UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 038C received by DB20S

**** UoSAT Bulletin-65 13:00 7th March 1984 ****

** UoSAT-Oscar-9 Status **

Following problems on 2nd March after a most successful launch and initial activation of Oscar-11, the Surrey Command Station 145MHz transmitter has been left modified to the Oscar-11 command frequency last successfully used on 1st March. We loaded this short bulletin from G3YJO with a hastily-installed second transmitter. Further bulletins on Oscar-9 will be prepared as the situation - and time - allows.

** UoSAT-Oscar-11 Status **

Following a flawless launch on DELTA 174 from Vandenberg Air Force Base, Ca., UOSAT-2 separated from the launcher at approx 19:11 gmt over Turkey and in range of the Command Station at Surrey. A lengthy series of instructions was transmitted to the spacecraft to establish the initial operating conditions and then the s/c computer was instructed to switch the 145.825 MHz downlink on for 10 secs to check housekeeping data and ensure that outgassing of the beacon did not give rise to corona. The spacecraft responded perfectly first time and good data was received & decoded at Surrey. The 145 MHz beacon was then activated for several minutes, under computer control, and further data gathered which confirmed that the spacecraft was in very good shape. Just prior to LOS at Surrey, the computer was instructed to activate the beacon once more for a further 4 minutes and good data was received as the spacecraft disappeared over the horizon.

On orbit #2 the 145 MHz beacon was re-activated by abbreviated computer instructions and the short and long bursts of telemetry repeated - data indicated everything on the spacecraft to be entirely nominal and so the computer was instructed to keep the 145 MHz beacon active in check-summed telemetry at 1200 bps for the next 80 minutes.

The spacecraft arrived at UoS silent (as expected) at AOS on orbit #3 and the short and long bursts of telemetry data process was repeated - data again indicated the spacecraft to be entirely nominal and so the computer was instructed to activate the 145 MHz beacon for the next 10 hrs whilst the spacecraft was out of range of the Surrey station.

With all having proceeded perfectly to plan thus far, the UoS team relaxed (collapsed?) and waited for telemetry reports from around the world!

The first indications that all was not well came from the printer when Larry Kayser wanted to know why he could not hear UO-11 followed by t/m from Phil Karn etc. The UoS Command Team were 'revived' and awaited the first pass of the day, orbit #8. The spacecraft was silent (again as expected) at AOS, however repeated attempts to re-activate the 145 MHz beacon using the s/c computer failed as did direct command. Heated analysis of the situation resulted in the preliminary theory that the 'Watch-Dog' timer (a device that de-activates the 145 & 435 MHz beacons after 21 days if no commands have been detected from the ground - remember UO-9!) may have been incorrectly

prematurely. The 'Watch-Dog' can be reset by command and this, and re-activation of the 145 MHz beacon, were attempted on orbit #9 - however with no success. Continued attempts, on orbit #10 yielder nothing and things began to look rather grim. At that time no reason could be found for the premature shut-down of the beacon and the prevailing theories tended towards cataclysm. Additionally, t/m 'went down' and we had to resort to phoning around to gather more pieces of the picture! Data from G.Ratcliffe via phone from Australia confirmed that the spacecraft systems were functioning nominally when he tracked UO-11 just before termination of transmissions. The spacecraft was in very good shape!

Detailed examination of the s/c computer software used during the first few passes shewed that the timing had been in error - the timing clock selected had been running at 8 times that required - resulting in premature shut-down of the beacon on both orbit #2 and #3 entirely in agreement with observations! This now veered the theories away from the 'Big Bang' and towards some sort of spacecraft systems problem.

Lack of feedback from the spacecraft keeps us effectively blind and all we can do is postulate the most likely theories based on pre-launch experience. The current theory is that there may be a problem with the 145 MHz beacon causing it to fail to operate correctly and generate wide-band noise and block the command receivers. This theory is based on observations of the performance of the beacon during test where some problems of this nature were encountered but were later believed to have been fixed. The Surrey Command Station are continuing to attempt to command the 145 MHz beacon OFF and the 435 MHz beacon ON - so far without success. If the 145 MHz beacon is ON but not operating correctly, it should be possible to observe it with high gain antennas and spectrum analysers etc. Should this prove to be the case, then it may be most profitable to attempt to command the spacecraft using the 1.2 GHzcommand uplink as this uplink is the most independant of the VHF/UHF systems.

All we can do is try out various theories - we tend not to favour total system failure or spontaneous detonation at present rather some more limited scenario. We shall keep you posted as to our thoughts and progress. Needless to say, everyone here is somewhat disappointed after the efforts of the last months and such a flawless start to UO-11's life!

We still have faith, though!

Martin Sweeting UoSAT Programme Manager + UoS Team

** Orbital Predictions - from KA9Q **

```
Satellite: oscar-9
Catalog number: 12888
Epoch time:       84059.37579141
   Tue Feb 28 09:01:08.377 1984 UTC
Element set:      589
Inclination:        97.5794 deg
RA of node:         32.4183 deg
Eccentricity:     0.0004812
Arg of perigee:    120.6543 deg
Mean anomaly:      239.5299 deg
Mean motion:    15.24558043 rev/day
Decay rate:       6.413e-05 rev/day^2
Epoch rev:            13280
Semi major axis:  6867.216 km
Anom period:      94.453603 min
Apogee:             507.926 km
Perigee:            501.317 km
Beacon:             145.8250 mhz
```

```
Satellite: oscar-10
Catalog number: 14129
Epoch time:       84052.17797385
   Tue Feb 21 04:16:16.940 1984 UTC
Element set:      85
Inclination:       25.5984 deg
RA of node:       214.2593 deg
Eccentricity:     0.6089416
Arg of perigee:    247.5009 deg
Mean anomaly:      39.4882 deg
Mean motion:    2.05858806 rev/day
Decay rate:        8.01e-06 rev/day†2
Epoch rev:              520
Semi major axis: 26105.357 km
Anom period:    699.508575 min
Apogee:          35627.257 km
Perigee:          3833.982 km
Beacon:           145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time:       84064.46078527
   Sun Mar  4 11:03:31.847 1984 UTC
Element set:      5
Inclinition:       98.2551 deg
RA of node:       126.9087 deg
Eccentricity:     0.0012928
Arg of perigee:    253.6204 deg
Mean anomaly:      106.2574 deg
Mean motion:    14.61847144 rev/day
Decay rate:       0.00034629 rev/day†2
Epoch rev:              40
Semi major axis:  7062.434 km
Anom period:     98.505511 min
Apogee:           712.698 km
Perigee:          694.437 km


** Spacecraft orbital data **

Orbits for 7th March

            UoSAT          OSCAR-8          NOAA-7
Orbit no :  13388          30614            13952
Eqx time :  14:18:06       15:10:15         14:44:30        GMT
Eqx long :  340.5          303.5            349.4           deg.w
Mean hgt :   496.0          904.0            850.0          km
Period   :   94.5204471    103.1631066      101.9572850     mins
P-drag   :  2.477E-05       8.277E-07        7.500E-06      *N-ref
Long inc :  23.6289921     25.7899720       25.489v396      degs
L-drag   :  6.233E-06         .000E+00       2.000E-07      *N-ref

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey,
England - Thank you
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Dies waren die ersten Signale von UoSAT-2, nach dem Einschalten um 19:16:25 UTC am 1.3.1984, ORBIT# 0

received by DB2OS

UOSAT-2 0000410000419

0022330134060224400354200404220503530603360704030803 5E09034E
1051361129 7C12000313085F1400141500371600161756 8D18546E195068
2051712118392266332300012400062500072608952761022861682944 92
30519E31038932284F33587A340007 35354 4364313 3740 6 638408739404A
4075174100054267164300074417174500454600024741064841094941 38
5047 1751092F 5265 2 6536572 54756 555000056000 3 5740 3 558407E59407F
6082C06158C562800C6302436404066501026600006700016800 0E69000F

UOSAT-2 0000410000551

0193801683C0244980332460404220503420603b407040308035E090339
1051141129 7C12000313084E1400141500371600161755 8E18540819 5085
2051352118282266332300012400062500072609 0D27596F28595329450A
3047113104063228 4F335868340007353544364 29A373997384096394 04A
4075604100054267074300074417174500454600024741064841184941 2A
5062895109 0D52664353670754748A55000056000357403558407E594080
6083E36158C562800C6302436404 06&501026600006700016800 0E69000F

UOSAT-2 0000410000658

0051370140270263160364320404220503350603140704030803 4F090328
1034421129831200031308391400051500261600071755351853 5A195085
2051532118182266332300012400062500072609QD27587F285816294518
3020673104243228 5E335858340007353522364256373887384096394 05B
4075534100054267164300074417244500454600024741174841184941 2A
5057705109 1C52664353&69F54753055000056000357403558407E594080
6082E2615BC562800C6302436404066501026600006700016800 0E69000F

UOSAT-2 0000410000722

0021120153430268840355650404220503350603050704030803 4F090328
1051141129831200031308 4E1400141500371600161755 0618533C195085
2051422118282266332300012400062500072609 0D27585D28577F29451B
3045753104243228 5E335849340007353511364247373869384 0)639405B
4075354100054267164300074417244500454600024741174841284941 2A
5051325109 1C52662553263154749855000056001357403558408159 4080
6083E3615BC562800C6302076404066501026600006700016800 0E69000F

UOSAT-2 0000410000804

a) 144 MHz power O/P = 610 mW
T = 14,8°C
Batt temp = 15,4°C, Batt charge/discharge = −369,6 mA
Vbatt = 13,69 V

