+18 20 58	96	5 49	Stewart
017	00.39	HD 124897	14 13 23	+19 26 30	92	5 26	Pallavicini
017	09.20	1147+245	11 47 44	+24 34 34	126	6 21	Willmore
017	17.37	HD 118100	13 32 07	-08 05 06	92	2 42	Pallavicini
017	22.55	HD 20630	03 16 44	+03 11 18	110	1 47	Pallavicini
018	04.00	BE Uma	11 55 10	+49 13 03	125	1 49	Cole
018	09.43	1147+245	11 47 44	+24 34 34	127	5 21	Willmore
018	17.56	BE Uma	11 55 10	+49 13 03	125	1 17	Cole
019	09.30	3A0004+725	00 04 17	+72 31 19	101	4 13	Pye
019	21.48	BE Uma	11 55 10	+49 13 03	126	1 12	Cole
020	01.40	PKS1103-006	11 03 58	-00 36 36	131	6 9	Bergeron
020	10.39	NGC 4690	12 46 00	-41 02 02	90	27 45	Manzo
021	15.15	NGC 4507	12 32 54	-39 38 02	95	5 45	Bergeron
021	23.41	HD 81799	09 25 01	-22 07 25	134	1 10	Zwaan
022	04.00	HD 18322	02 53 59	-09 05 52	96	2 30	Bedford
023	03.34	PSR1055-52	10 55 49	-52 10 44	100	13 16	Brinkmann
024	09.22	4U0316+41	03 16 30	+40 50 00	112	6 2	Branduardi
025	03.32	3A0316+414	03 12 50	+41 20 00	111	6 51	Branduardi
025	11.58	A426	03 16 30	+42 04 59	111	7 8	Branduardi
025	23.10	4U0352+309	03 52 15	+30 54 01	117	7 08	Robba
027	01.33	MCG8-11-11	05 51 10	+46 25 55	137	1 10	Maraschi
027	05.37	MKN 348	00 46 04	+31 41 04	79	8 54	Bergeron
027	17.4	3C111	04 15 02	+37 54 21	121	2 15	Briel
027	22.47	MKN 205	12 19 34	+75 35 15	116	2 8	Zimmermann
028	04.00	PKS 1136-13	11 36 38	-13 34 09	125	11 36	Bergeron
028	18.30	2A1348+700	13 51 52	+69 33 16	111	3 17	Fink
029	00.44	PKS 1217+23	12 17 38	+02 20 21	125	3 55	Zimmermann
029	07.08	0916+86	09 16 17	+86 25 15	111	2 52	Witzel
029	12.10	3A1344-325	13 44 58	-32 35 02	91	3 50	Pye
030	16.38	EPS CRA	13 55 21	-37 10 26	89	3 7	Heise
030	22.20	PKS1136-13	11 36 39	-13 34 08	128	5 57	Bergeron
031	08.07	HD 16157	02 32 28	-44 00 36	74	1 43	Pallavicini
031	13.57	HD 72905	08 34 46	+65 11 41	132	1 50	Pallavicini
031	18.22	HD 2905	00 30 08	+62 39 22	91	2 50	Zwaan
031	23.35	2A1219+305	12 18 33	+30 23 24	131	3 13	Warwick

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
032	04.38	NGC 5548	14 15 42	+25 22 00	106	3 50	Branduardi
032	11.04	MKN 421	11 01 39	+38 28 00	145	3 54	Warwick
032	17.45	MKN 501	16 52 13	+39 47 00	80	3 53	Warwick
033	01.01	LMC X-2	05 21 17	-72 00 22	84	6 57	Pakull
033	11.44	MKN 421	11 01 39	+38 38 00	145	2 36	Warwick
033	17.17	2A1219+305	12 18 34	+30 23 24	133	12 53	Warwick
034	12.02	MKN 501	16 52 14	+39 47 00	81	2 23	Warwick
034	16.30	NGC 5033	13 11 09	+36 52 00	122	3 5	Pounds
034	22.01	NGC 4593	12 37 01	-05 04 00	123	2 38	Pounds
035	23.47	VV Pup	08 12 52	-18 53 54	142	3 54	Osborne
036	05.46	2S1254-690	12 54 21	-69 01 07	86	6 17	Peacock
036	14.03	PG 1524+438	15 24 10	+43 51 59	99	2 14	Mason
036	17.45	MKN 501	16 52 14	+39 46 59	82	4 5	Warwick
037	00.55	MKN 421	11 01 40	+38 27 59	147	2 55	Warwick
037	06.24	2A1219+305	12 18 34	+30 23 25	135	3 21	Warwick
037	13.08	MKN 79	07 38 47	+49 55 50	141	1 22	Pounds
038	05.48	0851+202	08 51 03	+20 09 26	172	4 45	Willmore
038	14.32	MKN 876	16 13 48	+65 50 00	98	8 18	Pounds
039	00.48	0014+81	00 14 03	+81 18 27	99	3 11	Witzel
039	06.35	0851+202	08 51 03	+20 09 26	171	4 25	Willmore
039	22.40	2353+81	23 53 58	+81 36 11	98	2 52	Witzel
040	06.20	0851+202	08 51 03	+20 09 26	170	4 24	Willmore
040	14.07	0I417	07 10 03	+43 54 26	139	5 29	Cavaliere
041	00.05	4C55.16	08 31 04	+55 44 41	138	1 45	Cavaliere
041	04.25	IE0643-1648	06 43 04	-16 48 25	128	5 19	Beuermann
042	01.10	Omega Cen	13 23 48	-47 23 00	99	13 45	Koch-Miramond
042	18.09	4U1323-62	13 23 04	-61 48 00	92	2 5	Van Paradijs
042	21.20	3A1239-599	12 39 07	-59 55 47	97	2 19	Warwick
043	02.12	IE0643-1648	06 43 04	-16 48 25	127	0 44	Beuermann
043	06.07	0754+100	07 54 23	+10 04 39	154	7 29	Maccagni
043	16.47	IE0643-1648	06 43 04	-16 48 25	127	2 22	Beuermann
043	21.47	E1149.4-6209	11 48 15	-62 15 00	100	5 21	Bignami
044	05.28	4U1322-42	13 22 32	-42 45 30	104	11 7	Molteni
044	18.25	3A1431-409	14 33 34	-40 59 32	94	13 25	McHardy
045	19.32	4U0115+63	01 15 14	+63 28 38	86	4 14	Staubert
046	05.15	Vela X-1	09 00 13	-40 21 25	125	2 30	Peacock
046	10.53	0300+470	03 00 10	+47 04 33	91	2 17	Biermann
046	15.45	Cen X-3	11 19 02	-60 20 57	105	11 44	Peacock
047	06.05	Vela X-1	09 00 13	-40 21 25	125	2 48	Peacock
047	11.30	4U1547-49	15 43 34	-47 30 59	84	5 30	Peacock
048	19.22	Vela X-1	09 00 13	-40 21 25	125	1 54	Peacock
049	08.52	Vela X-1	09 00 13	-40 21 25	125	3 38	Peacock
050	05.35	Vela X-1	09 00 13	-40 21 25	125	2 49	Peacock
050	11.22	SN1006 West	14 59 07	-41 51 23	94	7 7	Pye
050	18.53	SN1006 East	15 00 14	-41 39 47	94	9 36	Pye
051	05.50	RCW 86	14 38 11	-62 12 00	90	4 55	Peacock
051	12.38	HD 127493	14 29 08	-22 29 35	108	2 0	De Korte
051	16.44	A2147	15 58 56	+16 05 00	96	6 5	Morini

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
052	00.23	MKN 29845	16 03 22	+17 56 06	95	3 1	Peacock
052	06.23	Vela X-1	09 00 13	-40 21 25	125	2 5	Peacock
052	10.39	MKN 291	15 52 54	+19 20 19	98	5 57	De Korte
053	07.10	Vela X-1	09 00 13	-40 21 25	125	2 15	Peacock
053	12.30	RCW 86	14 39 36	-62 22 00	91	3 43	Peacock
053	17.46	H1626+01	16 23 12	+01 52 11	89	1 45	White
053	21.17	G292.0+1.8	11 22 20	-58 58 59	109	7 34	Fitton
054	07.15	1538+149	15 38 31	+14 57 25	102	9 7	Maccagni
054	18.55	HD 30945	04 45 22	-17 01 23	92	2 50	Bedford
058	00.49	3C279	12 53 35	-05 31 07	139	8 21	Cavaliere
055	10.55	M13A	16 39 54	+36 33 01	93	4 35	Birkinshaw
055	18.15	4U0352+309	03 52 15	+30 54 01	87	2 3	Robba
055	22.40	4U0115+63	01 15 14	+63 28 37	79	3 29	Staubert
056	04.43	E0731.4+3158	07 31 26	+31 58 47	133	6 21	Horstmann
057	00.55	N2146	06 10 45	+78 22 30	104	3 25	Fricke
057	06.00	H1659+44	16 59 00	+44 28 12	91	1 48	White
057	08.38	Her 1/2	17 15 00	+50 13 00	90	24 07	McKechnie
058	15.58	MKN 291	15 52 54	+19 20 20	103	5 02	Willmore
059	23.06	GR 275	16 20 30	+26 02 24	98	6 19	Heise
059	09.06	H1642+11	16 42 05	+11 51 00	92	1 24	White
059	13.18	1308+326	13 08 08	+32 36 54	138	4 4	McHardy
059	19.45	RCW 86	14 38 11	-62 22 20	96	3 24	Peacock
061	02.55	NGC 5506	14 10 42	-02 58 00	128	5 53	McHardy
061	11.30	Her X-1	16 56 02	+35 25 03	93	9 36	Trümper
062	00.10	1020+40	10 20 13	+40 03 30	146	2 36	Miller
062	05.19	0615+82	06 15 33	+82 03 56	100	2 21	Witzel
062	09.43	HD 35296	05 21 30	+17 20 18	99	1 59	Pallavicini
062	14.35	1038+52	10 38 43	+52 49 19	134	3 27	Miller
062	21.14	NGC 5548	14 15 42	+25 22 00	128	8 5	Branduardi
063	08.15	I ZW 186	17 27 04	+50 15 30	90	12 31	Maccagni
064	16.31	0954+55	09 54 14	+55 37 17	129	2 53	Miller
064	22.41	Her X-1	16 56 02	+35 25 03	95	11 22	Trümper
065	12.33	4U1624-49	16 24 18	-49 05 18	91	5 16	Watson
065	21.11	0945+40	09 45 50	+40 53 44	140	2 53	Miller
066	21.53	1308+326	13 08 07	+32 36 54	141	3 55	Miller
067	05.08	RCW 103	16 13 48	-50 55 05	94	13 13	Peacock
068	07.53	AM Her	18 14 58	+49 50 55	84	3 35	Heise
068	13.30	1308+326	13 08 07	-32 36 54	141	3 9	McHardy
068	19.18	Her X-1	16 56 02	+35 25 03	97	2 41	Trümper
069	00.06	SN1006 East	15 00 14	-41 39 47	111	14 22	Pye
069	17.46	1308+326	13 08 07	-32 36 54	142	3 7	McHardy
069	23.07	G191 B2B	05 01 31	+52 44 48	90	4 23	Heise
070	06.00	Puppis A	08 22 10	-42 45 00	118	16 30	Aschenbach
071	02.37	Sco X-1	16 17 04	-15 31 15	105	4 27	Peacock
071	10.00	Her X-1	16 56 02	+35 25 03	98	4 01	Trümper
072	03.12	Sco X-1	16 17 04	-15 31 35	106	4 30	Peacock
072	10.07	GX339-4	16 59 02	-48 43 06	92	5 57	Illovaisky
072	18.45	E0718-312	07 18 28	-31 17 22	111	3 7	Mason

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
073	00.48	Sco X-1	16 17 04	-15 31 15	106	1 43	Peacock
073	02.51	Sco X-1	16 17 04	-15 30 55	107	1 53	Peacock
073	06.55	HD 168454	18 17 48	-29 51 05	78	1 18	Zwaan
073	10.49	HD 99967	11 27 42	+46 55 59	136	2 9	Zwaan
073	23.04	H1557+08	15 56 51	+08 00 35	114	1 30	White
074	03.10	1510+70	15 10 11	+70 57 09	103	14 48	Miller
075	22.10	1003+83	10 03 23	+83 04 38	98	3 8	Witzel
076	02.02	1053+81	10 53 39	+81 30 31	100	4 0	Witzel
076	07.27	1150+81	11 50 22	+81 15 10	100	3 21	Witzel
076	13.24	HD 159532	17 33 43	-42 58 04	90	2 18	Zwaan
076	18.06	Her X-1	16 56 02	+35 25 02	100	5 54	Trümper
077	02.06	HD 155555	17 12 18	-66 53 40	92	5 24	Barstow
077	09.22	4U1538-52	15 38 39	-52 13 35	107	9 37	Molteni
078	02.02	IC 443	06 14 30	+22 45 00	96	18 00	Jansen
079	19.11	VW Cep	20 38 03	+75 24 58	81	7 49	Heise
080	07.00	IC 443	06 14 00	+22 20 00	94	4 35	Jansen
080	14.40	Her X-1	16 56 02	+35 25 03	102	3 9	Trümper
080	19.50	HD 161471	17 44 05	-40 06 35	93	1 59	Zwaan
081	00.13	Zeta Pup	08 01 49	-39 51 41	112	10 56	Den Boggende
082	09.19	IC 443	06 12 40	+22 30 00	91	12 02	Jansen
083	10.35	E1013-477	10 13 57	-47 43 12	127	3 9	Maraschi
083	16.31	T Pyx	09 02 37	-32 10 47	126	2 4	Duerbeck
083	21.10	Z Cam	08 19 43	+73 16 36	97	1 9	Mason
084	02.05	E1405-451	14 05 58	-45 03 06	129	7 25	Maraschi
084	11.57	Her X-1	16 56 02	+35 25 03	104	5 57	Trümper
084	21.00	3A1431-409	14 33 34	-40 59 32	129	3 21	McHardy
085	04.15	HD 65339A	07 57 30	+60 28 00	100	2 44	Ferrari
085	09.07	MKN 40	11 22 48	+54 39 26	122	4 8	De Korte
086	12.00	MKN 501	16 52 12	+39 50 22	105	2 31	Warwick
087	05.00	PKS 1934-63	18 34 48	-63 49 35	90	2 32	Peacock
087	10.36	NGC 31185	10 04 17	+33 16 00	131	2 52	Peacock
088	00.12	Her X-1	16 56 02	+35 25 03	106	9 48	Trümper
088	13.00	DW 0839+18	08 39 14	+18 46 27	119	3 0	Kollatschny
088	18.50	H1504+65	15 01 17	+66 23 59	105	3 58	White
089	04.02	HD 133029A	14 58 54	+47 28 00	119	2 46	Ferrari
089	09.40	0752+258	07 52 35	+25 50 36	106	3 0	Biermann
089	16.00	HD 10029	11 28 27	+69 36 25	106	10 38	Bedford
090	05.00	MKN 79	07 38 47	+49 55 50	97	4 23	Pounds
090	23.59	Vela SNR	08 15 59	-47 00 24	109	7 2	Smith
091	09.15	A1058+45	10 58 42	+45 55 33	125	2 45	Peacock
091	14.27	SY CNC	08 58 15	+18 06 25	121	1 43	Mason
091	18.10	H0850+13	08 55 46	+12 12 12	122	3 3	Sims
092	00.00	MKN 291	15 52 55	+19 19 59	127	4 50	De Korte
092	07.42	H1658+44	16 58 25	+44 04 38	105	3 8	White
092	13.06	Her X-1	16 56 04	+35 25 19	108	15 18	Trümper
093	11.00	A2147	15 58 56	+16 05 00	128	4 59	Morini
093	20.35	0923+39	09 23 35	+39 06 44	115	7 30	Miller
094	22.14	PSR0833-45	08 33 38	-45 00 19	112	13 47	Zimmermann

