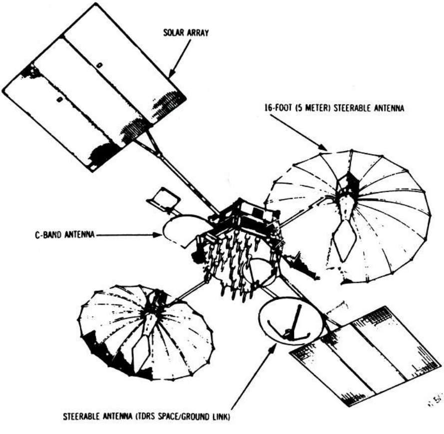
AMSAT-SM INFO

Jul Nummer 4 December 1988

Innehåll:



AMSAT - SM
Box 1311
600 43 NORRKÖPING
Postgiro: 83 37 78 - 4

Medlemsavgift 1989 : 60 kr

Styrelse:			
Ordförande:	Leif Möller	SM0PUY	tel: 0762 - 719 61
Kassör:	Magnus Ericsson	SM5SEM	tel: 011 - 23 91 24
Intern sekr:	Stefan Petersen	SM0PHK	tel: 0755 - 162 10
QTC - red:	Anders Svensson	SM0DZL	tel: 0176 - 198 62
Tekn. sekr:	Thomas Johansson	SM5IXE	tel: 011 - 23 84 28
Suppleant:	Mats Wiberg	SM5LWW	tel: 011 - 16 80 88
Suppleant:	Peter Hall	SM0FSK	tel: 08 - 754 47 88
Funktionärer:			
Bandata:	Birger Lindholm		tel: 009358 - 256 11 52
Bulletinredaktör:	Reidar Haddemo	SM7ANL	tel: 042 - 13 85 96
INFO-nätet:	Gordon Andersson	SM4MOT	tel: 019 - 722 09
Redaktör:	Leif Möller	SM0PUY	tel: 0762 - 719 61
Distributör:	Anders Hartzelius	SM5PXC	tel: 011 - 695 21
Medlemsreg.	Magnus Eriksson	SM5SEM	tel: 011 - 23 91 24
Försäljning:	Leif Möller	SM0PUY	tel: 0762 - 719 61
Distriktfunktionärer:			
SM0:	Kjell Zajd	SM0OGX	tel: 08 - 765 21 18
SM1:	Arne Gutedal	SM1BSA	tel: 0498 - 187 24
SM2:	Peter Åberg	SM2IZV	tel: 0951 - 411 44
SM3:	Hans Eckert	SM3HBQ	tel: 0290 - 216 38
SM4:	Olof Andersson	SM4CJK	tel: 054 - 13 14 13
SM5:	Christer Lindberg	SM5DXR	tel: 021 - 35 20 20
SM6:			
SM7:	Reidar Haddemo	SM7ANL	tel: 042 - 13 85 96

Årsprenumeration på SAT-INFO bulletin och keplerelement : 50 kr.

AMSAT-SM nätet på 80 m
3740 kHz
Söndagar kl 10.00

Manusstopp för INFO-bladet **1989 nr. 1** **15 Februari**

Redaktionsadress:
SM0PUY Leif Möller
Norrgården 5
186 32 Vallentuna

Omslaget: TDRS som placerades ut av rymdskytteln Discovery, läs mer på sidan 15.

ORDFÖRANDENS TANKAR

Så lackar det då mot jul och nytt år ånyo. Blickar vi tillbaka på det nästan gångna året så var den stora begivenheten vad gäller amatörradiosatelliter naturligtvis den lyckade uppskjutningen av OSCAR13. Aktiviteten över satelliten är hög och ett flertal Mode S stationer börjar också poppa upp. Den ända lilla smolk man kan hitta i den annars fyllda glädjebägaren skulle kunna vara att RUDAK-transpondern fortfarande inte tycks fungera. Ingen information om status vad gäller RUDAK har funnits tillgänglig på länge. 1989 kommer av allt att döma att bjuda på många intressanta satellitnyheter, bland annat ett antal microsat's (läs den utförliga artikeln om microsat i detta nummer och introduktionen i förra nummret).

Inom AMSAT-SM har det också hänt en del saker. Gordon, SM4MOT, summerar numera via packet vad som avhandlats på INFO-nätet. På detta sätt sprids informationen ut till ett flertal BBS'ar över landet. Reidar Haddemos utmärkta jobb med SAT-INFO BULLETIN har resulterat i en mängd prenumeranter och som en extra julklapp så distribueras nämnda publikation till alla medlemmar med detta INFO-blad. Vi hoppas att ni som inte prenumererar här tar tillfället i akt och upptäcker vilken ovärdelig källa till 'hot news' inom satellitvärlden ni har gått miste om och genast prenumererar för 1989.

Detta blir det fjärde INFO-bladet för året. Jag hade hoppats att kunna öka utgivningstakten men på grund av bidragsbristen har detta tyvärr ej varit möjligt. Som komplement till INFO-bladet finns SAT-INFO BULLETIN där mera färska nyheter publiceras. I INFO-bladet är det tänkt att vi ska publicera lite längre och mera ingående artiklar om amatörradiosatelliter. Vi planerar bland annat en artikelserie som tar upp keplerelement och banberäkningar. Jag är som alltid lyhörd vad gäller önskemål och tips från er kära medlemmar. Hör av med både ris och ros så vi kan förbättra / förändra saker och ting inom AMSAT-SM.

Till sist önskar jag Er alla en trevlig och skön julhelg och en god start på det nya året.

-PUY / Leif

	Sven Erik Naslund	Borgen 1562	864 00	MATFORS
	Lennart Svensson	Sandvägen 18	810 70	ÄLVKARLEBY
	Steinar Vissebråten		3540	Nesbyen NORGE
	Stefan Larsson	Lovgatan 10	431 35	MöLNDAL
	Stig Gustavsson	Arrheniusg. 14	392 38	KALMAR
	Anders Lindberg	Storgatan 44	640 23	VALLA
	Jan-Erik Landell	Norrgårdsg. 34	694 00	HALLSBERG
	Nils-Erik Frisk	Båstadsv.11 1tr	121 51	JOHANNESHOV
	Ebert Löov	Sjöåkrav. 60A	564 00	BANKERYD
	Herbert Horn	Tulipanhaven 53	2765	SMORUM DANMARK
	AMSAT-DL	Holderstrauch 10	D-3550	MARBURG i VÄSTTYSKLAND
	John-Arne Samuelsson	Gäddvägen 22	582 58	LINKöPING
	SAAB-SPACE	Box 13045	402 51	GöTEBORG
	Kungliga Biblioteket	Box 5039	102 41	STOCKHOLM
	Sveriges Sändareamatörer	östmarksg.43	123 42	FARSTA
	Birger Lindholm	Hasselbacken 305	SF-259 00	DALSBRUK FINLAND
	AMSAT-BELGIUM	Thier des Critchions 2	B-4600	CHENEE BELGIEN
	AMSAT-UK	94 Herongate Road	E12 5EQ	LONDON ENGLAND
	Sven Grahn	Box 4207	171 04	SOLNA
	Stig Akesson	Fogdevägen 3A	371 40	KARLSKRONA
	Roger Natanaelsson	Skeppargatan 11	931 31	SKELLEFTEA
	MYTECH Data AB	Box 7230	402 35	GöTEBORG
	Lennart Johansson	östgötag.91A 2TR	116 64	STOCKHOLM
	Gymnasieskolan Datainst.	Box 604	824 01	HUDIKSVALL
9M2CR	Colin Richards	73 Jalan Pantai	PORT DICKSON	MALAYSIA
G3RUH	James Miller	3 Bennys Way COTON	CB3 7PS	CAMBRIDGE ENGLAND
LA4XC	Harry Jonsen	Kapellvejen 160	OSLO 4	NORGE
LA5SCA	Kjell Stubberud	Vinnesgatan 55	N-3057	SOLBERGELVA NORGE
OZ1GBY	Bjarne Hansen	Svalevej 3	3751	östermarie DANMARK
OZ1LO	Leif Ottosen	Bankevejen 12	DK-4750	LUNDBY DANMARK
SK0AY	ELFA Radio Gang		171 17	SOLNA
SK2CP	ESRANGE	Box 802	981 28	KIRUNA
SK2GJ	Kiruna Radioklubb	Box 136	981 23	KIRUNA
SK4NI	Club Swedish Radio Supply	Box 208	651 02	KARLSTAD
SK4RL	Radioföreningen i Karlstad	Box 482	651 11	KARLSTAD
SK7CE	HAM CLUB Lundensis	Box 11001	220 11	LUND
SK7CS	Teleskolan	Box 814	391 26	KALMAR
SM0BMG	Bo Danielsson	Skogstorpsvägen 48	191 39	SOLLENTUNA
SM0DME	Jan-Erik Norrby	Grimstagatan 183 3TR	162 27	VÄLLINGBY
SM0DZL	Anders Svensson	Blåbärsvägen 9	761 63	NORRTÄLJE
SM0FBO	Bo Nyblom	Flotviksvägen 10	162 40	VÄLLINGBY
SM0FKG	Kent Lindberg	Lummergången 14	135 35	TYRESö
SM0FPT	Ulf Ingelsson	Kopparvagen 35	175 72	JÄRFÄLLA
SM0FSK	Peter Hall	Timotejvägen 14-15/67	191 77	SOLLENTUNA
SM0GBU	Berndt Birgersson	Allmogevägen 16	183 38	TÄBY
SM0GZT	Lars Bergman	Granängsringen 20A	135 44	TYRESö
SM0HBV	Bengt Afzelius	Lyckostigen 1	183 50	TÄBY
SM0HCB	Curt-Ove Andersson	Oslogatan 14	163 31	SPÅNGA
SM0ICG	Leif Ahlqvist	Arkenvägen 43	183 46	TÄBY
SM0IDK	Bjorn Samuelsson	Mohd. Fakhrod & Bros.	Box 439	Manama BAHRAIN
SM0IIN	George Wood	Surbrunnsgatan 12,1	114 21	STOCKHOLM
SM0JMN	Bernt Andersson	Passvägen 35	147 53	TUMBA
SM0KFV	N.E. Lofstedt	Hjortronvägen 111	196 31	KUNGSÄNGEN
SM0KPG	Bo Gustafsson	Estövägen 4A	149 00	NYNÄSHAMN
SM0KWH	Rolf Lickfett	Gyllenstiernsgatan 15	115 26	STOCKHOLM
SM0KVS	Bo Stromberg	Bjorkebyvagen 20	175 64	JÄRFÄLLA
SM0LCK	Gunnar Ekholm	Storholmsvägen 334	132 00	SALTSJö-BOO
SM0LEV	Ulrich Ibsen	Ladviksvägen 5	151 91	SöDERTÄLJE
SM0LKE	Owe Lundin	Rådhusgatan 8	185 00	VAXHOLM
SM0LZL	Olle Ahlström	Huginvägen 5	151 60	SöDERTÄLJE