```
00170601699702511703352704042205033U0603050704030803 4F090318
10510511298312000313083914001415003716000717547018532D195085
20513521180A22663323000124000625000726090D27579E285708294518
30373431041732284F335849340007353511364247373830384096394058
40765041000542670743000744172445004546000247411748412849411 9
50659F51090D526706536761547574550000560003574042584081594091
6082C0615BC562800C6302076404066501026600006700016800 0E69000F
 UOSAT-2            0000410000806

00229901570302655403599604042205033506030507040308034F090318
10513611298312000313084E1400141500371600161754611853 1E195085
20516 211818226633230001240006250007260 90D27579E285708294518
30447431042432285E33587A3400073534983642213738 3C384096394058
40750641000542670643000744172445004546000247411748412849412A
50471751091C526607536653547530550000560003574042584081594091
60826A615BC562800C6302476404066501026600006700016800 0E69000F
 UOSAT-2            0000410000835
```

Orbit# 1 am 1.3.1984 um 20:50 UTC
received by DB2OS

VOSAT-2 0000410013826

00519D013828026567035280404440503244601 9E07041208032909026D
10519C113003120003130828140005150028 600071760991861 1F195368
20519F21185F22663323 0012400062500072609 3E276245286320294708

```
40649F4100054267164300074416 9E4500324600024742724843 4F49413B
504652510 93E52634653640454756555000 0 4600035741 9E58424F594329
60836861 58C562800C6302436404066501 02 600006700016 8000E69000F
 UOSAT-2              0000410013830

00519D01234402508F03458A0404440503240601 9E07041208032909026D
10519C1130031200031308281400051500371600071760991861 1F195368
20519F21185F22663323000124000625000726093E27624528633C294708
30519E31037632284F33593F340007353423364177374066384258394 0D
40649F4100054267164300074416 9E4500324600024742724843 4F49413B
504652510 93E52634653639A54770155000056000357419E58424F594329
60836861 58C562800C6302436404066501026600006700016 8000E69000F
 UOSAT-2              0000410013845

00519D01631502611403494A0404440503240601 9E07041208032909026D
10519C1130031200031308281400141500261600071761011861 2C195379
20519F21186C22663323000124000625000726094927624528633C294708
30519E31042432285E33591D340007353401364144374066384258394 0D
40649F4100054267164300074416 9E4500324600024742724843 4F49414C
504652510 93E52634653639A54771055000056000357419E58424F594329
60836861 58C562800C6302436404066501026600006700016 8000E69000F
 UOSAT-2              0000410013855

00519D01493F02391903676404044405032406019E07041208032909026D
10519C1130031200031308281400051500261600071761101861 2C195379
20519F21187D22663323000124000625000726093E27625428634B294708
30519E31038932284F33592E34000735339F364133374055384258394 0D
40649F4100054267164300074416 9E4500324600024742724843 4F49414C
504652510 93E52634653267554772355000056000357419E58424F594329
60836861 58C562800C6302436404066501026600006700016 8000E69000F
 UOSAT-2              0000410013904

00519D01647402494803327504044405032406019E07041208032909026D
10519C1130031200031308181400141500261600161761101861 2C195386
20519F21185F22663323000124000625000726093E27625428635A294719
30519E31040632285E33598434000735339F364122374044384268394 0D
40649F4100054267164300074416 9E4500324600024742724843 4F49414C
504652510 93E52634653264654764455000056000357419E58424F594338
60836861 58C562800C6302436404066501026600006700016 8000E69000F
 UOSAT-2              0000410013919

00519D01568A02272503547504044405032406019E07041208032909026D
10519C1130031200031308181400141500261600161761231861 3D195386
20519F21186C22663323000124000625000726093E27626728635A294719
30519E31038932284F33592E34000735338E364122374022384268394 0D
40649F4100054267164300074416 9E4500324600024742724843 4F49414C
504652510 93E52634653265754768855000056000357419E58424F594338
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UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
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Frame counter : 0346 received by DB2OS

**** UoSAT Bulletin-66 13:00 16th March 1984 ****

** UoSAT-Oscar-9 Status **

Dual satellite control at the Surrey groundstation has been restored using a signal generator in place of the previous single-frequency transmitter. Thus requires manual doppler tuning, but allows a normal schedule again on Oscar-9. We will use a schedule similar to that used before the Oscar-11 launch campaign, modified if further bulletins are required.

** UoSAT-Oscar-9 Schedule **

Friday	Load bulletin, Digitalker, 1200 bd telemetry
Saturday	Bulletin
Sunday	Bulletin
Monday	High-speed radiation scan
Tuesday	Checksummed telemetry
Wednesday	Digitalker & Telemetry
Thursday	Whole-orbit recorded telemetry

** UoSAT-Oscar-11 Status **

Further detailed analysis of the telemetry data received from the UOSAT-2 spacecraft during the early operational orbits - gathered from the UK, Japan & Australia - still yields no indication of impending problems, all spacecraft systems were performing perfectly during that time.

Reports have been received from Canberra (Australia) and New Zealand of very low-level signals on 145.825 MHz. The prevailing theory is that the 145 MHz beacon malfunctioned when re-activated on March 2nd and is unstable producing only a small amount of power on 145.825 MHz.

Attempts by NK6K to activate the 435 MHz beacon using the 1.2 GHz uplink have, so far, proved unsuccessful, however the precision required for tracking the spacecraft at that frequency highlighted another potential problem area. Studies of the orbit ephemeres by KA9Q identified discrepancies between the orbit data used by different stations tracking the spacecraft based on radar observations. Since no signals can be reliably received from UOSAT-2, orbit data for the spacecraft has to be derived from repeated radar observations - assuming it is possible to identify positively the spacecraft amongst the other objects in much the same orbit!

It is essential that we have accurate and reliable orbit data before we can correlate reports of signals thought to come from UOSAT-2 and proceed with attempts to overcome the problem.

Reports of signals received on 145.825 MHz during the times that UOSAT-2 should be visible would be extremely valuable, but must include times, bearings, station position, equipment details and, preferably, tape recordings of any likely signals. With enough observations we should be able to piece together what has happened to UOSAT-2 - please help and we will get there!

Thanks to all helping so far.

** Oscar-11 Telemetry equations **

The Oscar-11 telemetry format is repeated below. Thanks to Harold Price, NK6K, for the initial compilation.

Checksummed TLM format. Channel format is:

nnvvvc

nn - channel number
vvv - value
c - To compute checksum, convert each ascii character into the binary, e.g. 'A', which comes in as 41H becomes 0AH. Exclusive OR all 5 values. Convert the lower four bits of the XOR answer to an ascii hex digit, e.g. 08H becomes 42H, this character is the checksum.

A 1Eh cursor home character preceeds UOSAT-2 in each frame The number after UOSAT-2 on the header line is the date in YYMMDDWHHMMSS, W is day of week, 0-6. The date below is bogus, it wasn't initialized after the s/c was powered up. The s/c was in the Bldg 836 clean room when this frame was taken. Some of the data is valid.

UOSAT-2 0000010040621

```
00515101039802011203010204023505028F06025107031508032909026D
10515011000012005613010314000515000416000717736418736819736A
20515321032222667723000124001725000726077427736728736829736 9
30515231016532284F33000034000735030536000537736638353E39353F
40763641000542688043000744000045056246000247736148353949346C
50561751017252661653263154111055852F56000357306758736F593539
60210561 7BC762800C63004164100365 1C0E661405673406680 00E69000F
```

Non-checksummed frame. Everything is the same as above expect that the checksum character becomes a space. This format is more pleasing to the human eye.

UOSAT-2 0000010040630

```
00515 01035 02010 03010 04023 05028 06025 07031 08032 09026
10515 11000 12004 13010 14000 15000 16000 17736 18736 19736
20515 21032 22667 23000 24001 25000 26077 27736 28736 29736
30515 31016 32284 33000 34000 35028 36000 37736 38353 39353
40763 41000 42688 43000 44000 45055 46000 47736 48353 49346
50561 51017 52661 53256 54111 55852 56000 57306 58736 59353
61210 6178C 62800 63004 64100 651C0 66140 67340 68000 69000
```

A dwell format is also available, in which only selected channels are displayed. The channels can come out in any order, in checksummed or non-checkedsummed format. The UOSAT-2 and time stamp may or may not be included.