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
095	13.00	Vela SNR	08 40 59	-47 00 05	112	3 50	Smith
095	19.06	Vela SNR	08 40 59	-43 00 13	114	4 49	Smith
096	03.39	Her X-1	16 56 04	+35 25 00	110	14 45	Trümper
096	22.34	NGC 2992	09 43 20	-14 02 12	131	5 55	Turner
097	07.30	3C382	18 33 09	+32 38 50	92	5 58	Perryman
097	16.20	1003+35	10 03 05	+35 08 48	121	2 12	Miller
098	11.54	E0731.4+3158	07 31 25	+31 58 26	92	6 50	Horstmann
098	23.18	NGC 4151	12 08 01	+39 41 33	131	5 42	Pounds
099	07.34	HD 89025	10 13 56	+23 40 15	128	1 55	Zwaan
099	12.07	H1914-27	19 14 51	-27 36 04	91	1 22	White
099	15.27	H1626+01	16 26 46	+01 35 35	129	2 55	White
099	21.37	NGC 4051	12 00 37	+44 49 18	126	8 16	Lawrence
100	08.30	NGC 1961	05 36 55	+69 19 44	75	8 53	Shostak
100	20.09	W50	19 08 58	+05 14 29	90	7 35	Brinkmann
101	06.25	M82	09 50 30	+69 54 56	95	9 56	Biermann
102	18.26	1221+80	12 21 42	+80 56 43	90	2 54	Witzel
103	17.17	E1652.2-0815	16 52 49	-07 57 15	128	3 0	Horstmann
103	23.11	3A0656-072	06 56 02	-07 11 45	84	5 19	Warwick
104	07.39	RCW 86	14 37 17	-62 00 11	125	7 56	Peacock
104	18.01	4C05.38	09 11 24	+05 19 25	114	5 27	Kollatschny
105	05.59	HD 32918	04 59 45	-75 21 18	90	4 43	Bedford
106	00.15	OY Car	10 05 20	-69 59 15	111	4 6	Mason
106	07.16	W 50	19 06 31	+04 59 52	95	5 50	Brinkmann
106	21.15	1323+79	13 23 25	+79 57 59	90	3 1	Witzel
106	21.15	1323+79	13 23 25	+79 57 59	90	3 1	Witzel
107	01.07	1304+79	13 04 09	+79 11 07	90	4 20	Witzel
107	08.15	HD68351	08 10 05	+29 48 28	92	3 6	Ferrari
107	14.21	RCW 86	14 38 14	-61 47 45	127	12 25	Peacock
108	05.33	PG1717+413	17 17 03	+41 18 51	108	2 40	Mason
108	17.05	SS 433	19 09 20	+04 54 02	97	12 31	Watson
109	20.24	NGC 4151	12 08 03	+39 40 56	124	7 20	Pounds
110	06.30	ES0103-G35	18 57 15	-65 53 42	105	3 14	Pounds
110	10.52	ES0103-G35	18 33 17	-65 28 38	108	9 37	Pounds
110	21.23	ES0103-G35	18 10 17	-64 49 54	110	4 27	Pounds
111	04.12	Nova Muscae	11 49 33	-66 55 12	121	5 37	Beuermann
111	13.10	NGC 3991/4/5	11 54 59	+32 37 38	127	7 0	Gavazzi
111	23.03	4U1223-62	12 23 48	-62 29 07	127	6 59	Re
113	20.45	4U1223-62	12 23 48	-62 29 32	127	1 17	Re
114	08.48	HM SGE	19 39 41	+16 37 19	92	9 12	Allen
114	19.20	4U1907+09	19 07 15	+09 44 41	101	2 28	Van Paradijs
114	23.20	GKP SNR	19 32 52	+29 59 47	91	2 52	Charles
115	03.06	GKP SNR	19 25 59	+30 00 00	91	2 54	Charles
115	06.55	GKP SNR	19 34 00	+30 59 47	90	3 25	Charles
115	11.81	GKP SNR	19 31 00	+31 59 47	91	2 36	Charles
115	15.05	GKP SNR	19 35 00	+31 59 47	90	3 35	Charles
115	21.21	4U1223-62	19 23 50	-62 29 37	127	2 1	Re
116	01.48	LMC X-4	05 34 15	-66 38 56	88	9 5	Pakull

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
122	20.33	VW Hyi	04 09 32	-71 25 48	88	17 26	Heise
123	17.45	E0012.7-7308	00 12 49	-73 08 48	91	11 20	Pye
124	22.25	HD187474	19 48 31	-40 01 21	110	3 34	Ferrari
125	04.32	GX339-4	16 59 01	-48 43 33	137	5 42	Illovaisky
125	12.20	RR Tel	20 00 21	-55 52 26	109	3 51	Cassatella
125	18.20	HD 198026	20 45 07	-05 13 00	91	5 26	Bedford
126	01.49	E0059.0-7228	00 59 10	-72 28 51	90	11 39	Pye
126	14.54	VW Hyi	04 09 32	-71 25 00	88	6 43	Heise
127	22.45	HD 186155	19 39 20	+45 24 05	90	3 42	Zwaan
128	17.35	1510+70	15 10 11	+70 57 09	92	3 25	Miller
128	22.50	AY Lyr	18 42 43	+39 33 30	103	7 55	Heise
130	13.31	Her X-1	16 56 01	+35 25 03	121	3 1	Trümper
130	19.25	3C 382	18 33 12	+32 39 15	109	3 33	Perryman
131	08.30	VW Hyi	04 09 31	-71 25 18	89	7 40	Heise
132	15 48	AY Lyr	18 42 41	+39 33 28	104	6 47	Heise
133	17.33	PHL1657	21 34 59	-14 46 23	90	7 8	Stewart
134	03.06	Cen X-3	11 19 04	-60 21 01	120	5 25	Peacock
134	11.19	AY Lyr	18 42 40	+37 56 52	106	1 10	Heise
134	14.59	PKS2126-158	21 26 25	-15 51 48	93	11 31	Stewart
135	05.16	PKS1217+23	12 17 38	+02 20 07	129	4 58	Zimmermann
135	13.48	AY Lyr	18 42 40	+37 56 52	106	1 31	Heise
136	05.18	2S1254-690	12 54 17	-69 00 50	124	11 42	Peacock
136	20.15	TT BOO	14 55 53	+40 56 00	119	1 7	Heise
137	00.15	3C273	12 26 33	+02 29 49	130	6 44	Turner
137	11.54	E0101.3-7301	01 01 24	-73 01 36	95	12 9	Pye
138	01.24	VW Hyi	04 09 28	-71 25 22	90	3 11	Heise
138	06.35	HD 193077	20 15 10	+37 15 43	93	11 33	Pollock
138	19.16	NGC 6964	20 47 25	+31 38 38	89	7 45	Bleeker
139	06.10	1418+546	14 18 08	+54 37 06	103	4 12	Willmore
140	00.35	1418+546	14 18 08	+54 37 06	103	8 31	Willmore
140	11.58	HD 193793	20 18 44	+43 41 35	90	6 2	Pollock
140	20.44	PKS2135-147	21 34 58	-14 46 28	97	6 21	Bergeron
141	05.20	1418+546	14 18 06	+54 36 26	103	4 55	Willmore
141	12.30	NGC5548	14 15 42	+25 21 29	129	9 25	Branduardi
142	01.05	TT BOO	14 55 53	+40 56 00	117	1 52	Heise
142	04.50	Cygnus X-1	19 56 26	+35 03 45	99	8 31	Page
142	14.43	4U2030+40	20 30 35	+40 47 06	91	6 53	Van der Klis
142	23.47	NGC 5055	13 13 36	+42 17 26	107	4 44	Gioia
143	19.10	AY Lyr	18 42 41	+37 56 30	109	3 46	Heise
143	22.30	MCG5-23-16	09 34 35	-29 51 28	95	3 18	Pounds
144	02.39	MCG5-23-16	09 45 26	-30 42 40	97	6 44	Pounds
144	10.20	MCG5-23-16	09 56 31	-31 30 55	99	3 20	Pounds
144	15.49	N4102	12 03 52	+53 00 09	90	5 11	Fricke
144	23.39	EM Cyg	19 36 42	+30 23 34	107	1 55	Heise
145	04.01	HD206860	21 42 06	+14 31 59	89	1 42	Pallavicini
145	07.32	Cygnus Loop	20 47 24	+31 43 21	94	6 49	Watson
145	17.54	PG1550+191	15 50 35	+19 04 55	140	5 39	King
146	06.30	HD 212697	22 23 50	-17 00 24	92	2 42	Pallavicini
146	10.40	2208-137	22 08 42	-13 43 35	94	3 49	Biermann
146	17.16	AY Lyr	18 42 41	+37 56 14	110	5 44	Heise

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
146	06.30	HD 212697	22 23 50	-17 00 24	92	2 42	Pallavicini
146	10.40	2208-137	22 08 42	-13 43 35	94	3 49	Biermann
146	17.16	AY Lyr	18 42 41	+37 56 14	110	5 44	Heise
150	02.54	1057+100	10 57 42	+10 05 25	94	5 7	Biermann
150	11.12	H1338+76	13 35 20	+78 15 34	77	4 44	White
151	16.01	A1907+09	19 07 15	+09 44 54	130	3 35	Page
152	21.35	NGC6814	19 39 54	-10 26 57	134	6 59	Branduardi
153	16.37	A1907+09	19 07 15	+09 44 54	131	1 38	Page
155	03.28	A1907+09	19 07 15	+09 44 54	132	1 16	Page
155	15.08	NGC4383	12 22 53	+16 44 48	104	3 8	Peacock
156	12.40	4U1223-62	12 23 48	-62 29 45	120	2 44	Re
156	18.25	A1907+09	19 07 15	+09 44 54	133	1 30	Page
156	22.20	NGC 6888	20 10 17	+38 12 27	103	24 57	Wendker
158	05.45	4U1907+09	19 07 15	+09 44 54	134	1 35	Van Paradijs
159	20.39	4U1223-62	12 23 47	-62 29 43	119	2 12	Re
161	05.45	4U1223-62	12 23 47	-62 29 43	118	1 37	Re
161	10.27	NGC 7582	23 15 31	-42 37 50	104	3 33	Pye
161	15.25	Sersic 159-03	23 11 16	-42 59 50	105	4 10	Pye
162	17.08	NGC3783	11 36 34	-37 27 33	108	5 52	Bell-Burnell
163	01.17	Cygnus X-3	20 30 38	+40 47 18	101	11 7	Willindgale
163	14.45	Her X-1	16 56 03	+35 24 51	121	39 1	Trümper
165	09.00	Cygnus X-3	20 30 39	+40 47 00	102	6 26	Willingdale
166	13.45	Cygnus X-3	20 30 39	+40 47 00	103	1 59	Willingdale
166	17.10	Gal. Plane (1)	09 39 13	-52 32 01	93	1 95	Turner
167	03.33	Gal. Plane (2)	21 39 13	+35 36 00	87	3 23	Turner
168	00.55	Cygnus X-3	20 30 38	+40 47 18	104	12 29	Willingdale
168	15.12	Gal. Plane (4)	21 39 14	+52 32 02	87	3 12	Turner
169	02.50	PKS0637-75	06 37 21	-75 13 16	99	12 00	Zimmermann
170	04.48	Gal. Plane (5)	09 39 14	-52 32 01	91	4 45	Turner
171	01.17	Gal. Plane (6)	21 39 13	+52 32 01	89	1 36	Turner
171	12.25	Gal. Plane (7)	09 39 13	-52 32 02	90	2 8	Turner
171	22.30	Gal. Plane (8)	21 39 14	+52 32 01	89	3 27	Turner
174	07.40	Gal. Plane (9)	21 34 14	+52 32 02	91	3 14	Turner
174	21.04	Gal. Plane (10)	09 39 13	-52 32 01	89	2 83	Turner
175	14.42	Gal. Plane (11)	09 39 14	-52 32 02	88	3 20	Turner
176	01.15	Gal. Plane (12)	21 39 13	+52 32 01	91	3 85	Turner
177	18.19	Gal. Plane (13)	21 39 14	+52 32 02	92	3 76	Turner
178	02.55	Gal. Plane (14)	09 39 14	-52 32 02	87	2 8	Turner
179	07.14	Gal. Plane (15)	09 39 14	-52 32 02	93	2 07	Turner
179	23.41	Gal. Plane (16)	21 39 14	+52 32 02	93	2 09	Turner
180	07.24	H0305-65	03 04 27	-65 24 59	97	2 20	White
181	15.20	I ZW 186	17 27 02	+50 15 12	105	7 48	Maccagni
182	15.35	Cygnus Loop	20 52 43	+31 43 02	116	6 25	Arnaud
190	14.30	Cygnus Loop	20 54 04	+30 39 5?	121	6 3	Arnaud
190	23.50	AE AQR	20 37 32	-01 03 00	150	2 58	Osborne
192	00.23	MR2251-179	22 51 24	-17 50 44	129	2 3	Pounds
192	04.45	HD206165	21 36 22	+61 51 14	91	1 57	Zwaan
194	06.54	Deep Field	15 00 47	+10 49 28	107	42 37	Culhane
197	17.10	IC 2602	10 41 10	-64 07 55	92	5 20	Schnopper