SM0MEM	Peder J W Seippel	Bäckalidsvägen 36	138 00	ALTA
SM0MRO	Nils-Ake Hamberg	Akmvägen 9	181 60	LIDINGo
SM0NBJ	Danny Kohn	Bergsatravagen 53	184 00	AKERSBERGA
SM0NTN	Lars Karlsson	Utmarksvägen 15 3TR	151 52	SoDERTALJE
SM0OGX	Kjell Zajd	Lojovagen 8	181 47	LIDINGo
SM0OHX	Johans Antus	Springarvägen 12	142 61	TRANGSUND
SM0PHK	Stefan Petersen	Mariekällsgatan 34	151 44	SoDERTALJE
SM0PUY	Leif Möller	Norrgården 5	186 32	VALLENTUNA
SM0PVG	Håkan Andersson	Stavangergatan 50	163 33	SPANGA
SM0WA	Bo Goransson	Vikingavägen 52	136 43	HANDEN
SM1BSA	Arne Gutedal	Lyegatan 11	621 43	VISBY
SM1LPX	K.E. Gustavsson	Siklings Klinte	620 20	KLINTEHAMN
SM1NVW	Mats Nyman	Rangsarve Nas	620 11	HAVDHEM
SM2CEK	Roland Näslund	Himlastigen 10:114 8tr	902 38	UMEA
SM2IZV	Peter Aberg	PL 698	920 51	GUNNARN
SM2KOT	Mikael Kostedt	PL 527	920 40	KRISTINEBERG
SM2MZD	Bo Pettersson	Hissjö 7385	905 90	UMEA
SM3AVQ	Lars Olsson	Furumovägen 21 K	803 58	GAVLE
SM3EAR	Hans Engman	Lundvägen 22	820 65	FORSA
SM3FRE	Benny Karlsson	Norrbågen 9	803 62	GAVLE
SM3JSW	Mats Eriksson	Gamla vägen 4	820 70	BERGSJo
SM3KPX	John Martinsson	Aspåsnaset 2514	830 40	KROKOM
SM3RF	Ingemar Boderus	Sörvåga 435	820 40	JARVSo
SM3RO	Sten Johansson	Murmästaregatan 31F	802 29	GAVLE
SM4-1972	Erland Larsson	Möllers väg 12A	777 00	SMEDJEBACKEN
SM4BKD	Sigvard Johansson	PL 521	694 00	HALSBERG
SM4CYY	Göran Johansson	Skogsgatan 11	664 00	GRUMS
SM4DFH	Lars Holm	Alvgatan 60	792 00	MORA
SM4DHT	Urban Carlzon	Byn	670 30	EDANE
SM4EFW	Gunnar Olsson	Linghed 115	790 23	SVARDSJo
SM4FVD	L.G. Karlsson	Bäckvägen 2	683 00	HAGFORS
SM4GOH	L.G. Persson	Aspvägen 4	702 20	öREBRO
SM4HEJ	Sven-Ove Wiklund	Norra gärdesgatan 15	664 00	GRUMS
SM4IRG	Ulf Larsson	Asgatan 17	693 00	DEGERFORS
SM4JLX	Inge Björk	Box 1	792 04	NUSNAS
SM4JUE	S.O. Andersson	Holen 2615	794 00	ORSA
SM4KWO	Bo Jansson	Alsättersgatan 5C:25	582 51	LINKoPING
SM4MDZ	Lennart Bratt	Fiskarsvagen 12G	712 00	HALLEFORS
SM4MOL	Sture Palminger	Hagavägen 76A	781 53	BORLANGE
SM4MOT	Gordon Andersson	PL 607	692 00	KUMLA
SM4NLL	Hans östervall	Hyttingsvägen 31	781 34	BORLANGE
SM4OLM	John David Skantz	Högdalsvägen 14	672 00	ARJANG
SM4SFZ	Kjell Granqvist	Lindåsvägen 28	711 00	LINDESBERG
SM5AGM	Folke Rosvall	Västerskärsringen 50	184 00	AKERSBERGA
SM5ASE	Ivan Geidnert	Trefaldighetsv.20A,3tr	183 68	TABY
SM5BGO	Per-Ake Andersson	Rydsvägen 266	582 50	LINKoPING
SM5BKI	Knut Nyman	Vetevägen 20	198 00	BALSTA
SM5BVF	Henry Bervenmark	Vallmovägen 10	175 74	JARFALLA
SM5BZ-OE1	Jan E Björk	Weimarer Strasse 49/1/3	1180 WIEN	öSTERRIKE
SM5CCF	Ake Edvardsson	Akersvägen 18	137 00	VASTERHANINGE
SM5CJF	Lennart Arndtsson	Envägen 6c	752 52	UPPSALA
SM5CUP	Björn Hedin	Orrstigen 5A	752 52	UPPSALA
SM5CWV	Gunnar Ahl	Alvestavägen 26	722 31	VASTERAS
SM5DMQ	Wei öhlund	Hyacintvagen 53	722 43	VASTERAS
SM5DUB	Stig Comstedt	Kyrkvägen 76	602 10	NORRKoPING
SM5EJN	Jan Ancker	Bygdevägen 6	154 00	GNESTA
SM5FUL	Ingemar Eriksson	Rönnebergagatan 8A	723 46	VASTERAS
SM5HL	Håkan Lindley	Krusenhofsvägen 302	616 00	ABY
SM5HMN	Gerry Eriksson	Liljegatan 5	753 24	UPPSALA
SM5IBE	Birger Eriksson	P. A. Tamms vag 11	740 63	öSTERBYBRUK
SM5IO	Stig Boberg	Sörgårdsgatan 36	582 39	LINKoPING
SM5IXE	Thomas Johansson.	Borgsgatan 8	602 36	NORRKoPING
SM5LWW	Mats Wiberg	Hallandsgatan 4 2TR	602 17	NORRKoPING
SM5LZM	Jonas Melin	Björnkärrsgatan 8A:21	582 48	LINKoPING
SM5MXU	''kan Carlfjo	Enebymovägen 11	602 13	NORRKoPING