Chan #	Name	Equation
00	Solar array current -Y	I=1.9(516-N) ma
01	Nav mag X axis	H=(0.1485N-68) uT
02	Nav Mag Z axis	H=(0.1523N-69.3) uT
03	Nav mag Y axis	H=(0.1507N-69) uT
04	Sun sensor 31	
05	Sun sensor #2	
06	Sun sensor #3	

08	Sun sensor #5	
09	Sun sensor #6	
10	Solar array current +Y	I=1.9(516-N) mA
11	Nav mag (Wing) temp	T=(330-N)/3.45 C
12	Horizon sensor	
13	Spare (tbd)	
14	DCE RAMUNIT current	
15	DCE CPU current	
16	DCE GMEM current	
17	Facet temp +X	T=(480-N)/5 C
18	Facet temp +Y	T=(480-N)/5 C
19	Facet temp +Z	T=(480-N)/5 C
20	Solar array current -X	I=1.9(516-N) mA
21	+10V line current	I=0.97N mA
22	PCM voltage +10V	V=0.015N V
23	P/W logic current (+5V)	I=0.14 (N<=500)
24	P/W Geiger current (+14V)	I=0.21N mA
25	P/W Elec sp.curr (+10V)	I=0.096N mA
26	P/W Elec sp.curr (-10V)	I=0.093 mA
27	Facet temp -X	T=(480-N)/5 C
28	Facet temp -Y	T=(480-N)/5 C
29	Facet temp -Z	T=(480-N)/5 C
30	Solar array current +X	I=1.9(516-N) mA
31	-10V line current	I=0.480 mA
32	PCM voltage -10V	V=0.036N V
33	1802 comp curr (+10V)	I=0.21N mA
34	Digitalker current (+5V)	I=0.13N mA (N<=500)
35	145MHz beacon powes O/P	P=(2.5N - 275) mW (N>200)
36	145MHz beacon current	I=0.22N mA
37	145MHz beacon temp	T=(480-N)/5 C
38	Command decoder temp (+Y)	T=(480-N)/5 C
39	Telemetry temp (+X)	T=(480-N)/5 C
40	Solar array voltage (+30V)	V=(0.1N-51.6) V
41	+5V line current	I=0.97N mA
42	PCM voltage +5V	V=0.0684N V
43	DSR current (+5V)	I=0.21N mA (n<=500)
44	Command RX current	I=0.92N mA
45	435MHz beacon power O/P	P=(2.5N-200) mW N>175
46	435MHz beacon current	I=0.44N mA
47	435MHz beacon temp	T=(480-N)/5 C
48	P/W temp (-X)	T=(480-N)/5 C
49	BCR temp (-Y)	T=(480-N)/5 C
50	Battery charge/dischg curr	I=8.8(N-513) mA
51	+14V line current	I-5N mA
52	Battery voltage (+14V)	V=0.021N V
53	Battery cell volts (MUX)	See below
54	Telemetry current (+10V)	I=0.02N mA
55	2.4GHz beacon power O/P	P=((N+50)**2)/480 mW
56	2.4GHz beacon current	I=0.45N mA
57	Battery temp	T=(480-N)/5 C
58	2.4GHz beacon temp	T=(480-N)/5 C
59	CCD imager temp	T=(480-N)/5 C
60-67	Status points 1-96	

The status points will be repeated again in the next bulletin.

Correction

Note that the equation for channel 52 (battery voltage) was incorrect by a factor of 10 and has been corrected.

Multiplexed Battery Scheme (channel 53)

Six consecutive TLM frames carry the total volts, the following ten frames will be individual cells, starting with cell #10. Each cell has its own equation which will be supplied when a documentation problem has been resolved.

** Orbital Predictions - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84063.90445011
Sat Mar 3 21:42:24.489 1984 UTC
Element set: 593
Inclination: 97.5793 deg
RA of node: 37.0021 deg
Eccentricity: 0.0004498
Arg of perigee: 107.8696 deg
Mean anomaly: 252.3144 deg
Mean motion: 15.24639690 rev/day
Decay rate: 7.823e-05 rev/day†2
Epoch rev: 13349
Semi major axis: 6866.971 km
Anom period: 94.448545 min
Apogee: 510.949 km
Perigee: 504.772 km
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84063.83285908
Sat Mar 3 19:59:19.24 1984 UTC
Element set: 90
Inclination: 25.6632 deg
RA of node: 212.1030 deg
Eccentricity: 0.6091272
Arg of perigee: 250.9131 deg
Mean anomaly: 36.7286 deg
Mean motion: 2.05853435 rev/day
Decay rate: -2.8e-07 rev/day†2
Epoch rev: 544
Semi major axis: 26105.808 km
Anom period: 699.526826 min
Apogee: 35633.003 km
Perigee: 3829.487 km
Beacon 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84067.40409430
Wed Mar 7 09:41:53.747 1984 UTC
Element set: MH 3-11-84mod
Inclination: 98.2510 deg
RA of node: 129.8480 deg
Eccentricity: 0.0006061
Arg of perigee: 243.8620 deg
Mean anomaly: 116.1950 deg
Mean motion: 14.61903052 rev/day
Decay rate: 4.76e-06 rev/day†2
Epoch rev: 83
Semi major axis: 7062.253 km
Anom period: 98.501744 min
Apogee: 705.268 km
Perigee: 696.708 km
Beacon: 145.8250 mhz

Satellite: Landsat-D'
Object: 1984-021A = NASA # 14780
NASA El.Set: # 5
Epoch: 84064.46281564
Incl: 98.2545
RAAN: 126.9100
Eccr: 0.0010697
Arg.Perg: 274.5334
Mean Anom: 085.4451
Mean Motion: 14.60712266
Drag: +0.00010338

** Spacecraft orbital data **

Orbits for 16th March

	UoSAT	UoSAT-2	NOAA-8	
Orbit no :	13541	217	5032	
Eqx time :	15:16:24	15:28:01	14:35:45	GMT
Eqx long :	353.7	267.4	300.2	deg.w
Mean hgt :	494.7	693.5	850.0	km
Period :	94.5042459	98.5644202	101.2794220	mins
P-drag :	3.875E-05	1.750E-06	9.000E-06	*N-ref
Long inc.:	23.6243378	24.6404045	25.3296116	degs
L-drag :	9.749E-06	4.400E-07	2.000E-07	*N-ref

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey, England - Thank you

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 0169 received by DB2OS

**** UoSAT Bulletin-67 23rd March 1984 ****

** UoSAT-Oscar-9 Status **

Dual satellite control at the Surrey groundstation has been restored using a signal generator in place of the previous single-frequency transmitter. Thus requires manual doppler tuning, but allows a normal schedule again on Oscar-9. We will use a schedule similar to that used before the Oscar-11 launch campaign, modified if further bulletins are required.

** UoSAT-Oscar-9 Schedule **

Friday	Load bulletin, Digitalker, 1200 bd telemetry
Saturday	Bulletin
Sunday	Bulletin
Monday	High-speed radiation scan
Tuesday	Checksummed telemetry
Wednesday	Digitalker & Telemetry
Thursday	Whole-orbit recorded telemetry

** UoSAT-Oscar-11 Status **

Yet further detailed analysis of the telemetry data received from the UOSAT-2 spacecraft during the early operational orbits - gathered from the UK, Japan & Australia - still yields no indication of impending problems, all spacecraft systems were performing perfectly during that time.

A number of reports are still being received at Surrey giving information on short bursts of either modulated or unmodulated signals on 145.825MHz. None of the reports so far have been corroborated by tape recordings or simultaneous reception at two or more stations, however the continuation of these reports is still encouraging.

Stations sending reports should attempt to provide the following details: Type of signal and modulation, time of start and end, tape recording, frequency and doppler variation, beam headings and any variation, and brief station equipment details. Please contact your national AMSAT organisation or the University of Surrey if anything of interest is heard. Thanks!

The prevailing theory is that the 145 MHz beacon malfunctioned when re-activated on March 2nd and is unstable producing only a small amount of power on 145.825 MHz, but enough elsewhere to block all the command receivers.

Attempts by NK6K to activate the 435 MHz beacon using the 1.2 GHz uplink have, so far, proved unsuccessful, however the precision required for tracking the spacecraft at that frequency highlighted another potential problem area. Studies of the orbit ephemeres by KA9Q identified discrepancies between the orbit data used by different stations tracking the

spacecraft used on radar observations. Since no signals can be reliably received from UOSAT-2, orbit data for the spacecraft has to be derived from repeated radar observations - assuming it is possible to identify positively the spacecraft amongst the other objects in much the same orbit! Much of the doubt over the orbit parameters has now been resolved, however the Landsat orbital elements are included in this bulletin as additional reference material.

Thanks to all helping so far.

** Oscar-11 Status Point Summary **

The Oscar-11 status point listing is repeated below. Thanks to Harold Price, NK6K, for the initial compilation.

The list below contains the status points which are presented in 'channels' 60 to 67 of the telemetry frame which was described in last week's bulletin.

The status points are stored with 12 points per telemetry channel, e.g. channel 60 has status bits 1,2,3,4,5,6,7,8,9,10,11,12 in that order. Thus, 60400 means status point 2 is set, (1), and 3-12 are reset (0).