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
198	13.54	4U1110-58	11 10 14	-57 59 52	90	1 35	v.Paradijs
198	18.09	SMC X-1	01 15 43	-73 42 40	112	4 8	Robba
199	09.00	HD 198478	20 47 15	+45 55 26	111	3 29	Zwaan
199	15.27	PG0027+260	00 27 28	+26 00 27	97	2 0	Mason
200	14.48	I ZW I	00 50 57	+12 25 45	99	5 26	Bergeron
204	04.08	HD 200723	21 02 00	+41 25 30	116	1 52	Zwaan
205	18.45	A98	00 43 44	+20 14 47	102	17 44	Molteni
212	22.40	HD 3196	00 32 39	-03 52 03	121	3 9	Bedford
214	11.04	4U2030+40	20 30 37	+40 46 58	121	5 30	Van d.Klis
219	13.22	Lamda AND	23 35 05	+46 11 26	108	4 44	Brinkman
223	02.39	4U1538-52	15 38 36	-52 13 43	105	5 41	Molteni
224	02.26	GC0109+224	01 09 25	+22 29 04	112	7 31	Maccagni
224	13.25	4U1538-52	15 38 36	-52 13 42	104	5 34	Molteni
226	16.22	4U1700-37	17 00 32	-37 46 14	116	10 39	Brinkmann
227	18.17	4U1700-37	17 00 32	-37 46 14	115	9 16	Brinkmann
229	00.41	4U1700-37	17 00 32	-37 46 14	114	5 23	Brinkmann
229	10.12	Tycho SNR	00 22 32	+63 51 34	96	13 32	Davelaar
234	12.10	AM Her	26 42 05	+25 20 28	93	2 23	Mason
243	07.10	Ar Lac	22 06 40	+45 29 40	125	2 03	Eyles
243	14.27	Jupiter	18 33 38	-23 28 36	116	12 22	Schnopper
245	15.50	H2311+77	23 14 51	+78 22 09	93	1 50	White
248	21.18	Ar Lac	22 06 26	+45 31 21	126	15 48	Eyles
252	11.45	PKS 0637-75	06 37 44	-75 11 19	89	4 17	Zimmermann
254	15.55	H0416-12	04 16 14	-12 16 57	105	1 14	White
259	23.50	MKN 1040	02 25 21	+31 07 48	126	5 13	Pounds
262	07.55	CD-42	19 44 06	-42 09 52	113	1 35	Heise
264	15.18	0335+096	03 36 04	+09 50 16	122	13 8	Schnopper
273	04.09	V 1017 Sgr	18 28 44	-29 27 46	90	1 10	Heise
273	07.20	HD 197481	20 41 58	-31 33 15	117	2 20	Pallavicini
275	00.43	MV Lyr	19 05 32	+43 54 59	98	2 23	Heise
280	23.10	Hyades I	04 25 58	+17 22 04	125	3 29	Schnopper
281	04.00	Hyades II	04 22 35	+16 59 20	126	5 26	"
281	10.20	Hyades III	04 15 30	+17 09 25	128	7 16	"
282	01.56	Er Vul	21 00 05	+27 34 44	120	2 32	Heise
284	11.15	TAU-C1 F1	04 26 19	+26 06 13	127	9 24	Bleeker
284	22.55	TAU-C2 F1	04 52 45	+30 33 54	121	15 7	Bleeker
286	09.23	1921-293	19 21 35	-29 22 56	89	6 00	Willmore
287	04.50	1921-293	19 21 34	-29 22 42	88	9 11	Willmore
292	04.10	SMC X-1	01 16 03	-73 44 47	96	6 33	Robba
295	00.54	E0003.0-7443	00 03 16	-74 45 55	93	9 29	Pye
301	00.17	VW HYDRI	04 10 04	-71 25 58	93	10 42	Heise
304	17.13	VW HYDRI	04 09 30	-71 26 15	92	2 27	Heise
305	10.06	AB DRA	19 51 07	+77 35 17	102	2 18	Mason
308	09.40	VW Hydri	04 09 30	-71 25 23	92	6 39	Pounds
315	19.50	NGC7314	22 32 57	-26 20 04	101	5 43	Pounds
318	20.01	HD100696	11 29 59	+69 36 29	96	5 12	Bedford
321	06.26	MCG2-58-22	23 02 05	-08 59 58	109	6 6	Pounds
321	22.56	1003+35	10 03 15	+35 10 25	93	3 6	Miller

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Principal Investigator
322	03.40	Sigma Gem	07 40 18	+29 02 30	122	9 11	Schnopper
323	20.45	Sigma Gem	07 40 18	+29 02 31	124	3 56	Schnopper
326	02.26	Sigma Gem	07 40 21	+29 02 01	126	8 57	Schnopper
330	15.00	Fairall 9	01 21 52	-59 06 37	93	7 3	Pounds
332	19.33	NGC7469	23 00 40	+08 33 46	104	7 2	Pounds
349	19.12	PHL909	00 54 28	+14 27 22	115	7 15	Stewart
352	10.30	3A0234-526	02 36 43	-52 27 21	94	6 35	Pye
353	05.15	VELA X-1	09 00 28	-40 21 11	101	10 49	Peacock
357	16.10	NGC526A	01 21 54	-35 20 29	91	5 24	Turner
(85)							
010	21.30	44 BOO	15 02 07	+47 53 59	91		Heise
017	21.50	Puppis A	08 21 16	-42 47 19	116	10 31	Aschenbach
019	09.28	G292.0+1.8	11 22 41	-58 58 43	90	10 2	Peacock
020	18.50	Perseus East	03 19 01	+41 17 43	116	8 50	Branduardi
021	04.50	NGC 1275	03 16 21	+41 17 43	115	14 21	Branduardi
023	08.00	NGC5506	14 10 52	-02 56 26	91	4 30	McHardy
024	08.40	AKN 120	05 13 34	-00 15 16	129	5 56	Pounds
032	13.35	3C273	12 26 41	+02 20 19	126	5 25	Turner
032	21.37	NGC5506	14 10 47	-02 57 29	100	5 51	McHardy
041	04.35	NGC5506	14 10 49	-02 57 12	109	5 82	McHardy
042	08.20	Vela X-1	09 00 19	-40 23 37	124	7 30	Peacock
044	06.59	Vela X-1	09 00 19	-40 23 39	125	13 40	Peacock
048	04.44	Vela X-1	09 00 19	-40 23 33	125	11 20	Peacock
053	08.22	NGC5506	14 10 48	-02 57 11	121	6 48	McHardy
054	17.36	MKN376	07 10 21	+45 46 24	125	5 16	Pounds

Outstanding AO-1 pointings (13)

Target	Proposal No.	Comments
SC 0627-54	CLU F10	To be scheduled
3C345	AGN F50	TOO Status waiting for outburst
U Gem	LLX G17	" " "
Cen X-3	HLX G19	Scheduled for Mar. 85
GX340+0	OCC G1	Occultation - on hold
GX349+2	OCC G4	" "
GX339-4	HLX F17	Apr. 85
3C382	AGN G8	2 observations Apr. + May 85
3C273	AGN G16	Scheduled May 85
PKS 1934-63	EXG F36	" Mar. 85
1E0630+1748	LLX G6	" " "
G292.0+1.8	SNR F47	" " "

LIST OF PV PHASE AND CALIBRATION OBSERVATIONS

Day (83)	Time	Target	RA	Dec	SAA	Duration h m	Comments
165	16.17	Denebola	11 44 44	+14 38 38		2 45	
166	12.30	Blank Field	13 06 15	+29 39 00		50 1	
170	20.23	Cygnus X-1	19 52 29	+35 03 00	114	2 15	
170	23.48	Cygnus X-1 -30'	19 54 29	+35 03 55	114	8 14	
171	09.10	Cygnus X-1 -3'	19 55 29	+35 03 55	114	7 20	
171	17.40	Cygnus X-1 -3'	19 56 17	+35 03 55	114	19 57	
173	05.56	Cygnus X-1 -3'	19 56 17	+35 03 55	114	1 33	
173	12.15	Cas A	23 21 00	+58 32 30	75	30 25	
174	20.52	N. Polar Spur	17 05 43	+04 43 57	148	8 47	
175	09.34	1837+049	18 37 30	+04 59 20	89	9 5	
175	22.28	1758-205	17 58 21	-20 31 58	176	6 27	
176	08.02	Vega	18 35 02	+38 44 09	117	4 38	
177	15.45	1E1145-616	11 45 50	-61 40 43	106	9 25	
178	05.32	SNR1209	12 09 11	-52 30 00	106	11 28	
178	17.21	SNR1209	12 09 44	-52 30 00	106	4 47	
179	00.30	Her X-1	16 56 02	+35 25 05	117	8 20	
179	11.00	HZ43	13 13 48	+29 22 00	88	11 59	
180	01.01	AM Her	18 14 46	+49 50 55	106	6 27	
180	18.22	AM Her	18 14 46	+49 50 55	106	19 14	
181	21.30	M31	00 39 48	+40 58 59	74	55 48	
184	12.31	M31	00 39 48	+40 58 59	74	1 59	
184	19.58	Cyg X-3	20 30 26	+40 47 13	111	32 8	
186	06.26	Cyg X-2 (Raster)	21 45 20	+37 37 52	107	24 36	
188	18.18	1E1145-616	11 45 02	-61 40 33	100	4 39	
188	23.29	4U1145-52	11 45 34	-61 55 44	101	4 30	
189	07.58	Ton 256	16 12 09	+26 11 46	115	4 45	
190	18.54	PSR1937+214	19 37 29	+21 28 29	135	29 47	
192	01.47	PSR1937+214	19 37 29	+21 28 29	135	2 3	
192	05.33	NGC 4151	12 06 48	+39 46 40	62	6 11	
192	12.38	NGC 4151	12 08 00	+39 41 00	62	33 52	
194	00.25	Virgo A	12 18 30	+13 00 00	61	13 35	
194	15.54	Virgo B	12 21 30	+13 00 00	69	8 16	
195	01.15	Virgo C	12 24 00	+13 00 00	69	3 11	
195	05.28	Virgo D	12 27 00	+13 00 00	70	13 31	
195	19.30	Virgo D	12 27 00	+13 00 00	70	2 35	
195	22.55	Virgo E	12 30 00	+13 00 00	70	3 58	
196	03.37	Virgo F	12 33 03	+13 05 03	70	2 23	
196	06.27	Virgo F	12 33 00	+13 00 00	70	8 33	
196	15.52	Virgo G	12 36 00	+13 00 00	71	14 50	
197	08.17	Coma Cluster	12 57 29	+28 11 24	71	14 53	
198	17.57	2S1636-536	16 36 55	-53 39 15	132	11 24	
199	17.59	M87	12 28 46	+12 40 12	67	24 16	
200	21.58	Deep Field	18 09 53	+31 23 30	122	28 27	
205	11.59	NGC 1275	03 16 30	+41 20 11	64	11 38	
206	01.55	A Eri	01 35 50	-57 30 00	111	9 37	
207	11.06	A Eri	01 35 50	-57 30 00	111	1 53	
207	15.21	M31	00 39 48	+40 58 59	94	26 11	

Day	Time	Target	RA	Dec	SAA	Duration h m	Comments
208	19.31	LMC X-1	05 40 06	-69 46 03	93	8 26	
209	06.31	2S0114+65	01 14 42	+65 01 31	79	7 52	
209	16.13	Cyg X-1 (Offset)	19 58 30	+35 07 45	125	1 15	
209	18.41	Cyg X-1	19 56 29	+35 03 55	125	8 57	
211	02.50	2S1705-440	17 05 18	-44 02 13	130	8 20	
211	12.30	2S1702-429	17 02 40	-42 57 58	129	7 34	
211	22.10	EX Hya	12 49 3	-28 58 39	77	27 1	
213	19.05	1702-363	17 02 24	-36 21 23	129	20 11	
214	19.30	2S1728-337	17 28 40	-33 47 52	133	7 36	
215	04.57	H1658-298	16 58 54	-29 52 28	127	8 49	
215	15.40	GX 17+2	18 13 11	-14 03 15	142	9 2	
216	02.05	H1426+01	14 26 34	+01 30 37	83	8 14	
216	10.41	H1426+01	14 26 50	+01 30 37	83	2 56	
216	15.52	WZ Sge	20 05 20	+17 33 31	143	5 33	
217	00.10	4U 1822-00	18 22 49	-00 02 24	138	7 41	
219	01.14	2S1755-338	17 55 21	-33 48 15	135	8 52	
219	11.28	1730-333	17 30 07	-33 21 17	129	2 2	
219	15.46	Sco X-1	16 17 04	-15 31 15	111	9 37	
220	01.50	Sco X-1	16 17 24	-15 25 57	111	6 9	
220	08.40	Sco X-1	16 17 23	-15 35 57	111	4 50	
220	15.55	2A 2206+542	22 06 08	+54 16 22	108	3 4	
220	21.32	3C445	22 21 15	-02 21 26	158	2 59	
222	10.54	H 2215-086	22 15 29	-08 40 12	164	3 51	
222	17.20	AM Her	18 14 59	+49 50 54	103	20 18	
223	15.50	W 49B	19 08 45	+09 01 24	139	11 30	
224	05.46	A 133	01 00 18	-22 04 00	129	6 7	
224	13.54	A0851-467	08 53 48	-46 12 36	62	5 56	
224	23.20	NGC 6221	16 48 30	-59 07 59	132	3 15	
226	19.50	1730-333	17 30 06	-33 21 17	111	2 30	
227	00.20	1730-333	17 31 36	-32 54 00	111	13 41	
227	14.53	1730-333	17 30 07	-33 21 17	111	4 6	
275	04.18	Beta Ori	05 12 08	-08 15 29	109	5 43	UV
279	13.10	MR 2251	22 51 25	-17 50 54	144	24 5	
291	02.32	HD45348	06 22 19	-52 38 13	92	7 25	UV
291	11.34	EPS ORI	05 33 28	-01 09 49	118	5 1	UV
297	21.57	Capella	05 13 00	+45 55 18	125	24 58	
355	15.33	Cas A	23 21 11	+58 52 00	106	15 27	
(84)							
024	16.33	NGC 1275	03 16 30	+41 20 11	112	9 51	
029	18.24	3C 273	12 26 32	+02 19 27	123	4 01	
039	13.34	HD 20902	03 20 44	+49 41 06	101	6 48	UV
049	14.18	Pleiades	03 45 00	+23 58 00	90	13 5	
066	06.07	Orion	05 32 50	-05 24 00	96	12 50	
073	03.10	Crab Nebula	05 31 31	+21 58 53	90	4 58	
081	21.10	Gamma Gem	17 21 11	-56 19 59	96	5 27	UV
085	16.10	Crab Nebula	05 31 31	+21 58 54	78	15 20	
114	00.32	HD187642	19 48 21	+08 44 41	92	6 35	UV
133	00.02	W49B	19 08 45	+09 01 24	116	15 3	