SM5NWC	Lars Ståhlbrandt	Brillingevägen 16	754 45	UPPSALA
SM5OIL	Fredrik Oscarsson	Näverbacken 7	616 00	ÅBY
SM5PFW	Bengt Eriksson	Lavendelgatan 26	582 58	LINKÖPING
SM5PHU	Jonas Hultin	Tallstigen 37	610 40	GUSUM
SM5PKE	Jan Johansson	Middagsgatan 82	582 67	LINKÖPING
SM5PXC	Anders Hartzelius	Stenhallsvägen 14	616 00	ÅBY
SM5PZK	Michael Reiborn	Blastadsgatan 118	582 62	LINKÖPING
SM5RCR	Gunnar Carlsson	Aliforsgatan 6B	644 00	TORSHÄLLA
SM5SEM	Magnus Ericsson	Knappingsborgsgatan 20	602 26	NORRKÖPING
SM5SHQ	Olof Jönsson	Barrskogsvägen 14	610 20	KIMSTAD
SM6-3337	Ingemar Axelsson	Fjällsyran 4	424 48	ANGERED
SM6AAL	Bertil Bengtsson	Spanvägen 4	517 00	BOLLEBYGD
SM6AUB	Wilhelm Kanold	Alfhöjdsgatan 16	431 38	MÖLNDAL
SM6CIX	Eide Hilmersson	Vitsippestigen 2	452 00	STRÖMSTAD
SM6CKU	B-A Jockert	Allatorp 1446	430 33	FJÄRÅS
SM6DGF	Bo Cristiansson	Matildebergsgatan 42B	431 38	MÖLNDAL
SM6FMB	Sven Palmersjö	Hus 574	430 84	STYRSÖ
SM6FWF	Tor Andersson	Box 46	531 04	JÄRPÅS
SM6FYU	Jan-Eric Bengtsson	Bergmansgatan 12	311 00	FALKENBERG
SM6HQZ	Åke Eriksson	PL 3098	668 00	ED
SM6JDO	Stig Bernhardsson	Box 4187 Glommen	311 04	FALKENBERG
SM6JEK	Jan Blidberg	Södra Fiskebäcksv.114	421 58	VÄSTRA FRÖLUNDA
SM6KHL	Lennart Herngren	Filsbacksvägen 1	531 70	LIDKÖPING
SM6KKX	Bo Georgsson	Knarråsvägen 14	432 03	TRÄSLÖVSLÄGE
SM6KPV	Peter Ingemarsson	Sankt Olofsgatan 3	521 00	FALKÖPING
SM6KQU	Dan Lydell	Kallkallegatan 4	416 53	GÖTEBORG
SM6KTC	Erland Ahle'n	Ulvsvägen 6 Gillstad	531 97	Lidköping
SM6KUT	Thomas Bengtsson	Sveagatan 2	531 31	LIDKÖPING
SM6LPW	Sven Eriksson	Mossen 3	430 91	HÖNÖ
SM6NZV	Carl-Axel Lindberg	PL 9063 BUERAS	439 00	ONSALA
SM6OOB	Leif Enebrand	Blåklintvägen 9	440 90	HENÅN
SM6PGI	Reine Attefors	Klockarevägen 2	302 56	HALMSTAD
SM6PQL	Timo Nyberg	PL 604A Uppergårdsv.10	438 00	LANDVETTER
SM6RHY	Håkan Johansson	Box 142	451 16	UDDEVALLA
SM7ANL	Reidar Haddemo	Tulpangatan 23	252 51	HELSINGBORG
SM7BCR	Lars Olof Karlsson	Ringvägen 49	260 40	VIKEN
SM7BHM	Ewe Håkansson	Pilspetsvägen 4	291 65	KRISTIANSTAD
SM7BKH	Bengt Wilander	Vilebovägen 1B	217 63	MALMÖ
SM7CSG	Birger Arnell	Fredrikslundsgatan 21	382 00	NYBRO
SM7DKF	Ronnie Nilsson	V Häggviksvägen 12	236 00	HÖLLVIKSNÄS
SM7DOE	Lars Eriksson	Heimdalgatan 11A	262 00	ÄNGELHOLM
SM7DSE	Kent Larsson	Hasselbacksvägen 4	240 13	GENARP
SM7EHR	Folke Back	Ringvägen 16	232 00	ARLÖV
SM7FCN	Björn Fagerholm	Pantstigen 6	570 93	FIGGEHOLM
SM7FCV	Bertil Johnsson	Tvåbrödersvägen 1C	393 58	KALMAR
SM7FMD	Per-Arne Olofsson	Brinellgatan 23	571 00	NÄSSJÖ
SM7FSR	Silvio Miselli	Roslins väg 10	217 55	MALMÖ
SM7GED	Rolf Noord	Norra Åby 20:2	230 23	ANDERSLÖV
SM7GVS	Olle Corfitsson	Hov PL 5826	269 00	BÅSTAD
SM7HBQ	Hans p Eckert	Box 49	575 21	EKSJÖ
SM7JIB	Arne Karlsson	Husebygatan 22	579 00	HÖGSBY
SM7JLM	Martin Bondesson	Kronotorpsgatan 10	262 62	ÄNGELHOLM
SM7LAD	Freddie Sten	Mejerigatan 10	235 00	VELLINGE
SM7MOB	Jörgen Hjort	Törnskatevägen 29	331 00	VÄRNAMO
SM7NRR	Lennart Edsö	Remmaregrand 3	222 51	LUND
SM7NWH	Bo Lindvall	Serenadgatan 23	214 73	Malmö
SM7OII	Harri Urhonen	Karl XII:s gatan 11A	271 00	YSTAD
SM7OLB	Inge Andreasson	PL 2011 Emmaljunga	280 22	VITTSJÖ
SM7OYE	Nicklas Jonsson	Idrottsgatan 70	216 16	MALMÖ

SILENT KEY

Med stor sorg och saknad har jag tagit emot beskedet om SM2EKQ, Ulf Östergrens hastiga bortgång. Ulf var sedan många år bosatt i Kiruna och arbetade som tekniker vid Rymdbolaget/Esrange. Hans amatörradiointresse gick aldrig att ta miste på - VHF, satelliter och på senare tid paketradio var Ulfs stora passioner. Ulf var också förgrundsfiguren i arbetet att åstadkomma ett fungerande paketnät i övre Norrland.

Jag har haft förmånen att lära känna Ulf under många av våra fiskeexpeditioner i fjällvärlden och minns honom som en person med frisk humor, lugn och en stor vilja att ställa upp för andra människor.

SM5IXE, Thomas

A M S A T   O S C A R - 1 3

T E L E M E T R Y

B L O C K F O R M A T

Compiled by DB2OS
for AMSAT-DL
1st September 1988

AMSAT OSCAR-13 (like all P3-Satellites) transmits 512 bytes per block, treated as 8 lines of 64 bytes each. Blocks are identified according to the first byte of the block (followed by space, coded as #20).

K, L, M, N blocks are message blocks (flying mailbox) from one command station to another, but also used for broadcast. All characters use ASCII representation. Bit 7 set to 1 may be used to indicate highlighted character display. No CR/LF will be transmitted, they should be inserted at the ground after 64 received characters!

Q blocks carry 128 logical telemetry channels in compressed data format.

Y blocks carry 64 plain text analog telemetry channels and will be sent infrequently (less than Q-blocks). It is proposed to use the Q-blocks for decoding, since Y-Blocks may be withdrawn in the feature.

Q-Block format:

```
Q  HI, THIS IS AMSAT OSCAR 13                      hh:mm:ss  dddd
#hhhh   #hhhh   #hhhh
ddd ddd ddd ddd ddd ddd ddd

0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
```

Line specification:

```
Line 0:
Byte pos.= 0      2             48          58
           <QöY> <text,name>    hh:mm:ss    dddd
                                 U T C      AMSAT day number
                                            1 January 1978 = 0
Line 1:
Byte pos.= 0            8             16
           #hhhh        #hhhh         #hhhh
           safety       transponder   command
           information  status        number
           word         (Syspage
           (see below)   byte #5E)
```

Safety Information Word (Emergency Flags):

bit	significance
0..7	as Syspage byte #56
8	Low Power, QRP mode
9	Extremly low power, QRPP mode
10	Command loss (Watchdog)
11	High temperature (battery or transponder)
12	Sunangle exceeds limit (50 degrees)
13..15	not used

Line 2:

Byte pos.=	0	4	8	12	16	20	24
	ddd	ddd	ddd	ddd	ddd	ddd	ddd
	2MUX0	2MUX1	2MUX2	2MUX3	2MUX4	2MUX5	2MUX6
(Syspage	#40	#41	#42	#43	#44	#45	#46)

Line 3: empty, blank line.

Line 4:
```
Byte = 0               10              20              30
       0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
```

Line 5:
```
Byte = 40              50              60              70
       0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
```

Line 4 and 5 are the telemetry channels #00 to #7F of the INTERMEDIATE EVENT SYSPAGE buffer. Up to 6 events stored, 128 bytes per event. The buffers are read out cyclically, one event at a time. The time recorded and the event counter identify the particular event.

Line 6:
```
Byte = 0               10              20              30
       0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
```

Line 7:
```
Byte = 40              50              60              70
       0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF
```

Line 6 and 7 are the SYSPAGE logical telemetry channels #00 to #7F, normally used to display realtime telemetry. Decode according to the OSCAR-13 telemetry decoding document. Bytes are expressed directly, not as character values.
In Y-Blocks only SYSPACE channels #00 to #3F (analog channels) are transmitted in ASCII (16 channels per line, 4 bytes per channel)!!

Example for Y-Blocks:

```
Y  HI, THIS IS AMSAT OSCAR 13                         19:22:41  3894
#00A6   #0020   #0193
64  1   255 166 19  230 0

193 7   147 7   193 7   164 117 200 7   130 25  118 7   149 32
7   7   133 7   13  7   131 112 14  7   131 7   112 7   131 7
155 129 134 148 191 145 132 142 75  145 132 7   228 129 127 7
179 129 126 128 62  141 132 7   13  127 124 7   208 133 125 7
```