UOSAT-B STATUS POINTS

1	145 MHZ GENERAL DOWNLINK POWER	OFF/ON
2	435 MHZ ENGINEERING DOWNLINK POWER	OFF/ON
3	2401 MHZ ENGINEERING DOWNLINK POWER	OFF/ON
4	TELEMETRY CHANNEL MODE SELECT	RUN/DWELL
5	TELEMETRY CHANNEL DWELL ADDRESS LOAD	OFF/ON
6	TELEMETRY CHANNEL DWELL ADDRESS SOURCE	GND/COMPUTER
7	PRIMARY SPACECRAFT COMPUTER POWER	OFF/ON
8	PRIMARY SPACECRAFT COMPUTER ERROR COUNT	BIT-1
9	PRIMARY SPACECRAFT COMPUTER ERROR COUNT	BIT-2
10	PRIMARY SPACECRAFT COMPUTER BOOTSTRAP	PROM/UART
11	PRIMARY SPACECRAFT COMPUTER ERROR COUNT	BIT-3
12	PRIMARY SPACECRAFT COMPUTER BOOTSTRAP	A/B
13	GRAVITY GRADIENT BOOM DEPLOYMENT PYROS	SAFE/ARM
14	GRAVITY GRADIENT BOOM DEPLOYMENT PYROS	HOLD/FIRE
15	GRAVITY GRADIENT BOOM DEPLOYMENT	SAFE/ARM
16	GRAVITY GRADIENT BOOM DEPLOYMENT	HOLD/DEPLOY
17	GRAVITY GRADIENT BOOM DEPLOYMENT	EXTEND/RETRACT
18	ATTITUDE CONTROL MAGNETORQUERS	SAFE/ARM
19	ATTITUDE CONTROL MAGNETORQUER -X	ON/OFF
20	ATTITUDE CONTROL MAGNETORQUER -Y	ON/OFF
21	ATTITUDE CONTROL MAGNETORQUER -Z	ON/OFF
22	ATTITUDE CONTROL MAGNETORQUER	REVERSE/FORWARD
23	435 MHZ PSK MODE	NRZI/NRZIC
24	2401 MHZ PSK MODE	NRZI/NRZIC
25	ATTITUDE CONTROL MAGNETORQUERS	HIGH/LOW POWER
26	DIGITALKER EXPT. POWER	OFF/ON
27	CCD CAMERA EXPT. POWER	OFF/ON
28	CCD CAMERA EXPT. INTEGRATION PERIOD	BIT 0
29	CCD CAMERA EXPT. INTEGRATION PERIOD	BIT 1
30	CCD CAMERA EXPT. VIDEO AMP. GAIN	BIT 0
31	CCD CAMERA EXPT. VIDEO AMP. GAIN	BIT 1
32	DSR POWER	OFF/ON
33	DSR MODE	READ/WRITE
34	DSR MODE	RUN/RESET
35	RADIATION DETECTORS GEIGER-A EHT P WER	OFF/ON
36	RADIATION DETECTORS GEIGER-B EHT POWER	OFF/ON
37	RADIATION DETECTORS GEIGER-C EHT POWER	OFF/ON
38	ELECTRON SPECTROMETER SENSOR EHT POWER	OFF/ON
39	DCE EXPERIMENT POWER	OFF/ON
40	DCE EXPT.	RESET/RUN

41	DCE EXPT. PROM SELECT	A/B
42	DCE EXPT. CPU CLOCK RATE SELECT	0.9/1.8 MHZ
43	NAVIGATION MAGNETOMETER POWER	OFF/ON
44	SPACE DUST EXPERIMENT POWER SELECT	OFF/ON
46	BCR STATUS	0/1
47	435 MHZ DOWNLINK MODULATION SELECT	AFSK/PSK
48	2401 MHZ DOWNLINK MODULATION SELECT	AFSK/PSK
49	ENGINEERING DATA	BIT 1
50	ENGINEERING DATA	BIT 2
51	ENGINEERING DATA	BIT 3
52	ENGINEERING DATA	BIT 4
53	ENGINEERING DATA	BIT 5
54	COMMAND WATCHDOG ENABLE	
55	COMMAND WATCHDOG RESET	
56	145 MHZ DOWNLINK DATA SELECT	A
57	145 MHZ DOWNLINK DATA SELECT	B
58	145 MHZ DOWNLINK DATA SELECT	C
59	145 MHZ DOWNLINK DATA SELECT	D
60	145 MHZ DOWNLINK DATA SELECT	E
61	145 MHZ DOWNLINK DATA SELECT	F
62	145 MHZ DOWNLINK DATA RATE	A
63	145 MHZ DOWNLINK DATA RATE	B
64	435 MHZ DOWNLINK DATA RATE	A
65	435 MHZ DOWNLINK DATA RATE	B
66	435 MHZ DOWNLINK DATA RATE	C
67	PARTICLE/WAVECOUNTER CONTROL	COUNT/RESET
68	DOWNLINK LOCKOUT	ENABLE/DISABLE
69	ENGINEERING DATA	BIT 6
70	ENGINEERING DATA	BIT 7
71	ENGINEERING DATA	BIT 8
72	ENGINEERING DATA	BIT 9
73	P/W channel plate control BIT 0	
74	P/W channel plate control BIT 1	
75	P/W channel plate control BIT 2	
76	SPACE DUST	
77	SPACE DUST	
78	SPACE DUST	
79	SPACE DUST	
80	SPACE DUST	
81	SPACE DUST	
82	SPACE DUST	
83	SPACE DUST	
84	DSR WRITE CYCLE COMPLETE	
85	1802 CWO OUTPUT	
86	1802 TLM PORT (MSB)	
87	1802 TLM PORT	
88	1802 TLM PORT	
89	1802 TLM PORT	
90	1802 TLM PORT	
91	1802 TLM PORT	
92	1802 TLM PORT	
93	1802 TLM PORT	
94	1802 TLM PORT	
95	1802 TLM PORT	
96	1802 TLM PORT (LSB)	

The 'engineering data' bits contain the internal status of certain modules and are unlikely to be of general interest.

** Orbital Predictions - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84072.37051070
Mon Mar 12 08:53:32.124 1984 UTC
Element set: 497
Inclination: 97.5837 deg
RA of node: 45.5674 deg
Eccentricity: 0.0004698
Arg of perigee: 87.3549 deg
Mean anomaly: 272.8215 deg
Mean motion: 15.24761403 rev/day
Decay rate: 6.832e-05 rev/day†2
Epoch rev: 13478
Semi major axis: 6866.605 km
Anom period: 94.441005 min
Apogee: 512.654 km
Perigee: 506.202 km
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84063.83285908
Sat Mar 3 19:59:19.24 1984 UTC
Element set: 90
Inclination: 25.6632 deg
RA of node: 212.1030 deg
Eccentricity: 0.6091272
Arg of perigee: 250.9131 deg
Mean anomaly: 36.7286 deg
Mean motion: 2.05853435 rev/day
Decay rate: -2.8e-07 rev/day†2
Epoch rev: 544
Semi major axis: 26105.808 km
Anom period: 699.526826 min
Apogee: 35633.003 km
Perigee: 3829.487 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84073.70137990
Tue Mar 13 16:49:59.223 1984 UTC
Element set: MH 3-13-84
Inclination: 98.2610 deg
RA of node: 136.1480 deg
Eccentricity: 0.0012076
Arg of perigee: 233.9610 deg
Mean anomaly: 126.0480 deg
Mean motion: 14.61818731 rev/day
Decay rate: 1.59e-06 rev/day†2
Epoch rev: 175
Semi major axis: 7062.526 km
Anom period: 98.507426 min
Apogee: 706.604 km
Perigee: 689.547 km
Beacon: 145.8250 mhz

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 088C received by OB2OS

**** UoSAT Bulletin-68 28th March 1984 ****

** UoSAT-Oscar-9 Status **

This bulletin has been produced two days earlier than usual in order to prevent loading it on Friday. G3YJO will be using a 26m dish antenna at Jodrell Bank, near Manchester, England, to listen for the UoSAT-Oscar-11 beacon on 145.825MHz. Calibration tests against Oscar-9 will be performed on Thursday and Friday afternoons, with Oscar-11 runs on Thursday evening and Friday morning and evening. Depending on the results obtained, further work may be done over the weekend and early next week.

** UoSAT-Oscar-9 Schedule **

The following schedule will be resumed from next Tuesday - this weekend the bulletin will run from Wednesday afternoon until Monday.

Friday	Load bulletin, Digitalker, 1200 bd telemetry
Saturday	Bulletin
Sunday	Bulletin
Monday	High-speed radiation scan
Tuesday	Checksummed telemetry
Wednesday	Digitalker & Telemetry
Thursday	Whole-orbit recorded telemetry

** UoSAT-Oscar-11 Status **

Analysis of all telemetry received from Oscar-11 indicates no reasons for the current silence and lack of telecommand.

A number of reports are still being received at Surrey giving information on short bursts of either modulated or unmodulated signals on 145.825MHz. None of the reports so far have been corroborated by tape recordings or simultaneous reception at two or more stations, however the continuation of these reports is still encouraging.

Stations sending reports should attempt to provide the following details: Type of signal and modulation, time of start and end, tape recording, frequency and doppler variation, beam headings and any variation, and brief station equipment details. Please contact your national AMSAT organisation or the University of Surrey if anything of interest is heard. Thanks!

After the 2m beacon reception tests this week, further work may centre on attempting to receive emissions from the three command receivers. These are powered separately direct from the batteries and analysis is currently being performed to determine the power levels output at the various local osclillator frequencies.