Day (84)	Time	Target	RA	Dec	SAA	Duration h m	Comments
147	17.40	Virgo E	12 21 33	+09 57 52	115	3 39	
148	01.50	Virgo D	12 24 28	+10 46 48	115	0 76	
148	04.30	Virgo C	12 26 21	+11 23 44	115	7 30	
148	13.10	Virgo B	12 27 35	+11 54 43	114	5 49	
148	19.58	Virgo A	12 28 44	+12 36 12	114	3 1	
148	23.55	Virgo B'	12 25 25	+13 04 38	113	6 41	
149	06.58	Virgo C'	12 22 18	+13 31 31	112	9 2	
149	17.20	Virgo D'	12 20 05	+13 50 01	111	7 40	
152	14.22	PSR1937+214	19 37 28	+21 28 02	117	4 23	
184	02.50	NGC 7469	23 00 42	+08 36 42	109	3 25	ME
188	04.15	NGC 7469	23 00 44	+08 36 48	113	2 15	ME
190	08.40	NGC 7469	23 00 42	+08 36 20	115	2 5	ME
191	20.00	NGC 7469	23 00 42	+08 36 20	116	2 3	ME
204	07.54	Cas A	23 21 10	+58 31 44	91	16 50	GSPC/ME
205	02.40	Cyg X-2	21 42 35	+38 05 28	117	13 56	GSPC
206	15.01	Cyg X-1	19 56 28	+35 03 55	124	6 58	GSPC
209	06.05	3C47	01 33 40	+20 42 21	94	11 36	ME
230	14.57	LE Cal.	01 04 13	+31 53 43	114	46 24	LE
288	17.00	Crab Nebula	05 31 38	+22 01 07	118	13 41	ME
318	06.25	CRAB	05 31 32	+21 58 34	147	2 40	GSPC
352	18.51	IH0900-48	08 58 17	-47 55 36	96	1 24	
352	20.52	IH0900-48	09 02 53	-48 26 45	95	2 0	
352	23.40	IH0900-48	08 54 29	-47 29 50	96	1 0	
353	01.24	IH0900-48	09 05 19	-48 26 59	95	2 36	
360	21.10	M87	12 28 56	+12 41 09	92	12 11	
(85)							
015	16.42	4U1530-44	15 30 57	-44 15 52	57	18 57	Occultation
020	06.41	HZ43	13 14 04	+29 22 13	111	6 90	LE
031	16.06	1402+04	14 02 28	+04 17 20	103	18 13	LE
036	08.45	Crab	05 31 25	+21 56 33	127	23 22	GS/ME

LIST OF TARGETS OF OPPORTUNITY

Day	Time	Target	RA	Dec	SAA	Duration h m
(83)						
181	15.05	Her X-1 Re-visit	16 56 01	+35 25 05	117	4 27
187	11.24	Supernova Evans	13 34 18	-29 37 00	107	18 36
188	06.10	Supernova Evans	13 34 18	-29 35 26	108	9 3
189	14.52	Her X-1	16 56 02	+35 25 05	114	26 6
198	10.14	Her X-1	16 56 01	+35 25 05	110	2 45
202	04.42	Supernova Evans	13 34 30	-29 35 26	95	27 18
203	08.30	Supernova Evans	13 34 30	-29 35 26	95	5 30
210	05.49	Her X-1	16 56 01	+35 25 05	106	14 33
210	20.35	Her X-1	16 56 01	+35 25 05	106	4 24
217	11.40	Her X-1	16 56 01	+35 25 05	102	1 3
217	13.07	Her X-1	16 56 20	+35 25 04	102	26 21
218	17.43	Supernova Evans	13 34 02	-29 38 48	80	5 44
225	05.23	Her X-1	16 56 02	+35 25 03	91	4 07
227	21.35	GK Per	03 27 46	+43 44 24	76	9 10
236	07.25	GK Per	03 27 45	+43 44 24	89	13 03
238	19.25	Her X-1	16 56 02	+35 25 03	91	3 5
240	05.21	1543-475	15 43 49	-47 33 35	91	2 3
287	14.39	0A0538-66	05 37 23	-66 58 26	91	9 5
318	16.25	VW Hyi	04 09 29	-71 25 23	90	3 21
324	04.36	V0332+53	03 31 05	+53 00 36	146	6 26
325	15.32	V0332+53	03 31 05	+53 00 35	147	3 17
328	14.47	IRAS I	04 09 42	+05 25 08	165	5 10
328	22.47	IRAS II	04 13 47	+12 17 36	171	3 58
329	05.40	V0332+53	03 31 14	+53 00 16	147	6 8
332	18.10	V0332+53	03 31 14	+53 00 17	147	5 24
335	23.44	V0332+53	03 31 05	+55 00 36	146	6 43
337	20.00	2109-09	21 09 28	-09 01 56	66	3 25
358	12.49	V0332+53	03 31 14	+53 00 24	138	3 23
359	18.40	V0332+53	03 31 14	+53 00 24	138	3 50
363	22.08	V0332+53	03 31 14	+53 00 24	135	2 33
(84)						
002	08.24	V0332+53	03 31 15	+53 00 24	133	2 56
007	08.40	V0332+53	03 31 15	+53 00 24	129	3 22
010	08.45	V0332+53	03 31 15	+53 00 24	127	5 46
019	15.52	V0332+53	03 31 15	+53 00 24	119	2 59
022	08.56	V0332+53	03 31 15	+53 00 24	117	4 41
023	20.58	V0332+53	03 31 15	+53 00 23	116	9 34
077	21.35	SU Uma	08 08 05	+62 45 36	106	1 33
081	13.55	4U1743-28	17 43 26	-28 30 27	94	5 15
102	08.25	1630-47	16 30 11	-47 16 12	124	6 17
102	23.35	AN Uma	11 01 35	+45 19 26	117	14 18
106	15.25	G357.7-0.1	17 36 59	-30 57 00	120	3 14
112	08.45	0851+202	08 52 26	+20 25 15	98	9 07
131	01.50	4U1630-47	16 30 16	-47 16 51	145	4 10
153	07.05	3C390.3	18 45 37	+79 42 38	76	7 0
158	01.40	VW Hyi	04 09 29	-71 25 23	94	2 05

Day (84)	Time	Target	RA	Dec	SAA	Duration h m
179	00.05	SS Cyg	21 40 44	+43 21 23	99	4 25
183	08.58	1630-47	16 30 14	-47 16 24	144	2 49
187	20.30	1608-522	16 08 52	-52 17 46	136	3 30
189	10.45	Cygnus X-1	19 56 27	+35 03 42	121	4 43
190	00.42	Cygnus X-1	19 56 27	+35 03 42	121	4 53
191	11.13	Cygnus X-1	19 56 27	+35 03 41	121	5 34
199	01.15	1730-33	17 29 38	-32 56 59	148	4 30
211	17.45	1630-47	16 30 13	-47 16 16	123	3 34
223	11.36	Nova Vul.	19 24 02	+27 15 24	128	2 8
236	09.25	HD 8357	01 20 19	+07 09 16	128	2 45
240	09.16	XB 1658-298	16 58 52	-29 52 37	102	1 53
251	16.55	VW Hydri	04 09 29	-71 25 24	100	3 5
258	14.16	SS Cyg	21 40 45	+43 21 23	127	6 53
259	13.12	SS Cyg	21 40 45	+43 21 22	127	2 28
259	17.19	3C390.3	18 44 42	+79 42 05	90	3 52
262	00.32	SS Cyg	21 40 45	+43 21 23	127	4 28
263	03.31	SS Cyg	21 40 45	+43 21 22	127	1 24
272	14.38	Cyg X-3	20 30 24	+40 46 11	115	6 9
285	20.58	0338-54	03 38 27	-54 19 24	110	2 7
318	11.30	H0139-68	01 39 17	-68 10 25	92	6 7
(85)						
006	12.20	PG1346+082	13 46 26	+08 12 26	84	3 9
012	03.00	RZ LEO	11 34 48	+02 06 00	118	3 0
016	20.48	HT Cas	01 06 51	+59 45 59	102	4 12
027	02.12	1E1207+39	12 08 26	+39 43 25	129	25 24
031	09.00	PG1346+082	13 46 36	+08 13 56	108	5 36
033	09.32	3C390.3	18 46 45	+79 42 44	98	21 39
037	12.24	1402+04	14 02 29	+04 17 33	109	13 21
038	18.25	GX301-2	12 24 25	-62 29 54	94	25 12
046	02.52	EXO 0748-673	07 48 26	-67 37 19	96	19 58
047	00.40	GX301-2	112 24 11	-62 29 51	99	12 46
047	14.17	1244-588	12 46 55	-58 47 59	101	6 43
048	00.20	H0900-42	08 50 24	-47 00 00	118	3 9
049	22.37	EXO 0748-673	07 48 24	-67 37 23	97	16 8
055	02.28	PKS0539-44	05 37 21	-44 06 47	95	3 7
055	11.45	1H 1430+423	14 30 11	+42 23 29	118	5 19
055	21.02	LX Ser	15 35 52	+19 03 05	105	2 26
057	11.26	EXO 0748-67[illegible]	07 48 24	-67 37 24	89	8 18

EXOSAT X-RAY SOURCES

'New' X-ray sources are discovered by EXOSAT serendipitously in the FOV of the telescope or in the offset quadrants of the ME or from an analysis of ME/GSPC 'background' data recorded during manoeuvres. We intend to maintain a list of published 'new' sources and readers are encouraged to report 'discoveries'.

It is recommended that the following convention be used when referring to EXOSAT sources in publications; in any case, this format will be adopted for any list maintained by the Observatory Team and is consistent with the recommendations referenced (below) and the Einstein HRI format.

Please note that this convention supercedes and renders obsolete the definition printed in Express issues 4 to 6.

EXOSAT Source Nomenclature

Source Position:	RA	02H	30m	20.5s	(1950)
	DEC	-02D	20m	33.2s	
Name :	EXO 023020-0220.5				

EXO 074824-6737.4: IAU Telegram No. 4039

Ref.(1) Dictionary of the Nomenclature of Celestial Objects
M.C. Lortet and F. Spite, Observatoire de Paris, Meudon

(2) IAU Sub-Group on Nomenclature Problems

IAU (EXOSAT) TELEGRAMS

Circular No.	Title	Comment	Authors
3841	Hercules X-1	Anomalous X-ray behaviour	EXOSAT Team
3842	Supernova in NGC 5236	Multi-waveband observations	W. Wamsteker
3850	GK Persei	351s periodicity during an outburst	M. Watson, A. Smith EXOSAT Team
3854	MXB 1730-335	Active, type 1 bursts	G. Pollard, N. White P. Barr, L. Stella
3858	4U 1543-45	Accurate position, ultra-soft spectrum	R. Blissett, EXOSAT Team
3872	GX 1+4	Unexpected low X-ray state: $\leq$4 UFU	R. Hall, J. Davelaar EXOSAT Team
3882	4U1755-33	Periodic dips in intensity	N. White, A. Parmar K. Mason
3887	4U2129+47 = V1727 Cygni	Unexpected low X-ray and optical state	W. Pietsch, H. Steinle M. Gottwald
3893	V0332+53	Accurate position, and flux	J. Davelaar, R. Blissett, L. Stella M. McKay, N. White, J. Bleeker
3902	V0332+53	Discovery of 4.4s period	L. Stella, N. White
3906	V0332+53	Unexpected brightening	A.N. Parmar R.J. Blissett T. Courvoisier L. Chiappetti
3912	V0332+53	Orbital parameters determination	N. White, J.Davelaar, A.N. Parmar, L. Stella M. van der Klis

Circular No.	Title	Comment	Authors
3923	Her X-1	Her X-1 'on' again at 80 Uhuru flux units, 1.24s pulsations (March 1.5 - 1.8)	J. Trümper, P. Kahabka H. Ögelmann, W. Pietsch, W. Voges, M. Gottwald, A. Parmar
3932	2S1254-690	Discovery of type 1 Burst and an absorption 'event'.	T. J.-L. Courvoisier, A. Peacock, M. Pakull
3935	AN URSAE MAJORIS	Serendipitous observation: soft X-ray flux suggests a return to the 'bright' state.	J.P. Osborne
3939	VW HYDRI	Discovery of X-ray pulsations during superoutburst	J. Heise, F. Paerels, H. van der Woerd
3952	2S1254-690	Discovery of a 3.9hr period in the X-ray light curve	T. J.-L. Courvoisier A. Parmar, A. Peacock
3961	4U1323-62	Type I Burst discovered	M. van der Klis, F.A. Jansen, J. van Paradijs, W.H.G. Lewin
3980	TV Columbae	X-ray periodicity discovered in range 1-7 keV.	A.C. Brinkman, J. Schrijver
3996	2S 0142+61	1456 sec Modulation of the X-ray flux	N.E. White, P. Giommi, A.N. Parmar, F.E. Marshall
4033	1E1402.3+0416	Rapid variability in BL Lac Objects.	P. Giommi, P. Barr
4038	PG0834-488	Detection of a hard X-ray flux	M.C. Cook
4039	EXO 0748-676	Discovery of a bright transient X-ray source which shows bursts, irregular intensity dips and periodic total eclipses	A.N. Parmar, N.E. White, P. Giommi F. Haberl.

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An X-ray corona in SS Cygni. King, A.R., Watson, M.G., Heise, J. Nature 313 (1985), p.290-291.

The Discovery of 4.4 second X-ray pulsations from the rapidly variable X-ray transient V0332+53. Stella, L., White, N.E. Davelaar, J., Parmar, A.N., Blissett, R.J., and van der Klis, M. Ap.J., 288, L45-49 (1985).

The old Nova GK Per: discovery of the X-ray pulse period. Watson, M.G., King, A.R., Osborne, J. M.N.R.A.S. (1985), 212, 917-930.

Transient quasi-periodic oscillations in the X-ray flux of Cygnus X-3. Van der Klis, M., Jansen, F.A. Nature 313 (1985), p.768-770.

Modification of the GSPC Calibration Data

New effective area and the standard background spectra calibration data has been added to the GSPC CCF.

The effective areas as given in EXPRESS No. 8 (p.26) are defined in the data types E1 and E2, as follows:

data types E1, E2: effective areas

E1 contains 50 pairs of energy/area (E_i/EA_i) for a burst length window of 89-104, E2 for a window of 89-107. The structure of data types E1, E2 is identical.

Units: E_i = 0.01 keV
EA_i = 0.001 cm^2

Record 1

Bytes	0-3	E_1
	4-7	EA_1
	8-11	E_2
	.	
	.	
	248-251	E_{32}
	252-255	EA_{32}

Record 2

Bytes	0-3	E_{33}
	4-7	EA_{33}
	.	
	.	
	.	
	136-139	E_{50}
	140-143	EA_{50}
	144-147	Burst length lower limit
	148-151	" " upper "

The absorption efficiency in data type AE has been updated to yield the correct effective areas (see EXPRESS No. 7, p.35 for the relation absorption efficiency ↔ effective area). Note that the energies E_i in data type AE are different from those in data types E1, E2.

The standard background spectra in data type B1 (gain 2) and B2 (gain 1) have been replaced by standard spectra obtained in observations with longer accumulation times (133504 sec for gain 2, 76504 sec for gain 1 - the corresponding old values were 30768 sec and 15008 sec). The layout of B1 and B2 is unaltered.