Example for decoded Q-Blocks: (as displayed on the ATARI 800XL IPS
----------------------------- groundsoftware package of AMSAT-DL)

```
Q  HI, THIS IS AMSAT OSCAR 13                        19:25:57  3894
        #00A6    #0020    #0193         64   1    255 166 19  230 0
SA    1.2
COM-U                                                RUDAK-ON
CMD-F      -140   U9-V        9.1   2-ANT   HI       T-TX        25.7
F-BIT     405.5   U14V-ST    14.6   70-ANT  HI       T-RX        15.7
AGC DB       -6   I14V-ST    2402                    T-S          4.0
MEM           5   CW-S         55                    P-OUT       11.2
```

```
Q  HI, THIS IS AMSAT OSCAR 13                        19:25:57  3894
        #00A6    #0020    #0193         64   1    255 166 19  230 0
SA    1.2
STROEME:          SPANNUNGEN:       LEISTUNGEN:       PANEL-I UND T:
                  BCR-SIN    31.0                     P1          422
BCR-IN        0   BCR-IN     37.2   PANELS      0.0   P2          160
BAT-NET      74                     P-BAT       1.0   P3            0
BAT-CH        0   BCR-SO     14.5                     P4          611
BCR-OUT    2596   BCR-OUT    14.6   BCR-OUT    37.9   P5          694
14V-ST     2402   14V-ST     14.6   P-TRANS    35.0   P6            0
14V-S        43   A-BAT       0.2   P-HF       11.2   SC-ROH    #00F1
10V-C        77   10V-C      10.0                     T-P1        8.1
                  BCR-01     10.0                     T-ABAT1     6.4
                  BCR-02      0.7                     T-MBAT      6.4
```

```
Q  HI, THIS IS AMSAT OSCAR 13                        19:25:57  3894
        #00A6    #0020    #0193         64   1    255 166 19  230 0
SA    1.2
T´S ARM 1:        T´S ARM 2:        T´S ARM 3:        T´S ZENTRUM:
P1          8.1   P3          6.9   P5          6.9   N204        6.9
RX-U       15.7   SEU         7.5   HELIUM      5.2   AZ50        7.5
RX-L       14.5   T-TO-S      1.7   IHU         5.8
WALL       12.2   WALL        5.2   RUDAK       5.2
TOP         4.0   BCR        16.9   M-BAT       6.4
BOTTOM      3.4   ABAT-1      6.4   NUT-D       2.8
TX-U       25.7   ABAT-2      6.4
TX-L       14.5
TX-S        4.0
```

```
Q  HI, THIS IS AMSAT OSCAR 13                        19:25:57  3894
        #00A6    #0020    #0193         64   1    255 166 19  230 0
SA    1.2
NAV, POS:    162-165
SPINRATE   36.1   SS-1         0*   S-SENS       5
T-HE        5.2   SS-2         1*   ES-SENS     64
T-N204      6.9   LS-A(MV)     0    LS-R´S      7.5
T-AZ50      7.5   LS-M(MV)     8    L-O#,Z   #A26F
                  ES-M       241    U-O#,Z   #A26F
                  ES-A       241
                  SPERR-#     15
                  M-STATUS     0
```

A M S A T   O S C A R - 1 3   T E L E M E T R Y

logical telemetry channels

S Y S P A G E

Compiled by DB2OS
for AMSAT-DL
1st September 1988

This document describes the decoding of the 128 logical telemetry channels of the AMSAT Phase 3C satellite, OSCAR-13.

Bytes are counted in the followings ways:

```
C  - unsigned count (0 to +255)
Cs - signed count (-128 to +127, 2s complement)
Cx - signed count (+63 to -192, #3F=+63, #FF=-1, #80=-128,
                   #7F=-129, #40=-192, modified 2s complement)
```

All temperature channels are decoded identically using the following decoding relationship:

Temp: T = (C-120)/1.71 Celsius

Current channels are linear, but have different calibrations for 1A, 2.5A and 5A max. current:

```
  1A:  I = (C-15)*4.854 mA
2.5A:  I = (C-15)*12.135mA
  5A:  I = (C-15)*24.27 mA
```

Here the Channel identification and decoding equations:

Byte	Channel	Calibration	Remarks
00	Uin-BCR	U=(C-10)*167mV	U-Panel: +0.6V @ 0.35A +0.7V @ 1A
01	Tx-PWRout-L	Average power=(261-C)^2 / 724 Watts	rectified envelope voltage.
02	T-Rx-U	Temp	Mode-B reveiver temperature.

03	---		
04	Uout-BCR	U=(C-10)*79.5mV	BCR output voltage.
05	---		
06	T-TX-U	Temp	Mode-B transmitter temperature.
07	I-14V-ST	5A	Transponder separation bus.
08	U-10V-C	U=(C-10)*53.2mV	Computer supply
09	Press He-Hi	off	Helium tank pressure.
0A	T-IHU	Temp	Integrated Housekeeping Unit
0B	I-14V-S	1A	Separation bus, 14V that supplies torquer and LIU.
0C	BCR-Oscill1	>6=OK	BCR status. No count = not working. Typically C=80.
0D	Press He-Lo	off	Helium regulator output.
0E	T-BCR	Temp	Battery Charge Regulator.
0F	I-10V-C	1A	10V continuous power supply.
10	BCR-Oscill2	As channel 0C	
11	Press Tank	off	N204 tank pressure.
12	T-SEU	Temp	Sensor Electronics Unit
13	IbatCharge	2.5A	Positive Current to battery.
14	L-Sensor (A)	U=(C-10)*8.53mV	Light-Sensor Antenna Side.
15	Motor Valve	off	
16	T-ABAT1	Temp	Auxiliary battery 1
17	I-BCR-OUT	5A	14V line to battery and other consumers.
18	L-Sensor (M)	U=(C-10)*8.53mV	Light-Sensor Motor Side.
19	---		
1A	T-ABAT2	Temp	Auxiliary battery 2
1B	I-BCR-IN	Equivalent to total current of all panels, not available due to sensor failure.	
1C	Spin rate	C>131, Spin rate=479/(C-109)-2 rpm C<=131, Spin rate=(131-C)*0.85+16 rpm	Sensor angular position oscillator. Lock indication channel #47.
1D	Rx-L-AGC	Gain reduction=(C-75)^2 / 1125 dB	
1E	T-MBAT	Temp	Mean battery (normally in use)
1F	I-Panel6	1A	Solar panel 6
20	Tx-PWRout-U	Average power=(287-C)^2 / 1796 Watts	As channel 01.
21	T-He-Tank	Temp	
22	T-Panel1	Temp	
23	I-Panel5	1A	
24	Rx-U-AGC	Gain reduction=(C-71)^2 / 2465 dB	
25	T-Tx-L	Temp	Mode-JL transmitter.
26	T-Panel3	Temp	
27	I-Panel4	1A	
28	---		
29	T-Rx-L	Temp	Mode-L receiver.
2A	T-Panel5	Temp	
2B	I-Panel3	1A	
2C	U-14V-ST	U=(C-10)*66.8mV	Transponder separation bus.
2D	T-RUDAK	Temp	RUDAK temperature.
2E	T-top	Temp	Arm 1, Antenna side.
2F	I-Panel2	1A	
30	U-9V-U	U=(C-10)*54mV	Internal 9 volt bus from Mode-B transponder.
31	T-wall-arm2	Temp	
32	T-bottom	Temp	Arm 1, Motor side.
33	I-Panel1	1A	
34	---		
35	T-wall-arm1	Temp	
36	T-N204	Temp	
37	---		
38	U-ABAT	U=(C-10)*78.5mV	Auxili[illegible] battery.

39	T-S-xpnder	Temp	Mode-S transponder.
3A	T-L-Sensor	Temp	Light sensor antenna side.
3B	---		
3C	U-9V-L	U=(C-10)*45.4mV	As channel 30, Mode-L
3D	T-AZ50-Tank	Temp	
3E	T-nutation damper	Temp	Arm 3.
3F	---		
40	ES-Sensitivity	2MUX0	Earth Sensor sensitivity threshold.
		bit significance	
		0 LSB 20mV	
		1 37mV	Hysteresis 200mV
		2 75mV	Threshold 600mV
		3 150mV	
		4 300mV	
		5 600mV	
		6 1.2V	
		7 MSB 2.4V	
41	Antenna/SERI	2MUX1	Antenna relays and SERI resistors.
		bit significance	
		0 LSB Hi-gain 2m to U	
		1 Hi-gain 70cm to L	
		2 --+ SERI-1 load resistor for	
		3 -+! SERI-2 both Light-Sensors	
		!! resistance	
		00 7.5 Ohm	
		01 3.9 Ohm	
		10 2.3 Ohm	
		11 5.9 Ohm	
42	RUDAK-Status	2MUX2	IN-B (ex Motor-PWR).
		C=82, Standard-ROS (S)	
		C=78, Emergency-ROS (N, Not-ROS)	
		C=80, Primitive-ROS (P)	
43	S&RUDAK-CNTL	2MUX3	Mode-S and RUDAK interface.
		bit significance	
		0 LSB RUDAK OFF	
		1 " NMI/	
		2 " Byte Clock	
		3 " Byte count reset	
		4 ---	
		5 Mode-S Beacon ON	
		6 " Squelch defeated	
		7 MSB " Squelch Hi Sensitivity	
44	BCR-Sin	2MUX4	Array voltage offset.
		U=29.1+(Cs*100)mV (16.3V...41.8V)	
45	BCR-Sout	2MUX5	Battery knee voltage offset.
		U=14.98+(Cx*20)mV (11.14...16.2V = 192...63)	
46	BCR-relays	2MUX6	
		bit significance	
		0 LSB BCR-2 ON	
		1 Auxiliary battery charging	
		2 Auxiliary battery connected, Main battery disconnected.	
47	SS-1	C=255 or C=0, PLL locked	Sun-Sensor angular position oscillator, Slit antenna side.
48	SS-2	Time offset from SS-1	

```
49   Flag-SS          C=1, SS-1          Sun sensor data.
                      C=2, SS-2
4A   SPIN-RAW                            Raw spin count (1/256).
4B   Sensor-control bit   significance  (OUT4)
                    0 LSB --+ MUX-CTRL for sensor elec. module
                    1      -+!
                             !!
                             00 - Sun data
                             01 - spin ref./spin counter
                             10 - ES lower beam
                             11 - ES upper beam
                    2      Earth sensor positive edge select.
                           (Strobes value of spin count at transition.)
                    3      Motor Instrumentation ON.
                           (Pressure sensors, motore valve indicator.)
                    4      0.3V Sun Sensor Sensitivity
                    5      0.6V  "    "        "
                    6      1.2V  "    "        "
                    7 MSB 2.4V  "    "        "
                           (Max threshold #F = 1 solar constant)
4C   SS-correction
4D   Last ES-A        Z                  last ES-pulse Antenna side.
4E      "             0#                 (Orbit number and MA value)
4F   Last ES-M        Z                  last ES-pulse Motor side.
50      "             0#                 (Orbit number and MA value)
51   Lockoutrange     Within +- C counts from sun sensor pip, earth
                      sensor handler ignores data (Spin count 1 circle=
                      256 counts.)
52   ES-A             Strobed spin count at edge selected,
                                         Antenna Side beam.
53   Update Flag1     Indicates update,Antenna Side beam.
54   ES-M             As channel 52      Motor Side beam.
55   Update Flag2     As channel 53        "    "    "
56   S/C STATUS       bit   significance
                      0 LSB LIU power ON
                      1      S/A plug status 0=Safe, 1=Arm
                      2      RUDAK-out (lock)
                      3      Mode-S Squelch open
                      4      ---
                      5      Memory Softerror Counter
                      6        "         "       "
                      7 MSB    "         "       "
57   ---
58   ---
59   ---
5A   ---
5B   N                no of 20ms per dot, morse speed.
5C   n                running count of units for morse.
5D   ---
5E   TRANSPONDER      bit   significance  (OUT7)
                      0 LSB GB OFF
                      1      GB FSK (1=+170Hz)
                      2      DPSK OFF
                      3      EB ON
                      4      --+ PSK source
                      5      -+! for GB (EB: don´t care)
                              !!
                              00 - no PSK
                              01 - ranging
                              10 - EB source
                      6      Low power transponder ON
                      7 MSB Passband OFF (Beacons and Mode-J +3dB)
5F   ---
60   MODUS            bit   significance  (ma      control)
```