Thanks to all helping so far.

** Oscar-11 Specification **

Just to remind us all what we are missing, here is a summary of the systems aboard Oscar-11!

145.825 MHz Beacon

The 145 MHz beacon on UoSAT-B is nearly identical to the one flown most successfully on UoSAT-1. The modulation index has been increased in order to ensure more optimum reception on most radio amateur receivers. Modulation is by frequency-shift keying, as on UoSAT-1.

435.025 MHz Beacon

This beacon is a completely new design which generates its frequency standard from a phase-locked synthesiser system. As a result, the DC to RF efficiency is much improved. In addition to frequenky-shift modulation, phase-shift modulation is a switchable option.

2401.5 MHz Beacon

When the original supplier of the 2.4GHz beacon was unable to meet his commitment, Colin Smithers, G4CWH, at the University of Surrey stepped in and designed and built the transmitter and power supply in under four weeks. The DC to RF efficiency has been improved by some 5 times over the UoSAT-1 implementation. Both AFSK and PSK modulation methods are possible.

Telemetry System

The basic output of the UoSAT-B telemetry system is very similar to that of UoSAT-1. However, 60 analogue channels, digitised to 3 decimal digits, and 96 status points encoded into hexadecimal digits are available together with a real-time clock for frame identification and the satellite identyfield 'UoSAT-2'. A checksum digit can also be added to each channel. A dwell facility has been added so that up to 138 channels can be output in rotation, combined with clock times and line feeds or frame ends in any combination.

1802 Computer & Digitalker

The 1802 computer has been designed to support all the modules on the spacecraft, as well as to control the overall scheduling and be usable for specific communications experiments. To satisfy these requirements, the computer has access to many modules via parallel interfaces, and to some of the others and the receivers and transmitters via serial connections. In addition, there is a real-time clock and a total of 48kb of RAM for data storage. The Digitalker speech synthesiser is housed with the 1802 and has ROMs containing over 550 words. These will be used initially for 'speaking' telemetry.

Navigation Magnetometer

The Navigation Magnetometer is a three-axis flux gate device, much upgraded from the one flown on UoSAT-1. Indeed, the 14-bit resolution is very similar to that obtained from the much more complicated scientific magnetometer on the previous craft. The Nav. Mag. will be used for determining the attitude of the spacecraft during initial manoeuvres, as well as for experimental measurement of magnetic field disturbances once the attitude is stable.

Magnetorquers & Boom Assembly

Magnetorquers - coils of wire energised to act as electromagnets - are built into all 6 faces of the spacecraft, wound around the edges of the honeycomb panels supporting the solar cells and the top and bottom plates. The fields created interact with the earth's magnetic field to produce a torque which tends to rotate the spacecraft.

When the spacecraft has been positioned so that the CCD camera end is pointing towards the earth - a long and complex process - a boom can be extended from the top of the craft. The boom looks similar to a steel tape measure, although nearly circular once it has been unrolled, and some 12 metres long. The boom carries a 2.5kg mass on the far end and this, in conjunction with the spacecraft body at the other end, creates a 'dumb-bell' configuration which naturally lines up with the earth's gravitational field so that one end points downwards, rather like a pendulum - it is, however, bi-stable! Any residual swinging motion can be damped with further controlled applications of the magnetorruers.

Sun Sensors

The sun sensors are made with specially fabricated solar cell substrates which are masked by grey-code stripes (and ilmuminated by light passing through a slit in a metal foil in front. Thd mask coding on the cells can be used to derive the angle at which the incident light is falling on the slit. 6 such sensors are mounted around the top plate to provide complete 360 degree coverage.

Horizon Sensors

Built by a first year student at the University of Surrey, the Horizon Sensor is able to detect when only one of two photodetectors is illuminated. The detectors are housed in two narrow tubes of 4mm diameter and mounted at a small angle to each other so that the whole sensor thus detects the 'edge' of an illuminated object. This will be the earth, the moon or the sun and a fix can then be made on the object's position.

Digital Communication Experiment

The Digital Communications Experiment (DCE) was designed and built by AMSAT and VITA groups in the USA and Canada. It has two serial ports which can receive and transmit to the RF system and the 1802, as well as an NSC-800 CPU and nearly 128kb of CMOS RAM. The DCE will be used to investigate various packet radio protocols for use with a future digital 'store-and-forward' satellite being planned by AMSAT. In addition, the DCE has interfaces with the navigation magnetometer and the telemetry system for long-term data storage.

Space Dust Experiment

The Space Dust experiment was built by a group of students at the University of Kent, England. It has a dielectric diaphragm which, when punctured by a large particle, discharges the capacitance associated with it, therby indicating the impact. In conjunction with a piezo crystal microphone which detects particles of smaller size, correlation techniques can yield a measurement of the momentum of the incident particle.

CCD Camera

The CCD camera is a re-designed version of the device flown on UoSAT-1. Indeed, the CCD array at the centre of the camera is the same type as used before, although the later batches of this part are substantially improved over the early one used 2 years ago. This time the analogue electronics surrounding the array are also greatly improved. The active area of 384 pixels by 256 pixels is stored with seven bits of grey-level, in 96kb of RAM in the DSR experiment. The DSR is then responsible for the picture downlink, adding addresses and error correction and detection information as required. The DSR downlink is organised in packets of 128 bytes each, three across each imager line, so that two may be selected for display (using an extra digital filter) on existing UoSAT-1 CCD displays. The variable video amp gain and integration period of the CCD imager have been set up to provide the latitude required to photograph both land images and also auroral features, the latter being of interest in conjunction with the particle detector experiments.

DSR Experiment

The DSR stores data from the CCD imager, particle counter experiment or computer UART and outputs it in a checksummed format. The unit has 2 banks of 96k x 8 CMOS memory which can be used as two seperate banks or as one 192kb bank. The output frame consists of a three byte sync code, a two byte frame address, 128 bytes of data and 5 bytes of error detection/correction code. The data is sent in serial form with start bit, 8 data bits and selectable 1 or 3 stop bits. The data can be output at 1200, 2400, 4800 and 9600 BPS.

Particle Detectors and Wave Correlator Experiment

Three Geiger counters, each with different electron energy thresholds, similar to those flown on UOSAT-1, and a multi-channel electron spectrometer are mounted on the spacecraft to serve as a near-earth reference for magnetospheric studies to be carried out concurrently with the AMPTE & VIKING spacecraft missions due for launch later in 1984, and for ground-based studies of the ionospheric D, E and F regions being pursued with riometers and EISCAT. Data will be available in either real-time or, for more detailed analysis, from stored measurements over both polar auroral regions to professional scientists and radio amateurs.

** Orbital Predictions - from KA9Q **

```
Satellite: oscar-9
Epoch time:       84072.37051070
   Mon Mar 12 08:53:32.124 1984 UTC
Element set:        497
Inclination:       97.5837 deg
RA of node:        45.5674 deg
Eccentricity:     0.0004698
Arg of perigee:    87.3549 dmg
Mean anomaly:     272.8215 deg
Mean motion:   15.24761403 rev/day
Decay rate:     6.832e-05 rev/day^2
Epoch rev:          13478
Semi major axis:  6866.605 km
Anom period:     94.441005 min
Apogee:            512.654 km
Perigee:           506.202 km
Beacon:            145.8250 mhz
```

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84063.83285908
Sat Mar 3 19:59:19.24 1984 UTC
Element set: 90
Inclination: 25.6632 deg
RA of node: 212.1030 deg
Eccentricity: 0.6091272
Arg of perigee: 250.9131 deg
Mean anomaly: 36.7286 deg
Mean motion: 2.05853435 rev/day
Decay rate: -2.8e-07 rev/day†2
Epoch rev: 544
Semi major axis: 26105.808 km
Anom period: 699.526826 min
Apogee: 35633.003 km
Perigee: 3829.487 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84074.72809939
Wed Mar 14 17:28:27.787 1984 UTC
Element set: 14
Inclination: 98.2528 deg
RA of node: 137.1715 deg
Eccentricity: 0.0014177
Arg of perigee: 219.1167 deg
Mean anomaly: 140.9008 deg
Mean motion: 14.61822236 rev/day
Decay rate: 3.62e-06 rev/day†2
Epoch rev: 190
Semi major axis: 7062.514 km
Anom period: 98.507189 min
Apogee: 702.718 km
Perigee: 682.693 km
Beacon: 145.8250 mhz

** Spacecraft orbital data **

Orbits for 28th March

	UoSAT	UoSAT-2	NOAA-8	
Orbit no :	13724	392	5203	
Eqx time :	15:28:01	14:56:46	15:30:57	GMT
Eqx long :	356.3	259.4	304.1	deg.w
Mean hgt :	494.7	693.5	850.0	km
Period :	94.4971555	98.5641140	101.2883550	mins
P-drag :	3.875E-05	1.750E-06	9.000E-06	*N-ref
Long inc :	23.6225537	24.6403275	25.3298390	degs
L-drag :	9.749E-06	4.400E-07	2.000E-07	*N-ref

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey,
England - Thank you

b

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 0160 received by DB2OS

**** UoSAT Bulletin-69 6th April 1984 ****

** UoSAT-Oscar-9 Status **

Following last weekend's experiments, a normal schedule has now been resumed.