These improvements have been incorporated into the GS calibration data included on FOT's since approximately Jan. 7th 1985. This new CCF supercedes the data on the AO-2 history tape. Any institute actively involved in GS data analysis should request a GS calibration history tape from the Observatory if the new GS CCF is not available on any of the FOT's despatched to P.I's at the institute.

M. Gottwald

Updates to the ME CCF

The recent (1985 February 5) EXOSAT observation of the Crab Nebula has extended the baseline for the measurement of the detector gain drifts reported earlier (EXPRESS No. 6, p.25) allowing a much more accurate measurement of the overall drifts to be made.

Analysis of this data by Alan Smith (ESTEC) in conjunction with the earlier measurements, shows that the average Argon gain drifts are as follows:

Detector	Gain Drift/day	Date of Start of Drift	Window
A	0.0	-	Thick
B	0.0	-	Thick
C	0.000145	1984 day 240	Thin
D	0.0003376	1983 day 309	Thin
E	0.0	-	Thick
F	0.0	-	Thick
G	0.000071	1983 day 168	Thin
H	0.0	-	Thin

Three out of the four thin-window detectors show increases in gain whereas all of the thick-window detectors are stable.

The small changes in gains reported earlier for detectors A,B,E,F and H are probably not real and were presumably caused by short term fluctuations in detector gain.

A revised programme of pre-amplifier gain adjustments, based on the above figures, has been implemented to keep the overall gains aligned at 6.7 keV. The revised gain change coefficients given above will be included on ME FOT's in the near future. FOT's that include this update will have a time of last update (bytes 8-11 of record 1 of the CCF) of 161705105.

A.N. Parmar
A. Smith

Modifications to the ME Auto Analysis

The slew analysis section of the ME auto analysis has been modified to give the position of any sources detected in the slew analysis. In addition a search of an X-ray catalogue indicates whether any sources detected are known sources/transients etc.

For sources detected in an offset quadrant, two positions are given because the data is analysed only by experiment half. The accuracy of these positions is one to two degrees since the source could be almost anywhere within the collimator response and the time of transit is not determined with great precision.

The slew analysis version number is now 1.2 (enabling users to check whether their output includes this facility).

Based on results of the recent Crab Nebula observation, the dead time is found to be more accurately modelled by an effective sampling rate of 3569 Hz. The ME auto analysis programs have been updated accordingly (V1.2 of the slew analysis and V2.5 of the scientific data analysis). A further discussion of the ME dead times will be included in the next issue of the Express.

A.N. Parmar

CMA1 Temperature and Detector Stability

During the early phase of the mission, the CMA1 detector/HT supply combination commonly exhibited unstable behaviour (ref. EXPRESS No. 3 p.3) at elevated detector temperatures. Operational procedures were instituted to maintain a low average CMA1 temperature, namely a systematic switch off of the 28V power supply (A1 line, analogue electronics and HT convertors) for maneouvres, perigee passes and some non-LE prime observations, and a restriction of the maximum solar aspect angle to $\leq$ 130°.

These procedures have reduced to practically zero the occurrence of instability and indeed long observations in the second half of 1984 have demonstrated that there is no immediately obvious degradation in performance if the temperature is maintained below 27°C.

In order to see how these constraints affect the total allowed duration of an observation it is important to quantify the CMA1 detector temperature behaviour as a function of the β angle and the total A1 line on-time. Data from observations carried out during the last three months has been analysed to give a set of curves describing the average time profile from the A1 line switch on of the CMA1 temperature at different β angles.

Figure 1 shows five of these curves, covering the typical range $90° \leq \beta \leq 130°$; curves for any other desired β angle can be readily extrapolated from the data collected.

Fig. 2 shows the derivatives of the temperature curves for β = 90° and 130° and indicates that the likely stable temperature for long observations would be 27.5° and 29.5° respectively. Based on this analysis, the following guidelines will be followed for planning and executing all future observations:

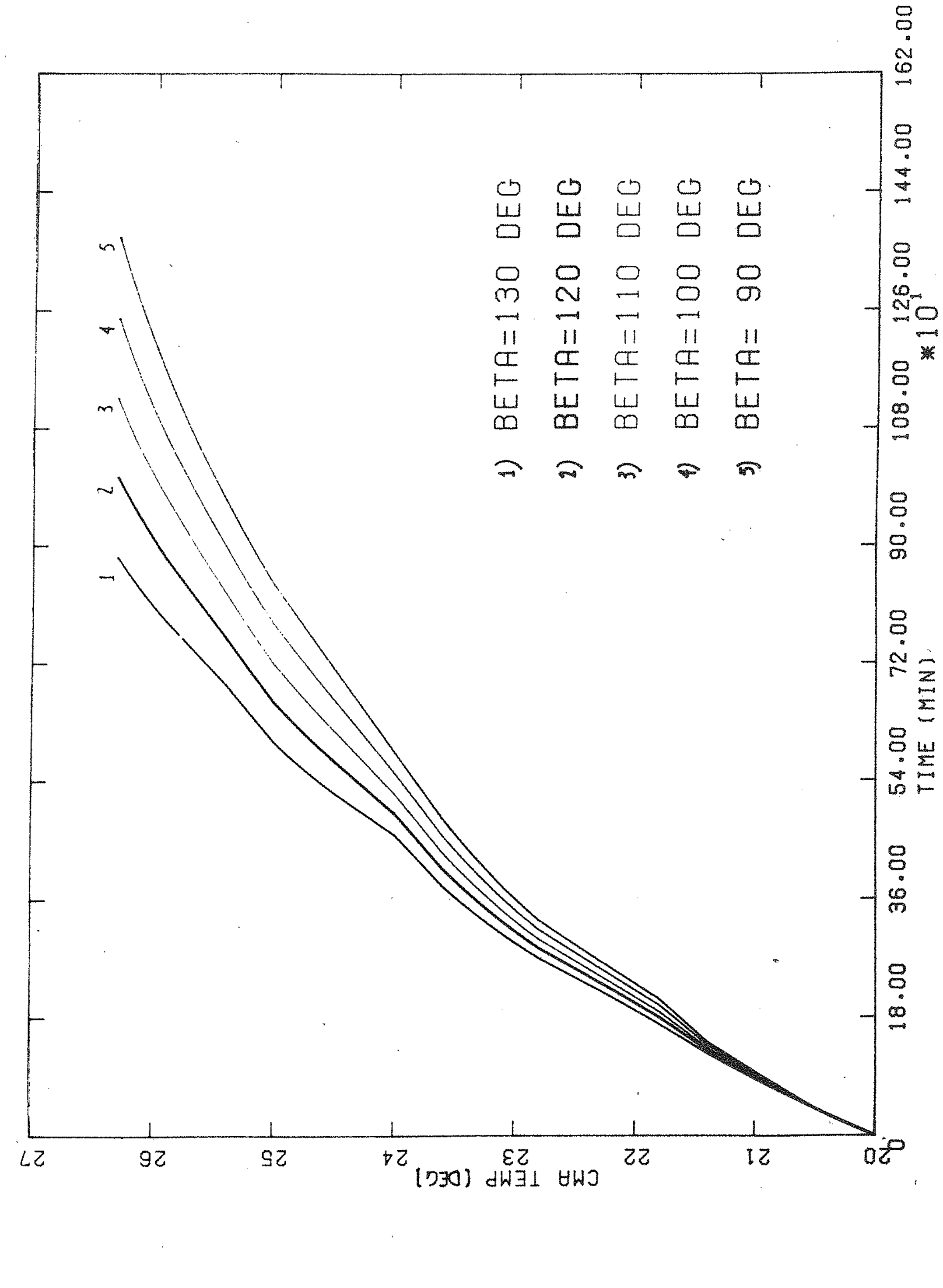
Maximum observation duration for $110° < \beta \leq 130°$: 4.5 units (12.5hr)

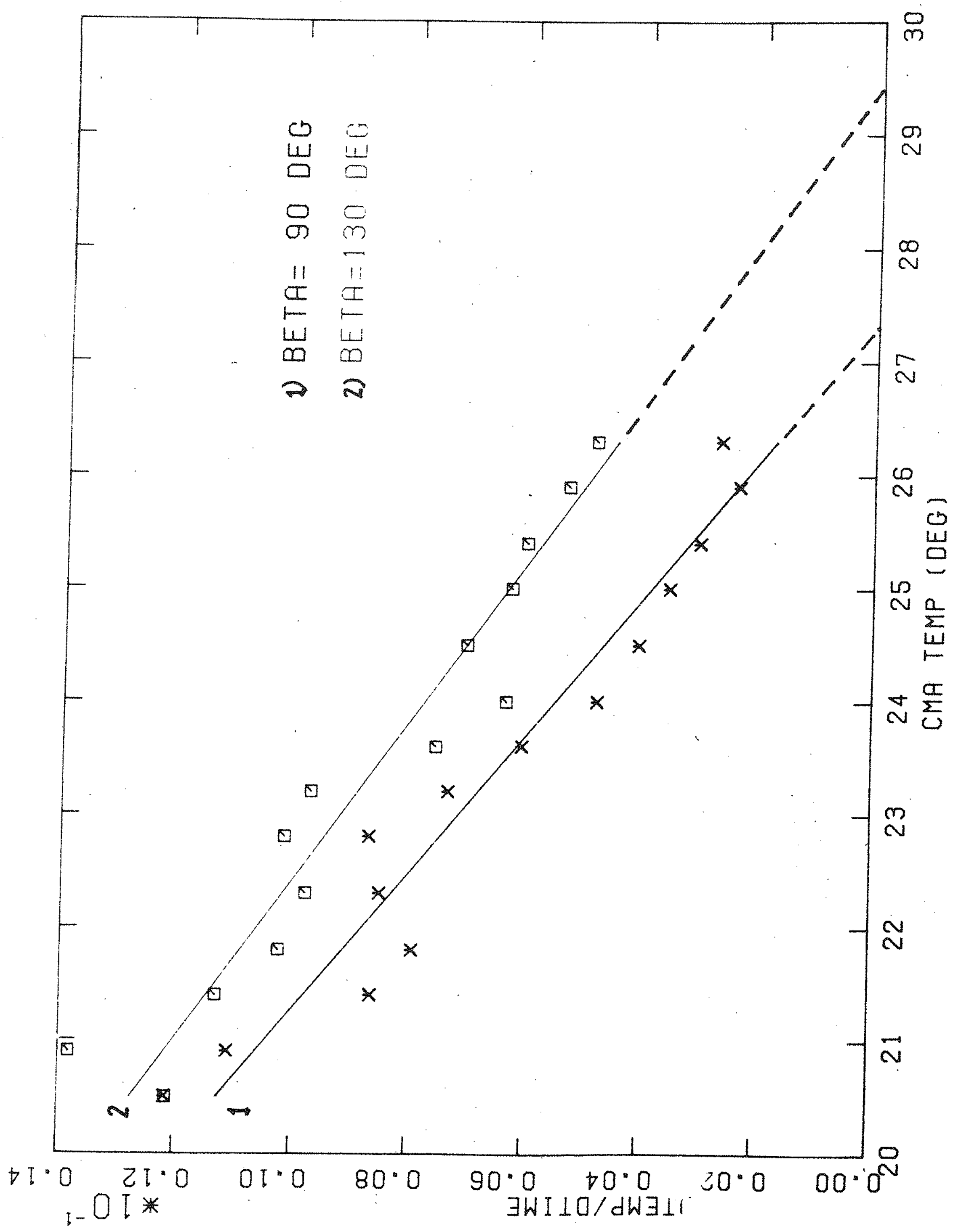
Maximum " " " $95° < \beta \leq 110°$: 9 units (25 hrs)

Basically unrestricted duration for $\beta \leq 95°$

NB. Practical durations for $95° < \beta \leq 130°$ will depend upon the starting temperature, but in most cases a 3 unit observation should be feasible.

P. Ferri


1) BETA=130 DEG
2) BETA=120 DEG
3) BETA=110 DEG
4) BETA=100 DEG
5) BETA= 90 DEG
TIME (MIN)
*10^1
CMA TEMP (DEG)
0
18.00
36.00
54.00
72.00
90.00
108.00
126.00
144.00
162.00
20
21
22
23
24
25
26
27
1
2
3
4
5



1) BETA= 90 DEG
2) BETA=130 DEG
CMA TEMP (DEG)
20
21
22
23
24
25
26
27
28
29
30
)TEMP/DTIME
*10⁻¹
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
1
2

EXOSAT DATA ARCHIVE

The EXOSAT Observatory is pleased to announce that the Data Archive will open in April 1985. This archive will comprise those observations performed before April 1984 for which an adequate calibration has been available for more than one year. Clearly, telescope observations which employed a Boron filter and some GSPC observations will initially be excluded.

The April issue of the EXOSAT Express will contain a full list of observations which are available. This list will be expanded in future issues of the Express.

The procedure for requesting archive tapes is a written input to the Project Scientist with the following information:

- Target name, day number, year, experiment of interest.

- A clear description (1-2 paragraphs) of the exact purpose for which the data is required. This should be at the level at which ESA can establish if the archive data will meet the needs of the user,eg. ME experiment time resolution required, telescope filters.

Attention is drawn to the article on p.44 describing the specification of the EXOSAT Observation Log. This log should be available by the middle of 1985 and will facilitate use of the archive.

After an archive request has been approved by the Project Scientist, the appropriate FOT will be despatched from ESOC. This despatch will of course have a lower priority than the observation programme FOT production and despatch. It is not envisaged to provide copies of the Automatic Scientific Analysis of FOT's. The interactive analysis facility at ESOC will however be available for analysis of archive data, again at a lower priority than analysis of current observation data.

A. Peacock

Plans for the EXOSAT Observation Log

With the imminent public release of data obtained during the first year of the EXOSAT mission, it is proposed to generate an observation log as a means of informing the Astronomical community about the EXOSAT observation programme. This would be a log of observations actually performed, as opposed to the list of planned targets contained in part IV of the EXOSAT Observers' Guide, and would be constructed along the lines of existing similar logs such as for the Einstein and IUE Satellites, though more detailed. The log will also form part of an overall EXOSAT archive and retrieval system to be implemented at a later date.

The following information will be used for constructing the log:

- manoeuvre history file (maintained automatically by the manoeuvre support software).

- FOT request file (maintained by manual entry of information on FOT request forms).

- observation directories on the FOT's themselves (created from housekeeping telemetry and saved on disc on the Observatory computers; there is one directory per experiment).

All of these 6 files will be available for examination at ESOC on the observatory computers, but the amount of information in them is rather large for a clear overall picture of the mission to be given. These so-called "primary files" will therefore be merged and condensed to give a single "secondary" file containing one alphanumeric record per stable pointing, ie. per target. The file will be distributed to the community as a print-out, or possibly in computer readable form to help in identifying useful EXOSAT data and (when appropriate) requesting copies of such data.