		0 magnet system ON	
		1 undespun magnet	
61	M-Soll	magnet vector desired angle to the despun sun (clockwise as seen from top, 1 circle = 256)	
62	M-Out	bit significance (OUT3, also L,S,J control)	
		0 LSB polarity Arm 1	
		1 polarity Arm 2	
		2 polarity Arm 3	
		3 Magnet power ON	
		4 Mode-J ON	
		5 ---	
		6 Mode-S ON	
		7 MSB Mode-L ON	
63	O-FRAC-lo	Fractional Z increment in 20ms	
64	O-FRAC-hi		Counts down to 0 from preset value. 255th Z has different value of O-FRAC. 7000 counts/Z.
65	0/256	Z from perigee	
66	O#-lo	Orbit number	
67	O#-hi		
68	UHR	10ms	UTC
69		sec	
6A		min	
6B		hour	
6C		day	1st January 1978 = AMSAT day 0.
6D		256day	
6E	SUO	10ms	IPS stopwatch 0.
6F		sec	
70		min	
71		min*256	
72	SU1	10ms	IPS stopwatch 1.
73		sec	
74		min	
75		min*256	
76	SU2	10ms	IPS stopwatch 2.
77		sec	
78		min	
79		min*256	
7A	SU3	10ms	IPS stopwatch 3.
7B		sec	
7C		min	
7D		min*256	
7E	Event-Lo		Used as event ID word in intermediate buffer.
7F	Event-Hi		

TDRS

av Leif Möller / SM0PUY

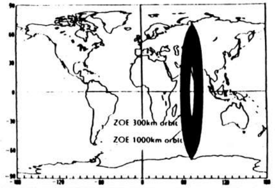
TDRS är ett system, som när det är fullt utbyggt, kommer att bestå av tre avancerade kommunikationsatelliter i geostationär bana. TDRS betyder Tracking and Data Relay Satellite. Satellitsystemet ska användas för kommuniaktion mellan olika satelliter (upp till 24 stycken), och för kommunikation med rymdskytteln. TDRS skall också användas för att reläa data från experiment ombord på skytteln till jorden. All trafik mellan TDRS och jorden går via markstationen White Sands i New Mexico.

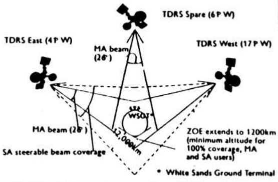
För närvarande finns två TDRS-satelliter i bana. TDRS-A placerades ut av skytteln i April 1983. På grund av problem i det raketsteg som skulle placera satelliten i geostationär bana fick en stor del av attitydkontroll bränslet användas till att placera satelliten i en användbar (men inte perfekt) bana. För närvarnade har TDRS-A en inklination på 2,7 grader vilket gör att markkontrollen måste följa satelliten med antennerna. TDRS-A är placerad på 41 graders västlig longitud i den geostationära banan. TDRS-B var tänkt att placeras på 171 grader västlig longitud men satelliten gick förlorad i Challenger-olyckan i Januari 1986.

Den första skytteln som skjöts upp efter olyckan placerade ut TDRS-C i bana på 171 grader väst. Senare i år kommer även TDRS-D att skjutas upp och placeras på 41 grader väst, TDRS-A kommer då att flyttas till 61 grader väst och fungera som reserv satellit. Med två operationella satelliter positionerade 130 grader från varandra är det möjligt att ha oavbruten kommunikation med satelliter i låg bana utom i en smal zon. Denna zon hamnar på andra sidan jorden mittemot mittpunkten mellan de båda satelliternas longituder. För TDRS-systemet hamnar denna zon över Indien. Zonen minskar med ökad höjd hos användarsatelliten och försvinner helt på 1200 km.

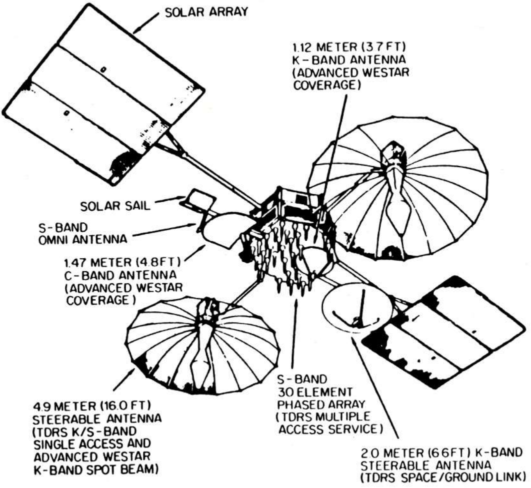
Satelliterna är utvecklade av TRW, NASA Goddard Space Flight Center och US Air Force Space Command. Livstiden på satelliterna är beräknade till 10 år. Två stora solpaneler försörjer satelliten med 1850 W elenergi. Varje satellit har sju antenner varav två är mekaniskt styrbara 4.9 meters paraboler för S och Ku bandet. Dessa antenner tillhandahåller höghastighets kommunikation (300 Mbit/s) för en användare (satellit). En elektroniskt styrbar S-bands antenn bestående av 30 helix element används för upp till 20 samtidiga användare. Satelliterna använder följande frekvenser:

Mottagning:	5.925 - 6.425 GHz
	2.200 - 2.300 GHz
	14.000 - 15.300 GHz
Sändning:	3.700 - 4.200 GHz
	2.000 - 2.100 GHz
	11.700 - 12.200 GHz
	13.400 - 14.200 GHz





ZOE, Zone Of Exclusion är den zon där inte TDRS har full täckning. ZOE blir smalare med ökad höjd hos användar-satelliten och försvinner helt på 1200 km. höjd.



****** RS1-2 Satellites 10-th anniversary. ******

On the 26 of october 1978 RS1 and RS2 were born. They were launched from Plesetsk on polar orbit and were active for several monthes. RS1 and RS2 were the first satellites built by USSR amateurs and students and have generated much interest in the application of small, inexpensive amateur equipment for space communication. The experience gained with RS1 and RS2 led to the construction of the ISKRA2-3, RS3-8 and RS10/11. Except RS1 and RS2 there was RS1-N experimental equipment installed inside of the same spaceframe RS1 and RS-noName, built by Moscow Power Institut students, seccessfully sepa- rated but not deployed antenna and solar panel system. Only one month after launching antennas were opened and satellite sent down telemetry for 11 hours untill bateries were dischar- ged. The solar panels were never deployed.

RS1 started life at an altitude of about 1700 km and change very little untill now. The beacon transmitter is alive at the present time and transmits down during good attitude on the sunshine. Students and amateurs use RS1 for educational purposes. The beacon frequency is 29401 KHz.

Thanks to all the experimenters worldwide who have suppor- ted this highly importent mission, the first USSR´s amateur radio contribution in the international AMSAT. 73 de UA3CR.

***** AMSAT-U *****

Ny 'Launch Plan' för ARIANE. Observera att den redan är på efterkälken. Uppskjutningen av ASTRA kommer enligt senaste uppgifter att äga rum den 9 December. Alla efterföljande uppskjutningar fördröjs motsvarande tid.