We have had a number of problems with a new telephone answering machine installed at the University to distribute satellite information. The machine has been accused of refusing to answer for long periods of time. The fault has been diagnosed that when one caller hangs up, the tape continues playing through to the end and then rewinds slowly. Only when completely rewound does the next call get answered. We suggest that if your call remains unanswered you call back in a few minutes when the machinations are finished! The machine can be called on Guildford (0483) 61202 at any time. Some 40-50 calls per day have successfully connected to this new machine, whilst the old one wore out in under 2.5 years!

** UoSAT-Oscar-9 Schedule **

Friday	Load bulletin, Digitalker, 1200 bd telemetry
Saturday	Bulletin
Sunday	Bulletin
Monday	High-speed radiation scan
Tuesday	Checksummed telemetry
Wednesday	Digitalker & Telemetry
Thursday	Whole-orbit recorded telemetry

** UoSAT-Oscar-11 Status **

Analysis of all telemetry received from Oscar-11 indicated no reasons for the current silence and lack of telecommand.

The following was received from G3YJO while listening for Oscar-11 last weekend:

'I have spent the last few days up here at Jodrell Bank Radio Telescope on the 85 foot antenna with a crossed-dipole feed on 145 MHz listening for anything emanating from UOSAT-2, both within a narrow 2.5 kHz bandwidth and +- 100 kHz wideband. The receiver & antenna system have been checked using UOSAT-1, the sun and Cassiopia and appear to be performing well. We have got probably the best UOSAT-1 data we are ever likely to see! The UOSAT-1 signal was peaking +75 dB above the minimum discernable signal level here, so I feel that we should be able to hear something if UOSAT-2 is radiating anything on the nominal frequency. The wideband signal performance is about 20 to 30 dB worse.

We also tracked OSCAR-10 and received good signals from out at 42,000 km with the 145.810 MHz beacon peaking at +55 dB above noise - the passband noise was also detectable at some 10 - 15 dB above the rx noise. Some good ssb signals were also copied.

We have tracked UOSAT-2 last Thursday evening, Friday morning

passes without anything detected at all that can be relied on - there were two bursts of carrier on the noise level, each of about 10 seconds duration, but these could not be identified positively and were most probably from other amateur activities.'

A number of reports are still being received at Surrey giving information on short bursts of either modulated or unmodulated signals on 145.825MHz. None of the reports so far have been corroborated by tape recordings or simultaneous reception at two or more stations, however the continuation of these reports is still encouraging.

Stations sending reports should attempt to provide the following details: Type of signal and modulation, time of start and end, tape recording, frequency and doppler variation, beam headings and any variation, and brief station equipment details. Please contact your national AMSAT organisation or the University of Surrey if anything of interest is heard. Thanks!

After the 2m beacon reception tests, we are now actively considering how best to receive signals from the local oscillators of the three command receivers. These are powered separately directly from the batteries and the signals should be receivable using a large ground station. Oscar-9 can be used for calibration but unfortunately the facilities at Jodrell Bank were not suitable.

Thanks to all helping so far.

** Oscar-11 Specification **

Just to remind us all what we are missing, here is a summary of the remaining systems aboard Oscar-11!

Mechanical Framework

The spacecraft is constructed in a similar way to Oscar-9, that is with a square-section central core supporting rigid top and bottom plates. Solar cells are mounted on all four sides of these plates, enclosing a basic cuboid of dimension 35.5 * 35.5 * 58.5 cm. Two stacks, each of two module boxes of dimension 23.5 * 17.6 * 3.1 cm, are mountud on the outside of each face of the central core. A 'wing' extends the base of the spacecraft symmetrically by 16 cm on each side in one axis to permit the mounting of two SHF helical antennas, one on each side of the launcher attache fitting which is itself mounted in the centre of the bottom plate. The Navigation Magnetometer and Space Dust experiments are mounted above this wing, one on each side.

Solar Cells

Four solar arrays of dimension 49.5 * 29.5 cm are attached to the four sides of the spacecraft. These are capable of supplying up to about 0.9A at 28v when fully illuminated. The cells were manufactured by Solarex.

Battery

A solid octagonal block of aluminium, 14.9 * 14.9 * 10.2 cm, is fitted into the centre core of the spacecraft and is drilled to accept ten 'F'-sized Nickel-Cadmium cells, each 3.2 cm in diameter and 9 cm long. These cells, in series, form a 12v battery of 6.4Ah nominal capacity and are charged when the spacecraft is in sunlight in order to provide sufficient power to run the craft during peak load demands and its eclipse periods.

Battery Charge Regulator

Two redundant BCRs are responsible for accepting the 28v supplies from the solar cells (and a similar supply from the umbilical connector) and charging the battery as required depending on the current drain, the battery voltage and the battery temperature.

Power Conditioning Module

The PCM regulates the 12-14v battery bus supply to provide 10v, 5v and -10v supplies for powering the spacecraft systems and experiments.

Power Distribution Module (PDM)

The PDM switches the various regulated and unregulated rails to all the s/c systems and experiments, dependent on the commands which it receives from the Telecommand system. Each switch has an individual current foldback facility so that a faulty module is allowed to draw up to a pre-determined current before it is latched off, necessitating a power-down under positive command before resetting.

Telecommand system

The telecommand system comprises three uplink receivers, three data demodulators, a command detector and sets of command latches which hold the status of the command specified. The receivers are located in the 144MHz, 438MHz and 1268MHz amateur bands and the demodulators are robust devices which do not depend on phase-locked loops or other potentially unstable techniques. A command detector scans the three receivers according to a priority system and detects a valid set of command instructions, passing the data contained therein to the relevant latch. Some latches drive a set of multiplexer address inputs directly so that uplink and downlink path selection may be performed immediately on the command latch board.

The 112 command latches drive the Power Distribution System, the remaining spacecraft systems and experiment functions. There is a parallel i/o port to the spacecraft 1802 computer for autonomous control of spacecraft operations in addition to serial data links with the 1802 computer and the DCE for backup operations.

** Orbital Predictions - from KQ9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84072.37051070
Mon Mar 12 08:53:32.124 1984 UTC
Element set: 497
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RA of node: 45.5674 deg
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Arg of perigee: 87.3549 deg
mean anomaly: 272.8215 deg
Mean motion: 15.24761403 rev/day
Decay rate: 6.832e-05 rev/day^2
Epoch rev: 13478
Semi major axis: 6866.605 km
Anom period: 94.441005 min
Apogee: 512.654 km
Perigee: 506.202 km
Beacon: 145.8250 mhz

Satellite: oscar-10

Epoch time: 84063.83285908
Sat Mar 3 19:59:19.24 1984 UTC
Element set: 90
Inclination: 25.6632 deg
RA of node: 212.1030 deg
Eccentricity: 0.6091272
Arg of perigee: 250.9131 deg
Mean anomaly: 36.7286 deg
Mean motion: 2.05853435 rev/day
Decay rate: -2.8e-07 rev/day†2
Epoch rev: 544
Semi major axis: 26105.808 km
Anom period: 699.526826 min
Apogee: 35633.003 km
Perigee: 3829.487 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84074.72809939
Wed Mar 14 17:28:27.787 1984 UTC
Element set: 14
Inclination: 98.2528 deg
RA of node: 137.1715 deg
Eccentricity: 0.0014177
Arg of perigee: 219.1167 deg
Mean anomaly: 140.9008 deg
Mean motion: 14.61822236 rev/day
Decay rate: 3.62e-06 rev/day†2
Epoch rev: 190
Semi major axis: 7062.514 km
Anom period: 98.507189 min
Apogee: 702.718 km
Perigee: 682.693 km

** Spacecraft orbital data **

Orbits for 6th April

	UoSAT	UoSAT-2	NOAA-7	
Orbit no :	13861	523	14376	
Eqx time :	15:11:48	14:09:13	15:28:34	GMT
Eqx long :	351.9	247.3	359.1	deg.w
Mean hgt :	493.4	690.1	850.0	km
Period :	94.4751235	98.5647708	101.9638225	mins
P-drag :	7.263E-05	3.497E-06	7.500E-06	*N-ref
Long inc :	23.6170029	24.6402398	25.4898966	degs
L-drag :	1.827E-05	8.800E-07	2.000E-07	*N-ref
Incl :	97.562	98.260	98.900	degs
Freq :	145.825	145.825	137.620	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey,
England - Thank you

Satellite: Landsat-D'
Object: 1984-021A = NASA # 14780
NASA El.Set: # 5
Epoch: 84064.46281564

Incl: 98.2545
RAAN: 126.9100
Eccr: 0.0010697
Arg.Perg: 274.5334
Mean Anom: 085.4451
Mean Motion: 14.60712266
Drag: +0.00010338

** Spacecraft orbital data **

Orbits for 23rd March

	UoSAT	UoSAT-2	NOAA-7	
Orbit no :	13647	319	14178	
Eqx time :	14:13:38	15:01:34	14:58:21	GMT
Eqx long :	337.8	260.7	351.6	deg.w
Mean hgt :	494.7	693.5	850.0	km
Period :	94.5001389	98.5642417	101.9641325	mins
P-drag :	3.875E-05	1.750E-06	7.500E-06	*N-ref
Long inc :	33.6233043	24.6403596	25.4898542 (25.)	degs
L-drag :	9.749E-06	4.400E-07	2.000E-07	*N-ref

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey,

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UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, Engnand
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Frame counter : 014E received by DB2OS

**** UoSAT Bulletin-72 27th April 1984 ****

** Lecture **

Martin Sweeting (G3YJO), Stephen Hodgart, Neville Bean (G8NOB), & Roger Peel (G8NEF), have been invited to present papers at a 'UOSAT Spacecraft Colloquium' to be held in Paris on 27th April at the Montparnasse Centre. The colloquium, organised by the Association Nationale Sciences Techniques Jeunesse, will be attended by members of French Universities, Engineering Colleges, Schools and Aerospace Industries - including representative from projects specifically interested in low-cost spacecraft engineering.