A listing of sections of the manoeuvre history has in fact already been printed in various issues of the EXOSAT Express, and can be used as a provisional log until the final one is available.

The record length of the secondary file will be 192 bytes, which will be shortened on the print-out to 132 bytes by reformatting, for example the LE2 status will be printed on a new line underneath the corresponding information for LE1 (only for the small proportion of observations for which both LE's were used).

A detailed specification of the record layout for one record of the log follows. Note that this is a provisional specification only.

J.R. Sternberg

E X O S A T   O B S E R V A T I O N   L O G   <850305.1558>

This is a specification of the contents of the 'secondary' log of all Exosat observations. It specifies the layout of 1 record of a 'flat file' derived by merging 6 primary sources of information. It also describes the layout of a printed log to be distributed to the Astronomical community - the printed layout is slightly different from the file record. Basically the log should have one record(with this layout) per pointing, however to aid readability of the PRINTED log a blank line should be inserted at each perigee (which can be recognised during log construction by change in orbit number). The occurrence of a trim manoeuvre results in an observation getting split into 2 lines in the log: the extra lines are just left as they are - the fact that they belong to the same observation is obvious from other information on the line.

Each piece of information is encoded as meaningful character(s) - if a field is left blank, this can mean either 'not true' or 'not applicable' or 'not (yet) inserted in log'. It should be obvious which applies in a particular case.

Start & stop times of FOT's themselves aren't currently included in this secondary log because of complications such as multi-target FOT's, possible different time-limits for different experiments but same target, however the 'consecutive targets' (C) flag is sufficient to show how targets are grouped on FOT's. (However, multi-target FOT's are rare).

Slew & IFT data are not used at all in the construction of this file.

The sources of information for each field are indicated below by the following letters:

A = auxiliary data (=manoeuvre history)
F = FOT request file
D = indexed observation directories (1 per experiment)
- = manual (via editor) insertion

description of field (of secondary file)	data source	char. pos'n	length in bytes	format/contents of field	format on PRINTED log (where this differs from file)
blank space		1	1		
start time of stable pointing	A	2	9	yydddhhmm	yy ddd hhmm (with leading
end " " " "	A	11	9	yydddhhmm	- ddd hhmm zeroes where
right ascension (of star tracker)	A	20	6	hhmmss	necessary)
declination (" " ")	A	26	7	+ or -ddmm.m	
target name (left justified)	A	33	16	up to 16 chs	
spare (for auxiliary or manual info)		49	22		
miscellaneous information expressed as					allow space for up to 3(1X,I2) integers
numeric footnotes : 1st footnote		71	2	! integers	(should never need all 5)
2nd "		73	2	! as	
3rd "		75	2	! specified	
4th "		77	2	! below	
5th "		79	2	! this table	
'continuation flag', showing whether data for this pointing direction are contained on the same FOT as for the preceding line of the log, for at least 1 of the available FOT's:	F	81	1		
- first pointing for multi-target FOT				*	
- continuation of multi-target FOT				C	
- FOT contains only one pointing				(space)	
principal investigator (a number > Ø pointing to a table of PI's names and addresses. Ø means 'Observatory'.)	F		3	integer(right adjusted)	

proposal code : divided into 2 fields, to permit search by prop. class					
- class of proposal(PV ,TOO,LLX,AGN etc)	F		3	up to 3 chs, left justified	
- identification of proposal	F		5	up to 5 chs	
4 flags for whether FOTs exist :	F				
(space means corresponding FOT doesn't exist)			1	L if LE1	
			1	K if LE2	
			1	M if ME	
			1	G if GS	
orbit number	F		3	integer(right adj.)	not printed (just controls line spacing)
spare (for FOT details)			5		
LE1 on/off flag	D	1Ø5	1		
(if not on, all other LE1 fields = blank)					
on for at least part of pointing				+	
off or no useful data for whole ptg				-	
information not yet available				(space)	
filters used during CMA obs :	D				
PPL			1	P	
4ØØØ Lexan			1	4	
Al/Pa			1	A	
3ØØØ Lexan			1	3	
Boron			1	B	
LE1 CMA (without grating) used for at least part of observation	D		1	C	
LE1 CMA (WITH grating) used for at least part of observation	D		1	G	
LE1 PSD used for at least part of obs	D		1	P	
spare (for LE1 payload info)			7		
LE2 - same payload info as for LE1	D	121	16	same as LE1	printed on new line under LE1(only if LE2 used)
ME on/off flag	D	137	1		
(if not on, all other ME fields = blank)					
on for at least part of observation				+	
off/not useful for whole of obs				-	
information not yet available				(space)	
ME position monitors :	D				
half 1 offset for at least part of obs			1	1	
half 2 offset for at least part of obs			1	2	
coaligned for > 15 consecutive mins			1	C	
('flat' is not recorded in this file)					
ME in non-nominal status	D		1	*	
(meaning tbd by A.Peacock)					
spare (for ME payload info)			7		
GS on/off flag	D	149	1		
(if not on, all other GS fields = blank)					
on for at least part of observation				+	
off/not useful for whole of obs				-	
information not yet available				(space)	
GS gain 1 or 2 (whichever for longer)	D		1	1 or 2	
spare (for GS payload/other status info)			2		
LE1 primary OBC mode :	D	153	1		
old DIRECT with or without filter				O	
new DIRECT without spatial filter				N	
new DIRECT with diamond filter				D	
new DIRECT with rectangular filter				R	
(the use of a spatial filter is indicated, even if filter was used for only part of a pointing; if both D & R were used, choose whichever for longer)					
LE2 primary OBC mode	D		1	same as LE1	printed on new line under LE1(only if LE2 used)

```
ME primary OBC mode :                          D          2
     HTR3 (full)                                                      T3
     PULS                                                             P1
     PULS2                                                            P2
     HER5                                                             E5
     HER3/4 per experiment half                                       EH
     HER3/4 per quadrant                                              EQ
     HER3/4 per detector                                              ED
     HER2                                                             E2
     MDIR2 (new DIRECT)                                               D2
ME secondary OBC mode   :                      D          2
     HER6                                                             I6
     HTR3 OPT                                                         T3
     HER5 (only considered as secondary                               E5
      mode if another primary mode is on)
(if there are 3 ME modes, ignore HTR3 OPT
 and indicate 3 modes via a footnote)
ME Ar integration time for primary mode        D          3       # of secs(right adjusted)
ME Xe      "        "    "     "      "        D          3       # of secs(  "       "   )
 (these are only to nearest sec and
  1 means anything < 1.5)
ME channel compression (primary mode)          D          2       factor   (  "       "   )
  (e.g. 1 means uncompressed)
ME channel selection(HER4 or 5 only) :         D          1
      no selection (all channels sent)                                Ø
      standard Ar/Xe selection # 1                                    1
      standard Ar/Xe selection # 2                                    2
          etc  (tbd)
      any other unusual selection                                     ? (i.e. the '?' is actually in the record)
ME int sample rate(HER3/4/5)                   D          1     log(base 2) rate (right adj.)
 (use HER5 if HER4/5 together)
ME int sample rate (HTR3(full))/HER6)          D          2       "        "   (   "    " )
 (use HTR3(full) if both are running)
GS OBC program :                               D          1
    old DIRECT (not EI)                                               O
    new DIRECT (EI)                                                   N
    HEBLn  (histograms)                                               H
GS E hist integration time (HEBLn)             D          2       # of secs(  "       "   )
GS E sample rate  (any mode)                   D          2     log(base 2) of rate(right adj.)
spare (for any OBC information)                          17
                                                      ________
                 total record length   =         192 bytes
```

The following information is pointed to by the 'numeric footnotes' mentioned near the beginning of the record layout:

```
                                            source       footnote #
  solar aspect angle < 90 degs                A              11
  non-nominal attitude stability              -              12
  telemetry loss due to ground
    segment or FOT production problem         -              13
  solar flare affects data                    -              14
  ME/HTR3 OPT data present at 64 per sec
      while sampling at only 32 Hz            D              15
  ME/HER4 data partly lost                    -              16
  crash of OBC                                -              17
  public release of data delayed              -              18
  observation is a raster scan                -              19
  observation is an occultation               -              20
  three ME OBC programs running
    together (3rd one usually HTR3 OPT)       D              21
```

J.R.S.

THE LIFETIME OF THE EXOSAT SPACECRAFT

1. Background

EXOSAT's design specification was based on a two-year operational phase. This had a number of major influences on the system design, particularly on the requirements for orbit stability, end-of-life solar array power and attitude/manoeuvre fuel.

This article examines the actual situation after 21 months of operation and considers those factors which will determine the ultimate lifetime expectancy of the mission.

2. Orbit Considerations

The EXOSAT orbit had to satisfy the following criteria:

- maximimum time spent outside the van Allen radiation belts.
- line of apsides (apogee-perigee line) close to perpendicular to the ecliptic plane, to maximise the area of sky over which lunar occultations could be effected.
- a Northern apogee such that a single, Northern hemisphere ground station (Villafranca, Spain) could be used for telemetry reception, telecommanding and tracking.

These criteria led to a choice of orbit with the nominal characteristics as shown in table 1.

The constraints on the time of day of launch for 26th May 1983 are shown in Fig. 1 and were:

- the Solar Aspect Angle (SAA) during the initial transfer orbit had to lie between 30° and 120°.
- there should be no eclipse during the transfer orbit.
- the final orbit lifetime had to be greater than 2 years.
- the maximum eclipse duration in the final orbit had to be less than 60 minutes from considerations of battery design.

The EXOSAT launch took place 1 minute prior to window closure and the orbit achieved had the characteristics as shown in Table 1 and a lifetime of approximately 3 years.

TABLE 1

Orbital Elements	Nominal	Achieved (26.5.83)
Height of Perigee	350 km	346.6 km
Height of Apogee	196235 km	191708.7 km
Eccentricity	0.9355	0.93433
Inclination	72.5°	72.47°
Argument of Perigee	286.5°	286.36°
Orbit Period	93.6 hrs	90.6 hrs

EXOSAT's orbit is perturbed strongly by the gravitational influence of the Sun and the Moon and this has the (principal) effect of changing the eccentricity of the orbit whilst the semi-major axis remains essentially constant. Thus the perigee height has increased from 350 km initially to a maximum of ca. 4500 km in November 1984, since when it has gradually decreased such that without active control, the EXOSAT spacecraft will re-enter the Earth's atmosphere during the second-half of April 1986 (see Fig. 2).

EXOSAT has, however, a hydrazine reaction control system with a capability of imparting 173 m/sec to the orbit. This system was included to permit active orbit control in order to modify the orbit period by small increments to achieve the geometry required for moon occultation of X-ray sources. Hydrazine usage to date has been 2.3 m/sec for commissioning and calibrating the system.

If the remaining 170 m/sec were used for perigee-raising, the lifetime of the orbit could be extended by about 1 year ie. until April 1987. The amount of the extension increases slightly the later the orbit manoeuvres are delayed; this effect is demonstrated in Figures 3 to 6. The optimal strategy is to perform small manoeuvres starting in April 1986 such that the perigee height is maintained just above the critical value at which the orbit would decay due to atmospheric friction (a few hundred kilometres). Other considerations, however, will probably dictate that less than the full 170 m/sec is used to extend the lifetime (see Section 5 below).

3. Power from the Solar Array

With the exception of eclipses (when battery power is used) the subsystems and experiments are powered from the Solar Array (consisting of 3312 solar cells) mounted on top of the spacecraft and rotated such that it remains near-normal to the Sun direction.

The output from the Array varies because of:

i) degradation of the solar cells from ageing and irradiation.

ii) variation in the Solar input caused by the eccentricity of the Earth's orbit around the Sun. This effect produces a variation of ca. 7% in Solar input from perihelion (2nd January) to aphelion.

The superposition of these two effects since launch can be seen in Fig. 7, which shows the Array output as derived from the Sun bus current and voltage sensors. The "noise" on this curve is the combined effect of telemetry quantisation, Array offsets from normal (up to 5°) and occasional high readings taken close to perigee when there is a significant input to the Array from Earth albedo.

The power currently required from the Array is around 230 Watts. This is not a constant load figure but includes also the "peaks" which occur as a result of aperiodic operation of thrusters and the temperature-control circuits of the gyros and therefore represents the level at which battery discharge will not occur. From the trend of the Array output to date, it can be seen that this load can be supported throughout the remaining natural mission lifetime and any possible extension.

4. Attitude Control Fuel

Limit-cycling and attitude manoeuvres (slews) are achieved using a cold-gas propane reaction control system. 14 kilograms of propane were loaded, with a pre-launch allocation between attitude manoeuvres and attitude stabilisation of approximately 55%:45%. This manoeuvre allocation was based on a (nominal) slew rate of 300 deg/hr. In practice, the amount of fuel used for manoeuvres has been somewhat less, since the slew rates used have been lower (171 deg/hr was eliminated in Dec. 1984). However a number of anomalies which have occurred with the Attitude and Orbit Control System, (AOCS, see earlier reports) have used additional propane fuel, for which there was no allowance in the original budget.

Although there is no direct measure of either the amount of propane used or the amount remaining in the tanks, two indirect but somewhat inaccurate methods are available:

i) Propane logging. Measurements have been made of the fuel consumption for limit-cycling and manoeuvring. This involves an operational procedure whereby the commanded propane plenum pressure is reduced for a short time and the rate of fall of the pressure is monitored. A housekeeping exercise is then carried out to integrate the consumption over time, adding in separately estimates for the additional fuel used as a result of anomalies (spurious triggering of Safety Mode, thrusters "stuck-on" etc). This method indicates that approximately 5.5 kg of propane remains as of the middle of February 1985.

ii) Propane gauging. The propane tanks are equipped with heaters with a total rating of 2.4 Watts, which are normally switched on only during eclipses. Switching on these heaters and monitoring the subsequent temperature rise (equilibrium is reached after about 4 days) allows an estimate of the propane remaining in the tanks.

Such an exercise was undertaken in the middle of February 1985 and the preliminary results give a "best fit" to a remaining propane mass of 4 kg.

These exercises are currently being re-examined in an attempt to reconcile the substantially differing results. Meanwhile, two measures are being applied to reduce the rate of consumption:

i) reduction of the manoeuvre frequency during the forthcoming AO3 programme, ie. increase the mean observation duration, and limitation of the slew rate to 42.7 deg/hr.

ii) Use of the Fine Sun Sensor for roll control (with the OBC program SMC compensating for sun motion) whenever possible. This measure results in lower noise injection into the X-axis limit cycle than the alternative 2-star roll control technique.

In this manner the overall consumption can be reduced to just over 2 kg per year for future operations, assuming of course that no further fuel-consuming anomalies occur.

Analysis of the calibration orbit manoeuvre indicates that, if all of the 170 m/sec were utilised, this could cost up to 1 kg of propane for attitude stabilisation during the orbit manoeuvre. This fuel is required to compensate for the misalignment between the line of action of the hydrazine thruster and the spacecraft centre of mass.