Arianespace launch manifest

Desigation	Date	Vehicle	Payload(s)
V25	September 1988	Ariane 3	GStar 3*
			SBS 5
V26	October	Ariane 2	TDF 1
V27	November	Ariane 4	Astra 1
			Skynet 4B
V28	December	Ariane 2	Intelsat VF15
V29	January 1989	Ariane 4	JC Sat 1
			MDP 1
V30	February	Ariane 2	Tele X
V31	March	Ariane 4	Superbird A
			DFS 1
V32	April 1	Ariane 3	Olympus
V33	May	Ariane 4	TV Sat 2
			Hipparcos
V34	June	Ariane 4	Spot 2
V35	September	Ariane 4	Intelsat VI F1
V36	October	Ariane 4	Superbird B
			Inmarsat 2FI
V37	November	Ariane 4	TDF 2
			DFS 2

* Includes Geostar RO2 mobile communications payload

THE FIRST FLOCK OF MICROSATS

Courtney Duncan, N5BF
Compiled, 16 October 88

This paper is derived from a series of four proposals given to four different organizations containing a technical overview of the four original MICROSATS. It is prepared at the request of Mr. John Champa, Executive Vice President of the North American Radio Amateur Aatellite organization (AMSAT-NA) in order that prospective users of MICROSATS and other interested parties may be apprised of the capabilities of and intentions for this class of spacecraft.

INTRODUCTION

The names of the first group of MICROSATS are currently specified as follows:

Before Launch	After Launch	Organization	Leader
BRAZSAT-A	BRAZSAT-OSCAR-XX	BRAMSAT	Junior T. DeCastro
LUSAT-A	LUSAT-OSCAR-XX	AMSAT-LU	Carlos Huertas
PACSAT-A	AMSAT-OSCAR-XX	AMSAT-NA	Vern Ripportello
WEBERSAT-A	WEBERSAT-OSCAR-XX	CAST	Robert Twiggs

Each ´XX´ designator will be replaced with the appropriate OSCAR number upon succesful deployment on orbit. BRAMSAT is the Brazillian Amateur Radio Satellite organization, AMSAT-LU is the Argentinian Amateur Radio Satellite organization, AMSAT-NA is the North American Amateur Radio Satellite organization, and CAST is the Center for AeroSpace Technology, Weber State College, Logan, Utah.

In addition, significant volunteer and financial support are provided by the American Radio Relay League and the Tucson Amateur Packet Radio Coroporation.

This paper details the feasibility, technologies, costs and schedule associated with this project.

MISSION GOALS

The respective missions are as follows:

BRAZSAT-A - Provision of an easily received signal for educational and scientific use consisting of a voice modulated beacon promoting good will communications on an international basis.

LUSAT-A - Demonstration of radio amateur commitment to extending digital communications facilities fully into the Amateur Satellite Service; provision of an easily utilized, satellite based facility for data storage and forwarding using amateur packet radio techniques; and a demonstration of the feasibility of digital store and forward facilities within the amateur radio environment for educational and scientific purposes.

PACSAT-A - Essentially the same goals as LUSAT-A.

WEBERSAT-A - Provision of an easily utilized, satellite based facility for video data acquisition and storage and transmission to amateur radio ground stations using amateur packet radio techniques.

All of the missions share these common goals:

1) A demonstration to the International Telecommunications Union (ITU) that amateurs from each involved organization have a strong interest in the use of the radio frequencies allocated to the Amateur Satellite Service for the improvement of amateur practices and in support the international amateur satellite community.

2) Provision of a test bed for evaluation and validation of hardware technologies and software to be employed.

3) Provision for advanced utilization of the spectrum allocated to radio amateurs by the regulating authorities of the various countries involved and the International Telecommunications Union.

All of the missions share these common constraints:

1) The cost of the satellite and ground station equipment is to be minimized.

2) The mass and size of the satellite are to be minimized in anticipation that one means of launch could be man-assisted and recognizing that many launch opportunities are potentially available for small, simple, lightweight satellite packages.

3) The mission will build on user equipment, techniques, and capabilities already utilized in the Amateur Satellite Service for digital or voice communications wherever possible. The cost of ground station construction or modification are to be minimized.

GENERAL MISSION DESCRIPTION

All four payloads will be implemented using the new AMSAT-NA satellite bus concept known as "MICROSAT." The satellites are cubical, measuring only 23 cm on each side, not counting antennas. They are designed for use in a variety of low earth orbits but will be most effective if placed into a sun synchronous orbit similar to the earlier Phase-2, AMSAT-OSCAR satellites. The projected satellite mass is 7.5 kg and the launch adapter and separation hardware weighs an additional 2.5 kg. The power produced by the satellite solar panels will be in excess of 6.0 watts averaged over one orbit for the worst case sun synchronous orbit.

LUSAT, PACSAT, and WEBERSAT will transmit in the 70 cm amateur band and will receive uplink signals in the two meter band. The

BRAZSAT will transmit in the two meter band. Planned frequencies are:

Mission	Downlink	Uplinks
BRAZSAT	145.980 MHz	--
LUSAT	437.150 MHz	145.900, 145.880, 145.860, 145.840 MHz
PACSAT	437.050 MHz	145.900, 145.920, 145.940, 145.960 MHz
WEBERSAT	437.100 MHz	??

These frequencies have been carefully coordinated in order to minimize the probabilities of mutual interference.

The digital downlink transmitters on LUSAT, PACSAT, and WEBERSAT will use binary phase shift keying (BPSK) modulation and will occupy a bandwidth of less than 20 kHz. BRAZSAT will transmit a narrowband FM signal modulated by a voice synthesizer. Its bandwidth will also be less than 20 kHz. Each satellite will have a maximum downlink transmitter capability of 4.0 watts power output and will be capable of transmitting at various lower power levels under automatic control of the satellite computer or ground command control as dictated by power budget considerations.

The telemetry system for each mission will make 32 or more analog telemetry parameters available to the onboard computer. These provide information related to the health of the satellite. Analog telemetry information will be converted to digital data that will, in turn, be available for transmission in unconnected beacon packets or to connected user stations. BRAZSAT telemetry information will be available via either the voice synthesizer or digitally. The number of telemetry channels will be extended during the design phase.

AMSAT has made arrangements to provide for the launch of all four MICROSATS as secondary payloads on the SPOT-2 mission. The launch vehicle is an ARIANE-1. The launch date currently shown by Arianespace is early to mid 1989. The orbit for the mission is sun synchronous at a nominal altitude of 822 km. The apogee altitude is planned for 835 km, the perigee is 817 km and the inclination is 98.7 degrees. The satellites will have an ascending node time of approximately 22:30 hours local time.

Although the four satellites will be in approximately the same orbit, there will be slight differences in the orbital parameters due to differences in deployment speed and direction from the launcher upper stage. Additionally, it is planned to deploy PACSAT and BRAZSAT in the direction of the orbital velocity vector and LUSAT and WEBERSAT in the opposite direction. This will result in very slightly higher and slower orbits for PACSAT and BRAZSAT and will speed the spread of the satellites along the trajectory.

A similar phenomena was seen with the deployment of RS-3, RS-4, RS-5, RS-6, RS-7, and RS-8 from the same launcher early in 1981. Although all six satellites were in the same polar orbit and thus were available at about the same times of day, their relative positions throughout the orbit at any particular time appeared to be random, changed from day to day and produced a good spread of operating opportunities.

BUS DESCRIPTION

The MICROSAT spacecraft bus structure is composed of five aluminum frames (or modules) formed into a composite stack held together with stainless steel tie bolts. This stack, an approximately cubical structure, is referred to as the "frame stack assembly." Dimensions of the stack are 230x230x213 mm. High efficiency solar cells are assembled onto four solar panels, which are installed onto the four sides of the frame stack assembly. Additional solar cell assemblies are mounted on the top of the spacecraft. The side panels are manufactured from aluminum bonded honeycomb material 4.8 mm thick. The thickness of these panels will assure than no buckling of the side panels can occur that might damage individual solar cells. Drawings of the spacecraft envelope, the spacecraft assembly and the frame stack assembly are provided in Figure 1.

Each of the five frames of the MICROSAT assembly stack contain electronic sub-assemblies suitable to the spacecraft mission, such as receiver, transmitter, computer, power supply and any special application modules such as the BRAZSAT voice synthesizer or the WEBERSAT camera controller and picture storage RAM.

The top and bottom panels of the MICROSAT spacecraft mount the VHF and UHF antenna assemblies and additional solar cell assemblies.

Electrical System Configuration

The frames or modules are used in a functional manner. Each fulfills an important aspect of the satellite's overall operation. The modules are numbered 01 through 05 starting from the baseplate of the spacecraft. The modules function as follows, listed from top to bottom:

LUSAT and PACSAT:

Module 05:	FSK Packet Receiver, all channels	(+Z)
Module 04:	Flight Computer	
Module 03:	Power Module	
Module 02:	Unused (This Space For Rent!)	
Module 01:	BPSK Packet Transmitter	(-Z)

BRAZSAT:

Module 05:	Command Receiver	(+Z)
Module 04:	Flight Computer	
Module 03:	Power Module	
Module 02:	Voice Synthesizer	
Module 01:	Telemetry Voice Transmitter	(-Z)

WEBERSAT:

Module 05:	Camera Module	(+Z)
Module 04:	Flight Computer	
Module 03:	Power Module	
Module 02:	FSK Packet Receiver, all channels	
Module 01:	BPSK Packet Transmitter	(-Z)

The modules are interconnected using a standardized bus arrangement which minimizes the number of wires necessary for all functions within the satellite. This standardized bus is implemented as an Addressable Asynchronus Receiver Transmitter (AART) board mounted to each module. Each AART makes use of one 25 pin standard Cannon connector for interconnection with each of the others. An electrical block diagram of a typical MICROSAT bus is shown in Figure 2.