*** UoSAT-Oscar-9 Status ***

We have had a number of problems with a new telephone answering machine installed at the University to distribute sattelite information. The machine has been accused of refusing to answer for long periods of time. The fault has been diagnosed that when one caller hangs up, the tape continues playing through to the end and then rewinds slowly. Only when completely rewound does the next call get answered. We suggest that if your call remains unanswered you call back in a few minutes when the machinations are finished" The machine can be called on Guildford (0483) 61202 at any time. Some 40-50 calls per day have successfully connected to this new machine, whilst the old one wore out in under 2.5 years!

** UoSAT-Oscar-9 Schedule **

Due to our trip to Paris this weekend, this bulletin has been extended to run until Tuesday morning. Normal service may resume on Tuesday afternoon if we survive the trip! The 21MHz HF beacon, the radiation counters and scientific magnetometer will be in use this weekend.

** UoSAT-Oscar-11 Status **

Apologies are due to radio amateurs in the south of England for the recent persistent commands being generated at the University of Surrey. Software to continually locate the sun-synchronous orbital plane of Oscar-11 has been written and is being used to eliminate possible errors in the orbital data.

** Latest UoSAT Newsletter **

The following is the latest UoSAT Newsletter which we will shortly be sending out to all enquirers about our satellite-activities.

Since the last Newsletter was published, the UoSAT Group has responded to a short-timescale launch opportunity and designed and constructed a second amateur radio scientific satellite. At the time of writing, serious problems which developed after the successful launch and initial operations of UoSAT-2 have not been resolved and the spacecraft has been silent for over a month. UoSAT-1 continues to function well and is

expect the various types of data available.

UoSAT-1 Status

Primarily as a result of improved ground station facilities and increased manpower, the daily operations of UoSAT-1 now provide a regular service to all observers. Various programs to transmit housekeeping data (e.g. telemetry, both raw and computer-processed), experimental data (e.g. high-speed radiation counter and magnetometer outputs) and educational data (e.g. speech synthesised telemetry) are now run on a regular basis. At weekends, a plain-text bulletin containing UoSAT news, general space and scientific news and orbital elements for a number of radio-amateur and weather satellites is tsansmitted together with frames of ASCII and speech-synthesised telemetry.

Attempts to stabilise UoSAT-1 with the antenna end locked pointing towards the ground were abandoned in mid-1983 following problems with tangled cables preventing the boom mechanism from extending more than a metre from the top of the spacecraft. Gravity gradient lock was achieved, however, for about 24 hours even with this small extension before natural forces caused the current end-over-end spin to resume. The CCD camera was used to generate somewhat poor images until the beginning of the UoSAT-2 campaign, when the operational complexity of overcoming the pointing problem caused by the spacecraft spin became too great. The CCD images, which were not particularly clear due to degredation of the CCD sensor itself before launch, had by this time become even less good but image processing by a small number of groups had demonstrated that there was potential for improvement. The video display readout module, which is separate from the CCD sensor, contains 32kb of dynamic RAM and is still working well, so methods of using this feature are being investigated.

UoSAT-2 Status

In October 1983, following several months of negotiation, NASA agreed to allow a second amateur radio scientific spacecraft to fly as a secondary payload with the LANDSAT-5 craft due for launch in March 1984. The main purpose ofthe UoSAT-2 mission was to follow up the investigations into low-cost spacecraft engineering made with UoSAT-1 by using the operational experience gained to create an improved second generation craft. Although this goal required over 100 hours per week working by the central team at Surrey and considerable effort by many other contributors from other UK universities and radio amateur groups around the world, a working and tested spacecraft vastly exceeding the original design aims was finally delivered to the Vandenberg Air Force Base, California, in late February.

Launch was at 17:59 GMT on 1st March 1984, carrying UoSAT-Oscar-11 (as it then became known) into a polar orbit of 700km altitude. The spacecraft was powered up automatically upon ejection from the launch vehicle and shortly afterwards - over the groundstation at the University of Surrey - the 145.825 MHz beacon was first switched on, using the bootstrap loader of the main spacecraft computer to control the timing. The first 10 second burst showed no problems, so on that orbit two further 5 minute transmissions of telemetry were made.

On the second pass over Guildford, the VHF beacon was again activated for 10 seconds to check that all was well, and this was followed by tests to confirm that in-band duplex commanding was possible. (i.e. the VHF uplink was not blocked by the VHF downlink) Finally on this pass, a small computer program was loaded to switch on the VHF beacon for about ten minutes.

On the final pass, more checks were made using short bursts of

telemetry at VHF. Finally, a computer program was loaded which turned the beacon on for 75 minutes.

When we attempted to command the beacon back on during the first morning pass on Friday, 2nd March, there was no response to attempts to restart the computer loader. After many attempts, the computer was powered down and the beacon switched on manually, also to no effect. At the time of writing this newsletter (mid-April), all our attempts to re-activate the spacecraft have failed. The problem is reasonably obscure - all telemetry received from UoSAT-2 looked perfect and there was no indication that a few hours of inactivity should cause a problem. Because there is no feedback from a 'dead' satellite, it is extremely difficult to plan experiments to isolate a fault - either a particular attempt succeeds Or there is no indication why it failed. Various medium to long-term plans are currently under way at the University to regain control of the satellite but these are dependent on assistance from external organisations and the timescales are therefore unknown.

Information on the UoSAT Spacecraft

AMSAT-UK, an organisation of radio amateurs interested in satellite matters, has produced a number of publications covering the UoSAT-1 satellite, tracking aids and formulae, computer programs and educational material. A list of publications may be obtained by sending a stamped, addressed envelope to:

The Hon. Secretary,
AMSAT-UK,
94, Herongate Road,
Wanstead Park,
LONDON E12 5EQ

The only information currently available on UoSAT-2 is the brief description distributed from the University of Surrey. A fuller technical handbook will be produced if the satellite is brought back under control.

The Institution of Electronic and Radio Engineers devoted the entire August / September 1982 edition of its Journal, "The Radio and Electronic Engineer" to a number of papers describing the sub-systems of UoSAT-1.

Spacecraft news and orbital data is also disseminated from the University of Surrey by two main methods:

1) There is a telephone answering machine installed on Guildford (0483) 61202 which gives general news and orbital information for the UoSAT satellites throughout the week.

2) The bulletins transmitted by UoSAT-1 (currently during most weekends interspersed with synthesised spoken telemetry and ASCII digital telemetry) contain a fuller set of news, operational schedules, data on new computer-generated downlink formats and orbital information for a number of satellites of interest to radio amateurs and amateur scientists. Obviously this is only of use once a able receiving station has been constructed.

VoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 068E received by DB2OS

**** VoSAT Bulletin-73 4th May 1984 ****

** VoSAT-Oscar-9 Schedule **

Due to a public holiday in the UK next Monday, this bulletin has been extended to run until Tuesday morning. The 21MHz HF beacon, the radiation counters and scientific magnetometer will be in use this weekend.

We will also be starting some more packet exchange tests as previously carried out last June & July before the VoSAT-2 construction work started. If the groundstation requirements for the 70cm uplink are suitable for large amateur stations, we will then allow limited availability for experimentation. The initial packet experiments will be carried out on Wednesdays.

Friday	Load bulletin
Saturday	Bulletin / 1200 bd telemetry / Digitalker
Sunday	Bulletin / 1200 bd telemetry / Digitalker
Monday	Bulletin / 1200 bd telemetry / Digitalker
Tuesday	Checksummed telemetry
Wednesday	Packet tests (see above)
Thursday	Whole-orbit telemetry data
Friday	Load bulletin

** VoSAT-Oscar-11 Status **

There is still no good news about Oscar-11. A number of more complex experiments are still in progress, but results are not expected for some weeks.

Apologies are due to radio amateurs in the south of England for the recent persistent commands being generated at the University of Surrey. Software to continually locate the sun-synchronous orbitalplane of Oscar-11 has been written and is being used to eliminate possible errors in the orbital data.

** VoSAT Questionnaire **

Following the current problems with Oscar-11, the VoSAT group at the University of Surrey is looking, once again, at plans for the future. In order to get an updated feeling for what amateur space facilities are required and appreciated, we will be putting a questionnaire on the VoSAT bulletin next weekend. Comments and suggestions for the best usage of VoSAT-1 would be most helpful as we will soon have time for more on-board software effort.