5. Conclusions

The optimum use of the remaining propane will have been made if the spacecraft re-enters the atmosphere at exactly the same time as the propane is exhausted.

One method of achieving this would be to leave the orbit uncontrolled until April 1986 and then to apply small orbit corrections to extend the life until such time as the propane is exhausted.

The approach however has two risk factors associated with it:

i) with only a single actuation to date, there is not yet a high confidence associated with the operation of the hydrazine system. Failure of a single manoeuvre late in the mission could be irrecoverable.

ii) it is not possible to perform orbit manoeuvres unless there are 3 operable gyros available to control the attitude. The X-gyro spin motor current rose dramatically on day 366 1984 and has displayed an erratic behaviour since. In the middle of February, it rose again and caused a significant temperature increase of the gyro box as a result of which the X-gyro was switched off. Prior to this step however, there was good reason to believe that the X-gyro could still be used to control the spacecraft. If a second gyro fails, it may be possible to "resurrect" the X-gyro to re-establish 3-axis gyro control.

All factors considered, the current philosophy is to leave the orbit uncontrolled until at least early 1986. If the anomalous consumption of propane has then been minimal throughout 1985, the strategy can be reviewed in the light of the best estimate of the propane remaining at that time.

A. Parkes

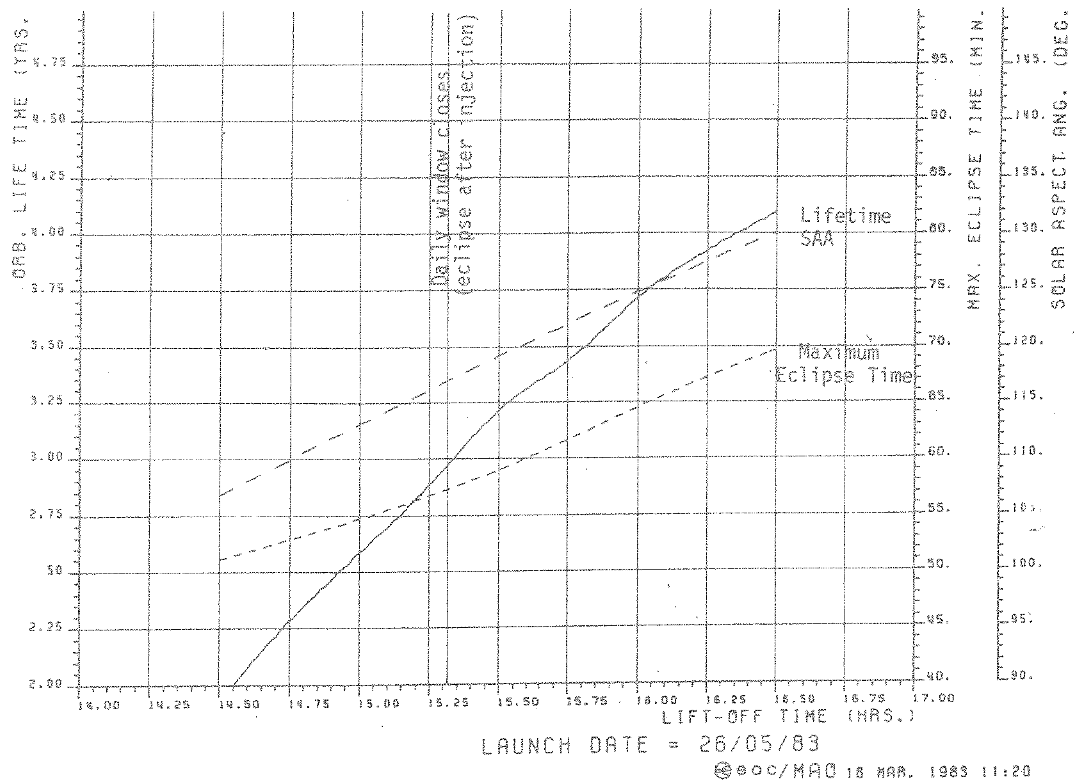


Fig. 1 EXOSAT Launch Window

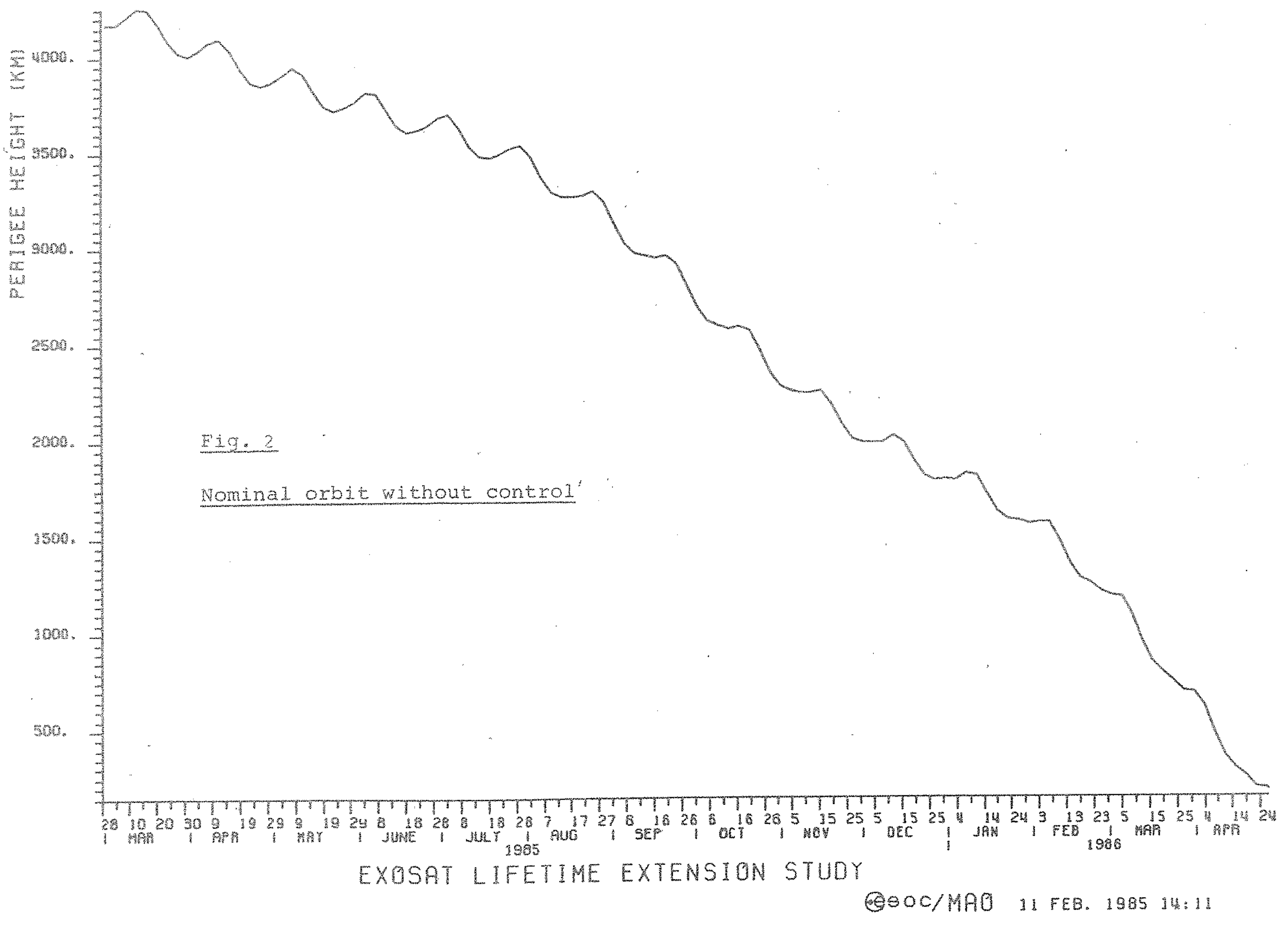


Fig. 2

Nominal orbit without control

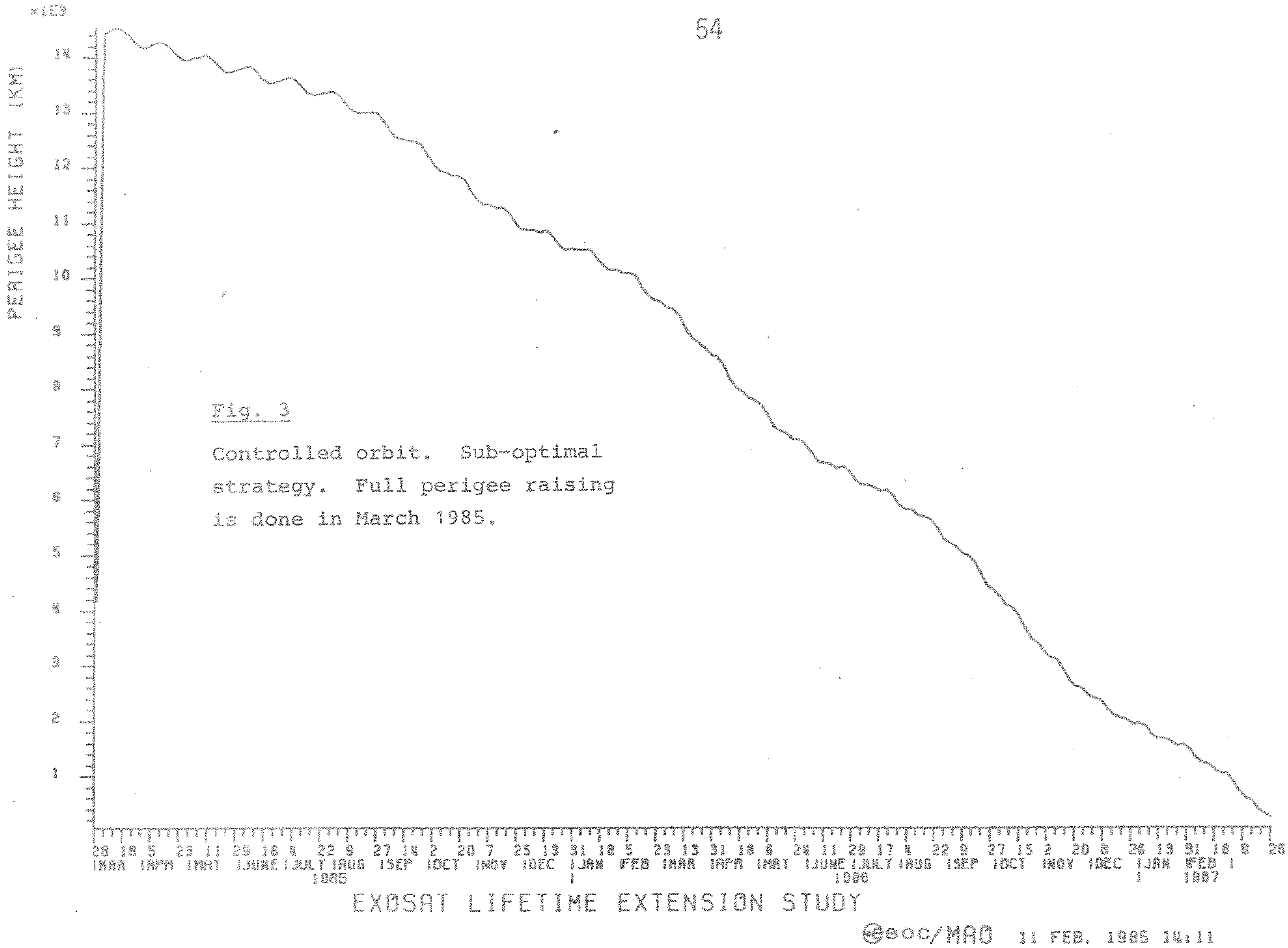


Fig. 3

Controlled orbit. Sub-optimal strategy. Full perigee raising is done in March 1985.

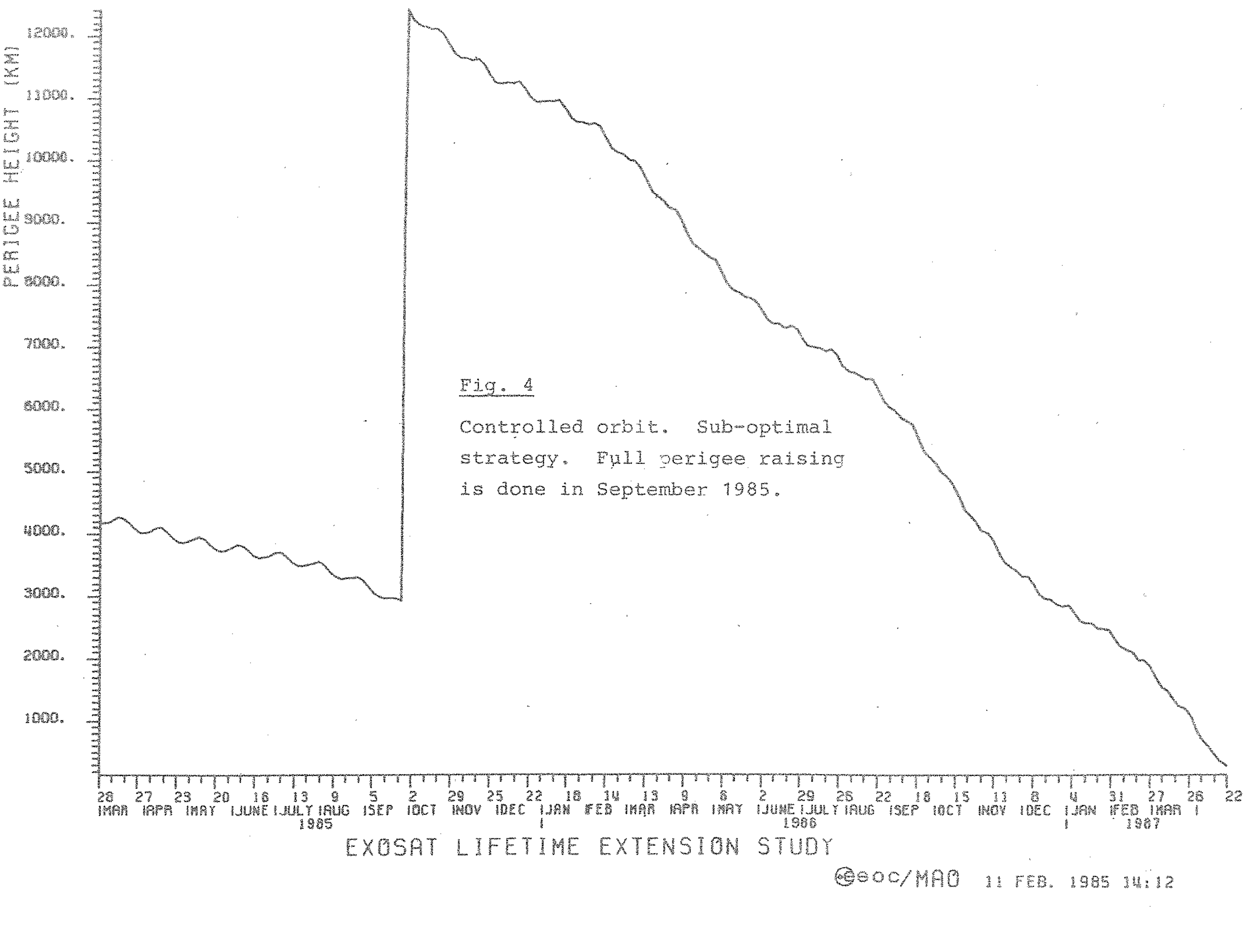


Fig. 4

Controlled orbit. Sub-optimal strategy. Full perigee raising is done in September 1985.