TRANSMITTER MODULES

BPSK Packet Transmitter Module

LUSAT, PACSAT, and WEBERSAT all use BPSK (binary phase shift keying) packet transmitters which are the means by which they communicate to the ground. All transmissions are digital, NRZ-I, BPSK, HDLC, and will conform with the AX.25 protocol now in widespread use in the amateur radio service. Under flight computer control, unconnected information packets containing telemetry information (and picture frames for WEBERSAT), and connected transmissions supporting user functions will be available.

The transmitters will use a state-of-the-art high efficiency power amplifier with a maximum power output of 4 watts. Since even at an overall efficiency of 60% the orbital average array power of six watts would be exceeded, a means of power control has been devised that will allow the transmitter to operate at reduced power levels of 2 W, 1 W, .5 W. The transmit power level may be set either by direct ground command or by the computer under complex software control. At the highest power settings it is anticipated that the DC-to-RF efficiency of the transmitters can be maintained at approximately 60%.

Data rates supported are 1200 and 4800 bits per second, selectable. Corresponding transmitted bandwidths are approximately 4 kHz and 15 kHz.

The frequencies chosen, 437.150 for LUSAT, 437.050 for PACSAT, and 437.100 for WEBERSAT are selected to minimize functional interference and particularly to inaugurate occupation of the upper MHz of the 70 cm satellite band of 435 - 438 MHz. The transmitters will directly drive 70 cm turnstile antennas which will allow users to employ linearly polarized antennas.

Telemetry Voice Transmitter Module

BRAZSAT employs a narrowband FM voice transmitter driven by a voice synthesizer. This transmitter is to operate on 145.980 MHz in the amateur two meter band and will drive a two meter turnstile on BRAZSAT similar to the 70 centimeter turnstiles on the other ~CROSATS. This frequency is just below the AMSAT- OS-

CAR 13 beacon and above the high end of the AO-13 mode B downlink passband. Power levels, controls, efficiency, and technology are similar to those for the 437 MHz transmitters.

The transmitter will employ FM modulation with a deviation of 12 to 15 KHz, consistent with narrowband equipment used in the amateur service. Normally, the transmitter will be used to transmit voice synthesizer data, however, if the satellite is being accessed by a command station, the downlink may revert to 1200 bps AFSK compatible with the Bell 202 tone standards. Once the flight computer is returned to "run" mode, voice synthesizer information will resume on the downlink.

PAYLOAD MODULES

Unused Module

Both LUSAT and PACSAT have an unused module space in location 02. Spacing hardware will be placed in this location that maintains the dimensions and thermal characteristics of the MICROSAT.

In the event that subsystems under development require more space within the satellite, this module may be used to accommodate parts of the other subsystems.

Voice Synthesizer Module

BRAZSAT will contain a voice synthesizer to convert text stored in the computer memory into plain language for modulation of the FM transmitter. The text is stored in computer memory by ground command and upload. Additional text is generated from computer measurements of various spacecraft electrical parameters, forming a voice telemetry system. After the sequence of telemetry parameters has been repeated several times, the flight computer will interrupt the telemetry sequence and forward a stored voice announcement to the voice synthesizer. After the completion of the announcement, telemetry will resume. This cycle will repeat continuously, however, multiple announcements can be stored and cycled, one after the other, during the announcement window.

A phoneme-based speech synthesizer (PSS) is used to translate the text into sounds. This method is preferred over other methods, such as LPC, because of the extremely efficient use of computer RAM. A single-chip implementation of this is possible, using a chip similar to the Votrax SC-02.

The Votrax SC-02 is a versatile, high-quality, phoneme-based speech synthesizer circuit, contained in a single monolithic CMOS integrated circuit. It is designed to produce an audio output of unlimited vocabulary, music and sound effects at an extremely low data input rate.

Speech is produced by combining phonemes, the building blocks of speech, in an appropriate sequence. The Votrax SC-02 contains five eight-bit registers that allow software control of speech rate, pitch, pitch movement rate, amplitude, articulation rate, vocal tract filter response, and phoneme selection and duration.

Announcements in English, Portugeuse, and Spanish are intended.

Camera Module

The WEBERSAT includes an experimental low resolution camera as its primary payload. Camera control, digital picture storage and compression are all handled by a special module.

Additional details on this module will be forthcoming from CAST as we complete their official proposal document shortly.

POWER MODULE

All MICROSATS include a power module of common design. It is the primary "work horse" of the system. The mechanical module itself is slightly larger than the others so as to accommodate the battery cells. The power module will receive the power from the solar panels and will down-convert the voltage of the arrays (20 V) to the battery main bus voltage of 10 V. It will provide the function of charge regulation for the battery, correcting for array and battery cell temperatures. The current from the arrays will be reduced when the battery is fully charged by adjusting the solar cell operating point. This is accomplished by increasing the array voltage away from the optimum operating point. This technique has been used on all spacecraft since AMSAT-OSCAR-7 and has been shown to be a very effective means of preventing battery overcharge.

The solar arrays on the satellite will consist of 18 identical sub-panels referred to as "clips." Each clip contains 20 high efficiency solar cells each measuring 20 mm X 20 mm arranged in a 4 X 5 cell pattern. The cells will operate at an efficiency of 15.5% at a temperature of 20 deg. C. Plans are to operate the spacecraft at slightly lower temperatures so as to further increase solar cell efficiency and improve battery lifetime. At temperatures of +5 to +15 deg. C each solar cell clip will produce at least 1.60 watts. The side panels of the spacecraft (+X, -X, +Y, and -Y) will each contain four clips, two series pairs wired in parallel. The top panel (+Z) for BRAZSAT, LUSAT, and PACSAT will contain four clips. The top panel of the WEBERSAT will accomodate the camera. The bottom panel for each MICROSAT (-Z) will also contain a total of 40 series cells; the pattern for the cells will be unique to that surface.

The power module will include eight 6 amp hour NiCd, high reliability battery cells manufactured by Saft or GE/Gates. These cells will assure adequate capacity to operate continuously during satellite eclipse and can also be used to operate the satellite during peak periods with a negative power budget. The cells will be carefully matched for charge and discharge characteristics to assure maximum reliability and lifetime. The battery main bus voltage will be as high as 11.7 V when the battery is fully charged at ambient temperature and will be as low as 9.2 V at the point of 70% discharge, the maximum safe discharge level.

The transmitter will operate directly from the unregulated battery supply bus in order to avoid any loss of efficiency due to the regulation process.

The power module will also include two regulated supplies operating at 7.5 V and 5.0 V. These voltages are needed for all digital equipment and various analog circuitry operating in other satellite modules. The telemetry system will monitor at least 16 voltages, currents and temperatures that power the satellite subsystems.

Flight Computer Module

Each MICROSAT contains a general purpose microcomputer for command and control purposes and for digital data management. The computer is responsible for ensuring that all spacecraft functions are properly carried out. It performs the following tasks, among others:

- o Battery-charge regulator set-point control
- o Telemetry measurement or calculation and conversion
- o Transmitter power level selection and scheduling
- o Command reception and decoding
- o Telemetry packet or data initiation
- o AX.25 protocol implementation, transmit and receive
- o Text output to the speech synthesizer on BRAZSAT
- o Picture data handling on WEBERSAT
- o Bulletin Board store and forward user services on LUSAT and PACSAT
- o "Watchdog" operation to reset the computer if no commands are received in a certain period or to reduce transmitter power output if the battery voltage becomes unacceptably low.

The flight computer is a custom design based on an NEC V-40 microprocessor. Three primary memory areas are supported. For executable image storage, 256K bytes of RAM are implemented with Error Detection And Correction (EDAC) hardware employing twelve bits per byte, eight data bits and four check bits. A 2K byte ROM boot loader is non-volatile and provides a means of safely restarting the flight computer from a hard reset. User messages, telemetry mass storage, voice, picture, or other data are stored in a nominal six megabytes of RAM which is accessed in half megabyte switched memory banks. Up to ten megabytes of RAM may be supported in the bank switched arrangement. Half megabyte memory banks may be individually powered down in order to conserve spacecraft power when the memory is not in use.

A single 8 bit analog to digital (A to D) converter in the computer measures voltages on a pair of bus lines reserved for analog measurements. This provides the means for the flight computer to monitor operating parameters throughout the spacecraft for telemetering and operational purposes.

All integrated circuits will be rated for radiation resistance or shielded, particularly the EDAC and switched RAM banks.

Onboard programs are managed by the Quadron Multi-tasking operating system which looks similar to MS-DOS to each of the running applicaitons. This approach is used in order to greatly simplify ground based software development on existing PCs.

Telemetry will be encoded from A to D measurements and logically organized into 32 or more channels within software. The proposed telemetry to be monitored includes at least:

CHANNEL No:	PARAMETER:	MODULE No: (ref. LUSAT or PACSAT)
00	TX PA Temperature	01
01	Baseplate Temperature	01
02	Tx RF Power Output	01
03	Mod 02 (Unassigned)	02
04	+X Array Current	03
05	-X Array Current	03
06	+Y Array Current	03
07	-Y Array Current	03
08	+Z Array Current	03
09	-Z Array Current	03
10	Total Bat. Load Cur.	03
11	Total 7.5 V Bus Cur.	03
12	Total 5.0 V Bus Cur.	03
13	Battery Voltage	03
14	7.5 V Bus Voltage	03
15	5.0 V Bus Voltage	03
16	BCR Input Voltage	03
17	Batt. Cell #1 Temp.	03
18	Batt. Cell #5 Temp.	03
19	-Y Array Temp.	03
20	Flt. Computer Temp.	04
21	RX #1 Sig. Level	05
22	RX #1 Freq. Offset	05
23	RX #2 Sig. Level	05
24	RX #2 Freq. Offset	05
25	RX #3 Sig. Level	05
26	RX #3 Freq. Offset	05
27	RX #4 Sig. Level	05
28	RX #4 Freq. Offset	05
29	RX Mod. Temperature (Top Plate Temp.)	05

The -Y array temperature is of interest because the -Y array covers the side of the MICROSAT containing the electrical bus channel. This parameter also provides a backup source of spacecraft spin rate information.

Other calculated or derived parameters to be included in the telemetry selections are:

- o Total Array Current
- o Total Power Output from Solar Arrays
- o Total S/C Load Power
- o Number of RX Channels Active
- o Downlink Serialized Frame Number
- o Uplink Serialized Packet Number
- o BCR Solar Array Voltage Set Point Value
- o Battery Voltage Set Point
- o UTC Clock and Date (kept internally to 1 ms)
- o Current Satellite Keplerian Elements
- o S/C in Sun/Eclipse
- o Battery Charging/Discharging (since last frame)
- o Battery Charging/Discharging (over last orbital period)

This list is to be expanded further.

FSK Packet Receiver Module

LUSAT, PACSAT, and WEBERSAT all contain digital receivers that operate on four channels in the amateur two meter band. Frequencies are tabulated above.

Each of the uplink channels may be set independently to receive FSK uplinks at either 1200 or 4800 bits per second by the flight computer or from ground command.

At both speeds, the uplink bit stream is Manchester encoded, NRZ-I, HDLC, and used to frequency shift a carrier at the channel frequency. At 1200 bps the bandwidth of the uplink signal is approximately 4 kHz. At 4800 bps, the uplink signal approximately fills the entire 15 kHz channel. As noted above, satellite telemetry contains uplink frequency offset and signal level information which can enable users to adjust their uplink frequency for best performance.

A low noise amplifier, a dual gate MOSFET device similar to the MRF-102, and a highly selective 3 MHz bandpass filter comprise the front end of the receiver. The filter is required to protect the receiver from strong out-of-band signals. A double conversion heterodyne scheme with a first IF in the vicinity of 40 to 50 MHz is then employed. Power dividers are used after this IF to split the receiver channels before conversion to the second IF at 10.7 MHz on four separate IF strips. These strips are nearly entirely implemented using Motorola MC3362 FM receiver integrated circuits. Each receiver channel finally demodulates the audio tones to produce a NRZ-L serial data stream that is used by the flight computer.

Amateur radio stations will be able to connect to the satellite at various privilege levels governed by appropriate security checks. Privilege levels are as follows:

0 - The ability to request particular telemetry information (all users)
1 - The ability to upload broadcast bulletins
2 - The ability to do forwarding BBS housekeeping
3 - The ability to configure telemetry functions
4 - The ability to change spacecraft operating parameters
5 - The ability to re-boot/reload the computer

Each user with special privilege capabilities also has all privileges at lower levels by default. Command stations operating at privilege level 5 must utilize a ground based engineering test model of the MICROSAT for thorough software verification before loading the actual orbiting computer.

Standard AART

Each module in each MICROSAT will attach to an AART (Addressable Asynchronus Receiver/Transmitter) board, a simple, standardized CPU-to-module interface for command (both discrete digital and analog multiplexer) data by the use of a single-wire bus which uses ordinary ASCII communications at 4800 bps. An identical PC board is used in each module (aside from the Flight Computer Module) to provide these command functions.

The inter-module electrical interface is a 25 wire bus. Each AART board provides the mechanical mounting for each module´s DB25 connector. Wires on the bus include +5, +7.5, and +10 v. DC module power, an analog pair from the modules to the A/D converter, various discrete control lines and mission specific signals, and the 4800 bps AART data.

For each module the AART provides: 24 discrete bits for module control, a 4 way multiplexed analog interface for telemetry data, and addressing for analog telemetry ports. The board is based on the Motorola MC14469 AART chip.

Analog data sampling devices are designed to relinquish the bus so as not to interfere with measurements from other points. Analog measurements are made one at a time by via the A/D converter in the Flight Computer Module.

Fortsättning i INFO 1 / 89.

OSCAR-13 SCHEDULE PLANNINGS UNTIL NEXT YEAR

For the 1st January of next year (1989) it is planned to reorient the spacecraft back to 180 degrees longitude and 0 deg lattitude, since sunangle is even better as in the past months. This gives optimum squint angle (direction of the satellite antennas from your view) around apogee, which results in a new schedule mainly modified for the Mode-L operation.

The following transponder schedule will be in use from January 6 until March 15:

Mode-B	from	MA 3	until	MA 100
Mode-JL	from	MA 100	until	MA 150
Mode-B	from	MA 150	until	MA 240
OFF	from	MA 240	until	MA 3

AO-13 must be again reoriented in early March 1989 using the magnetorquers due to the decreasing sunangle. Additional long eclipse periods cause a special schedule to be used to keep the battery and energy system in a safe condition.

The following transponder schedule will be in use from March 13 until May 3 :

Mode-B	from	MA 100	until	MA 150
Mode-JL	from	MA 150	until	MA 210
Mode-B	from	MA 210	until	MA 0
OFF	from	MA 0	until	MA 100

The Mode-S transponder will be in use around the best squint angles, but the exact Mode-S schedule will be published later in the CW/RTTY/PSK beacon.
The transponder schedule may also change to to engineering or if conditions change. Watch the beacon for up-to-date transponder schedule informations.

Vy 73´s Peter Guelzow, DB2OS
AMSAT-DL

K E P L E R   E L E M E N T .

Källa: Nasa 2-raders element, redigerade av B. Lindholm.
(Bör ej användas för precisa vetenskapliga analyser.)

Satellit	OSCAR 9	OSCAR 10	OSCAR 11	OSCAR 12
Int. beteckn	81-100B	83-058B	84-021B	86-061B
Föremål-nr ..	12888	14129	14781	16909
Element nr. .	354	361	363	120
Epok år	1988	1988	1988	1988
Epok dag	319.27852515	313.61490571	314.64813774	317.81951275
Inklination .	97.5970	26.9972	98.0380	50.0163
R.A.A.N.	356.9250	295.9105	13.6264	243.4199
Exentricitet	0.0002176	0.6038606	0.0012523	0.0011459
Arg. of Per..	146.5062	351.2307	296.9052	153.9233
Medel-anomali	213.6359	1.6160	63.0871	206.2160
Varv per dag	15.37780631	2.05882117	14.62565148	12.44396281
Axeleration .	2.5724E-04	-9.5E-07	1.329E-05	-2.5E-07
Epok varv nr.	39576	4067	25044	10246
Nodal oml.tid	93.701915	699.1800	98.515945	115.653036
Västl. förskj	23.422262	175.3506	24.629787	29.239291
Fyr frekven-ser	21.002/ 145.825/ 435.025/ 2401.0 MHz	145.810 MHz 145.987 MHz	145.826/ 435.025/ 2401.5 MHz	435.797/ 435.913 MHz
Referensvarv:	20 Nov 1988	18 Nov 1988	18 Nov 1988	18 Nov 1988
Varv nummer .	39664	4087	25167	10311
Tid (HHMM.MM)	0006.06 Utc	0753.27 Utc	0130.68 Utc	0057.54 Utc
Västlig long.	57.89	241.55	58.17	204.31

Satellit	OSCAR 13	R S 10/11	SALJUT 7	MIR
Int. beteckn.	88-051B	87-054A	82-033A	86-017A
Föremål-nr. .	19216	18129	13138	16609
Element nr. .	19	575	315	522
Epok år	1988	1988	1988	1988
Epok dag	273.72660805	319.90822911	320.23870439	319.55067225
Inklination .	57.5382	82.9296	51.6132	51.6240
R.A.A.N.	237.5900	36.4328	279.2909	14.7608
Exentricitet	0.6578369	0.0010618	0.0001093	0.0022006
Arg. of Per.	191.3601	290.0499	49.6067	321.2208
Medel-anomali	139.7626	69.9379	310.4230	38.7438
Varv per dag	2.09697959	13.71915722	15.34841812	15.77597427
Axeleration .	3.0E-07	9.5E-07	5.6145E-04	8.3915E-04
Epok varvnr.	225	7001	37526	15751
Nodal oml.tid	686.6553	105.021671	93.759292	91.216083
Västl. förskj	172.1935	26.381163	23.819563	23.193720
Fyr frekven-ser	145.812/ 435.651 MHz	29.357/.403, 145.857/.903, 29.407/.453, 145.907/.953 MHz	19.953 MHz	143.625=voice 166.125=data (AM)
Referensvarv:	17 Nov 1988	18 Nov 1988	20 Nov 1988	18 Nov 1988
Varv nummer .	327	7044	37600	15806
Tid (HHMM.MM)	0832.71 Utc	0103.79 Utc	0120.72 Utc	0048.93 Utc
Västlig long.	313.33	39.13	183.53	72.76

Den Nodala omloppstiden är uträknad för epok dagen.
Oscar 10 kan åter användas, men ej mellan fas 30 till 90 under tiden 29/11 och 28/12 1988 p.g.av eklips.