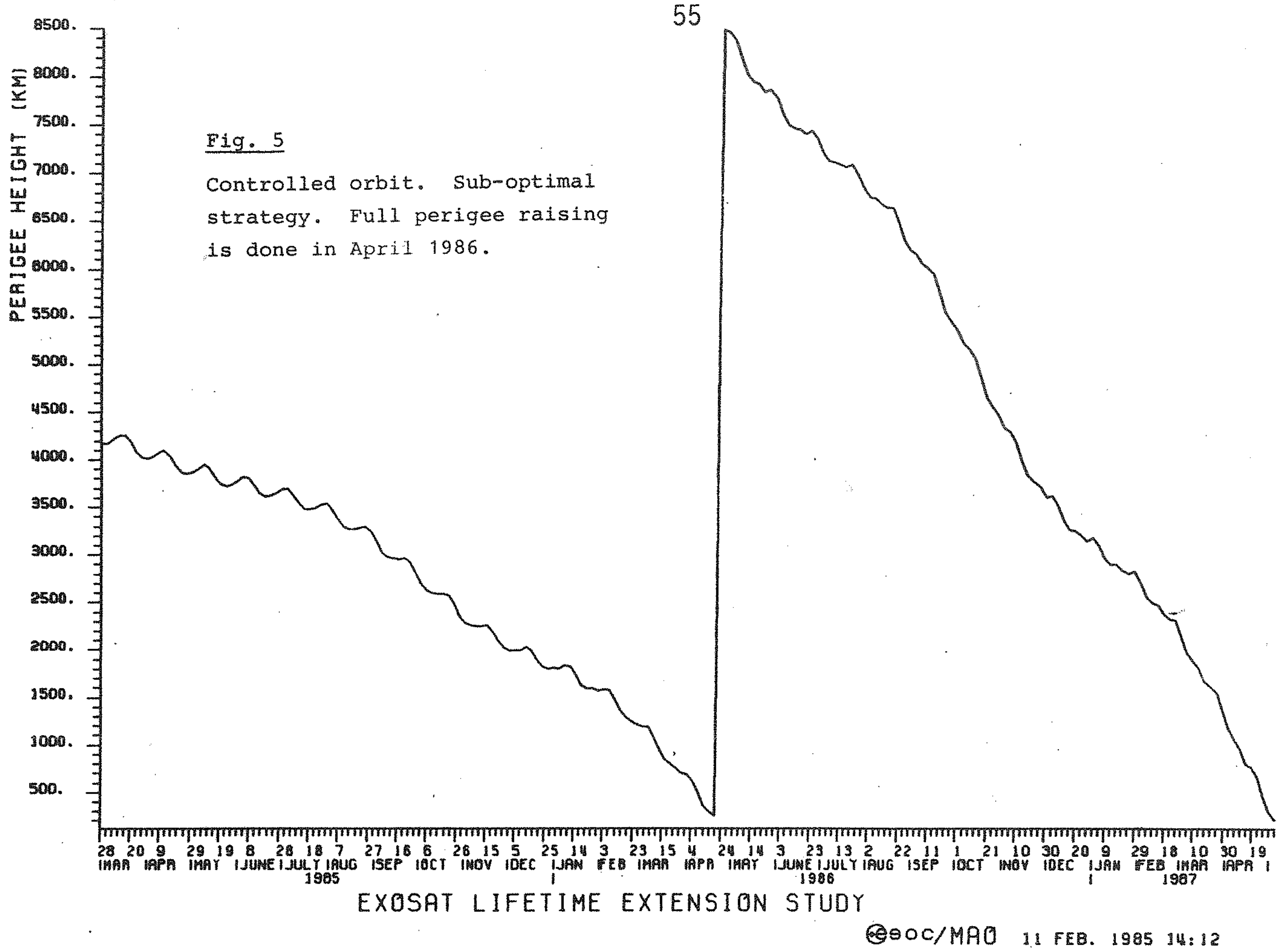


Fig. 5

Controlled orbit. Sub-optimal strategy. Full perigee raising is done in April 1986.

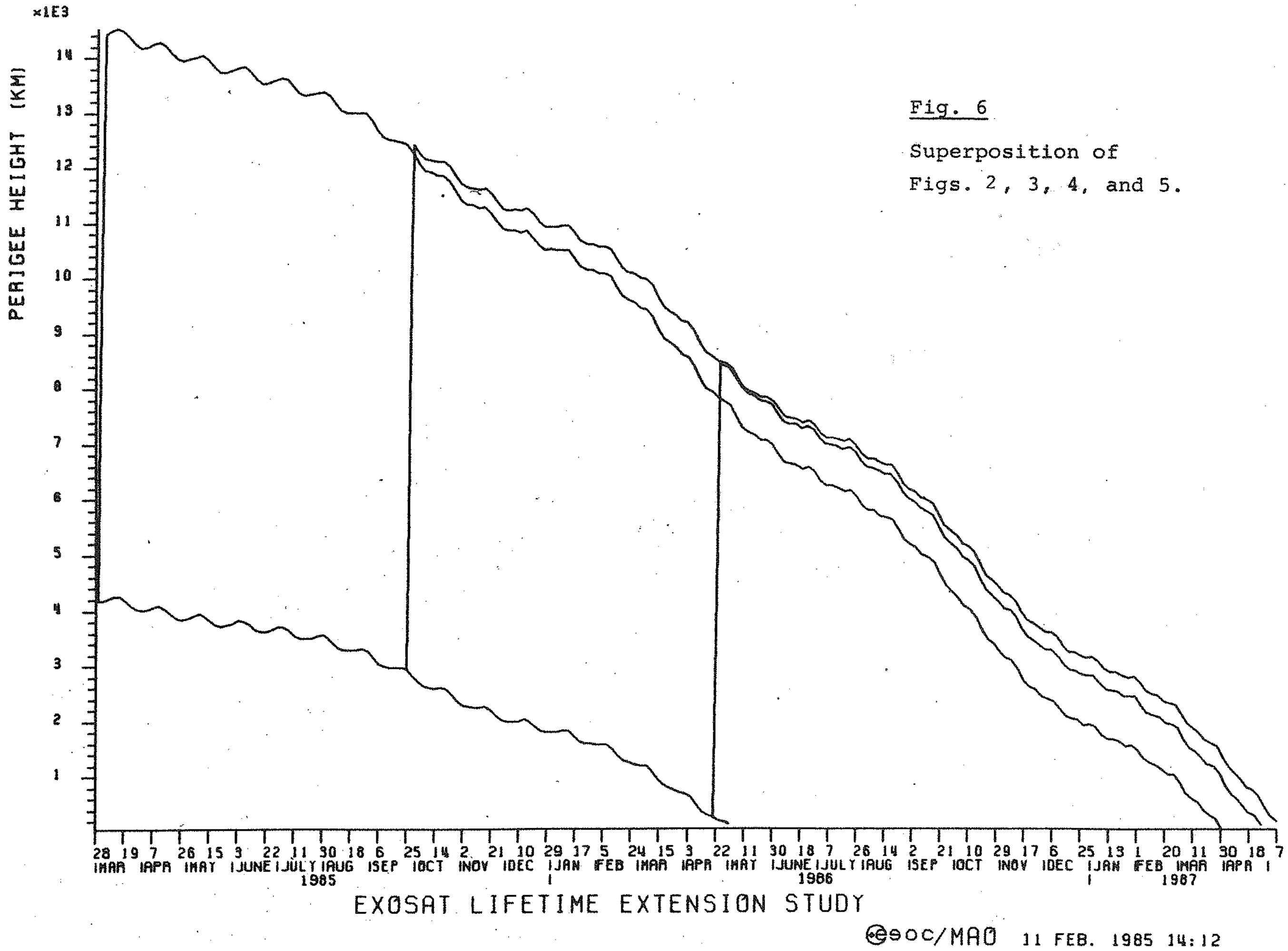
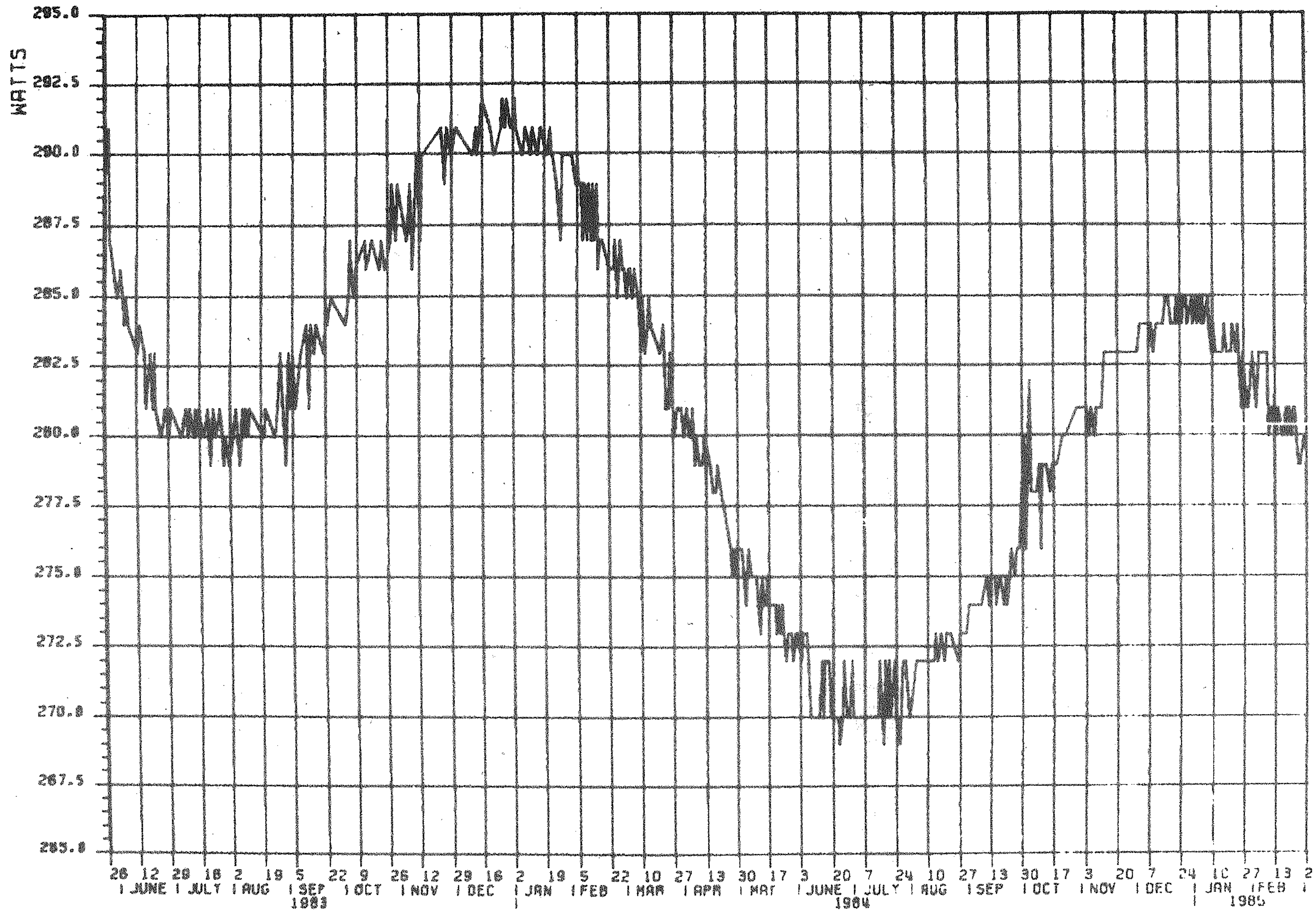


Fig. 6

Superposition of Figs. 2, 3, 4, and 5.



P170 AVAILABLE S.A. POWER EXOSAT

Fig. 7

OBSERVATORY TEAM

		Ext.
David Andrews	Observatory Manager	705*
Julian Sternberg	Observatory Software	703
Julian Lewis	System Software/HP Computers	702
Nick White	Senior Observatory Scientist	764
Paul Barr	Duty Scientist/Mission Planning	711
Jaap Davelaar	"	710
Paolo Giommi	"	715
Manfred Gottwald	"	758
Julian Osborne	"	714
Arvind Parmar	"	763
Luigi Stella	"	716
Anne Fahey	Mission Planning	707
Paolo Ferri	Observatory Controller	772
Maria Gonano	" "	772
Frank Haberl	" "	715
Geoff Mellor	" "	712
Antonella Nota	" "	717
Mark Sweeney	" "	716
Susanne Ernst	Data Assistant	713
Margit Farkas	" "	709
Grazia Giommi	" "	709
Linda Osborne	" "	713
Sandra Andrews	Secretary	704

*Direct dialling to any extension, prefixed by 886, is possible, eg. 06151-886-705

SECOND EXOSAT DATA ANALYSIS WORKSHOP

ESA proposes to hold a second EXOSAT Data Analysis Workshop on 22, 23 and 24th May 1985 at ESOC with a similar general format to that of the first Workshop of presentations by Observatory Team and ESTEC staff on specific aspects of the analysis. Demonstrations of the Interactive Analysis system will be given and access to the system restricted to those attending the Workshop.

In order to gauge the interest and identify likely topics and the level of presentation, colleagues currently involved in analysing EXOSAT data are kindly requested to complete the questionnaire and return it to the Observatory. Note that attendance at the Workshop will be limited and early application is encouraged.

Name: ....

Address:..

....

....

I would be interested in attending the Data Analysis Workshop

I would like presentations to cover the following aspects:

....

....

....

I would like to raise the following specific questions:

....

....

....

QUESTIONNAIRE

☐ There is an error/change of address on the current mailing list; the correct version is given below.

☐ Please add my name and address (printed below) to the EXOSAT Express mailing list.

☐ Please delete my name and address (printed below) from the EXOSAT Express mailing list.

NAME: ______________________________

ADDRESS: ______________________________

____

____

____

Tear off the page and return to: EXOSAT Observatory, ESOC,
Robert Bosch Str. 5,
6100 Darmstadt, W. Germany.