** Keplerian Orbital Elements - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84099.40458635
Sun Apr 8 09:42:36.260 1984 UTC
Element set: 613
Inclination: 97.5844 deg

RA of node: 72.9486 deg
Eccentricity: 0.0003141
Arg of perigee: 30.1444 deg
Mean anomaly: 329.9951 deg
Mean motion: 15.25230384 rev/day
Decay rate: 9.573e-05 rev/day†2
Epoch rev: 13890
Semi major axis: 6865.197 km
Anom period: 94.411967 min
Apogee: 494.507 km
Perigee: 490.195 cm
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84097.34280771
Fri Apr 6 08:13:38.586 1984 UTC
Element set: 97
Inclination: 25.7059 deg
RA of node: 206.1228 deg
Eccentricity: 0.6092647
Arg of perigee: 260.5025 deg
Mean anomaly: 30.1701 deg
Mean motion: 2.05857411 rev/day
Decay rate: -1.42e-06 rev/day†2
Epoch rev: 613
Semi major axis: 26105.470 km
Anom period: 699.513315 min
Apogee: 35636.380 km
Perigee: 3826.098 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84096.35772883
Thu Apr 5 08:35:07.770 1984 UTC
Element set: 19
Inclination: 98.2505 deg
RA of node: 158.7507 deg
Eccentricity: 0.0013759
Arg of perigee: 149.7713 deg
Mean anomaly: 210.4279 deg
Mean motion: 14.61838353 rev/day
Decay rate: 4.1e-06 rev/day†2
Epoch rev: 506
Semi major axis: 7062.462 km
Anom period: 98.506103 min
Apogee: 699.343 km
Perigee: 679.909 km
Beacon: 145.8250 mhz

** Spacecraft orbital data **

Orbits for 4th May

	UoSAT	UoSAT-2	NOAA-7	
Orbit no :	14288	932	14771	
Eqx time :	15:27:33	14:01:55	14:45:03	GMT
Eqx long :	354.7	245.1	347.7	deg.w
Mean hgt :	493.4	690.1	850.0	km
Period :	94.4441119	98.5633403	101.9622450	mins
P-drag :	7.263E-05	3.497E-06	7.500E-06	*N-ref
Long inc :	23.6091997	24.6398798	25.4899052	degs
L-drag :	1.827E-05	8.800E-07	2.000E-07	*N-ref
Incl :	97.562	98.260	98.900	degs
Freq :	145.825	145.825	137.620	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 0334 received by DB2OS

**** UoSAT Bulletin-74 11th May 1984 ****

** UoSAT-Oscar-9 Schedule **

This weekend, the 2.4 GHz beacon will be in use, with other loads shed as usual to conserve power. The 2.4GHz beacon will also be on next weekend for the benefit of ON6UG and other Belgian amateurs at their VHF-UHF Convention.

Due to the absence of G3YJO on holiday and an external visit by the remaining members of the team, we will be transmitting checksummed telemetry as on Tuesday. If the program can be altered in time, we may try to add Digitalker to the telemetry on the second day.

We had very limited success with the first series of packet experiments which we resuscitated after breaking off to build UoSAT-2. We will continue with these tests shortly and contact the stations who were lined up to collaborate last July.

Friday	Load bulletin
Saturday	Bulletin / 1200 bd telemetry / Digitalker
Sunday	Bulletin / 1200 bd telemetry / Digitalker
Monday	Whole orbit radiation data
Tuesday	Checksummed telemetry
Wednesday	Checksummed telemetry (maybe + Digitalker)
Thursday	Whole-orbit telemetry data
Friday	Load bulletin

** UoSAT-Oscar-11 Status **

There is still no good news about Oscar-11. A number of more complex experiments are still in progress, but results are not expected for some weeks.

Dr. Robert Leonard of SRI hopes to be able to listen to the Oscar-9 receiver local oscillators this weekend as a calibration (if all goes well) for similar experiments on Oscar-11 shortly.

** UoSAT Questionnaire **

Following the current problems with Oscar-11, the UoSAT group at the University of Surrey is looking, once again, at plans for the future. In order to get an updated feeling for what amateur space facilities are required and appreciated, we will be putting a questionnaire on the UoSAT bulletin next weekend. Comments and suggestions for the best usage of UoSAT-1 would be most helpful as we will soon have time for more on-board software effort.

Name:

Address:

Radio Amateur callsign?

Station details - what types of receivers and antennes on

Antenna tracking - fixed antennas, azimuth rotation only or azimuth and elevation?

Data demodulator - Purchased as built unit, kit or magazine article reference or brief description of active circuit elements if home-built?

Data processing or display - type of computer or VDU used - if any?

Data storage - audio data stored on magnetic tape or digital data on disc?

Orbital elements: Where do you get your orbital data from? Do you use circular EQX/EQCT or Keplerian elements? Whose computer program is used for processing the az/el figures for tracking?

Do you have automatic data capture available to take data transmitted overnight?

Date formats: Which of the following do you use (and for what)?

Telemetry (unchecksummed)
Telemetry (checksummed)
Whole-orbit radiation data
Whole-orbit telemetry
Digitalker
Bulletin
CCD "images"
RTTY telemetry
Morse code

Please rate the above data formats in order of interest.

Other possibilities: We are considering the following and would be interested in your comments:
Morse code bulletins (any speed possible!) on 21MHz or 145MHz.
Generation of different data at night, transmitted using heavy checksumming for stations to receive automatically (maybe even with non-tracking antenna).
Checksummed telemetry with Digitalker & bulletin at weekends.
Automatic chaining between programs to give greater availability of downlink over longitudes around 0 and 180.

Do you use any of the other amateur radio satellites? (e.g. Oscar-10, RS series, etc). Digital or audio communication?

Do you receive data from the NOAA or Meteor series of weather satellites?

We thank you for your efforts in replying to this questionnaire - we always aim to please and need the feedback! Please send your contribution to the UoSAT team, University of Surrey, Guildford, Surrey GU2 5XH, England.

** Keplerian Orbital Elements - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84120.85593829
Sun Apr 29 20:32:33.68 1984 UTC
Element set: 627
Inclination: 97.5897 deg
RA of node: 94.6975 deg
Eccentricity: 0.0000539
Arg of perigee: 311.5877 deg
Mean anomaly: 48.5370 deg

Decay rate: 6.793e-05 rev/day†2
Epoch rev: 14217
Semi major axis: 6864.409 km
Anom period: 94.395727 min
Apogee: 498.388 km
Perigee: 497.648 km
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84118.22660224
Fri Apr 27 05:26:18.433 1984 UTC
Element set: 98
Inclination: 25.6283 deg
RA of node: 202.6039 deg
Eccentricity: 0.6091288
Arg of perigee: 266.3461 deg
Mean anomaly: 26.3345 deg
Mean motion: 2.05852115 ref/day
Decay rate: -1.17e-06 rev/day†2
Epoch rev: 656
Semi major axis: 26105.922 km
Anom period: 699.531312 min
Apogee: 35633.631 km
Perigee: 3829.893 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84115.38609432
Tue Apr 24 09:15:58.549 1984 UTC
Element set: 23
Inclination: 98.2497 deg
RA of node: 177.7373 deg
Eccentricity: 0.0014838
Arg of perigee: 93.1724 deg
Mean anomaly: 267.1177 deg
Mean motion: 14.61850345 rev/day
Decay rate: 2.52e-06 rev/day†2
Epoch rev: 784
Semi major axis: 7062.423 km
Anom period: 98.505295 min
Apogee: 715.638 km
Perigee: 694.680 km
Beacon: 145.8250 mhz

** Spacecraft orbital data **

Orbits for 11th May

	UoSAT	UoSAT-2	NOAA-8	
Orbit no :	14394	1035	5828	
Eqx time :	14:19:07	15:13:56	14:42:47	GMT
Eqx long :	337.1	263.0	287.2	deg.w
Mean hgt :	493.4	690.1	850.0	km
Period :	94.4364134	98.5629801	101.2917500	mins
P-drag :	7.263E-05	3.497E-06	9.000E-06	*N-ref
Long inc :	23.6072626	24.6397892	25.3299700	degs
L-drag :	1.827E-05	8.800E-07	2.000E-07	*N-ref
Incl :	97.562	98.260	98.900	degs
Freq :	145.825	145.825	137.500	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey, England - Thank you

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 068E received by DB2OS

**** UoSAT Bulletin-76 25th May 1984 ****

Further investigations are continuing with efforts to characterise the signals received by the spacecraft receivers, which are not performing as well as expected. In addition, experiments to Improve the performance of the data decoders (which convert the audio signals received into digital data for use by the telecommand logic) are under way, concentrating on pre-distortion of the uplink waveforms. Stephen Hodgart, our attitude control expert at Guildford, has been working on an elementary magnetorquing manoeuvre which can be controlled to improve the average sun angle (and hence the temperature), the antenna pointing (always towards the ground over the Northern Hemisphere), and hence the command success rate, given a minimum of ground interaction in the process. This will be attempted on one of the next few 'warm' cycles, once all the possible side-effects have been evaluated.

** Oscar-11 Attitude - from Stephen Hodgart (UoS) **

The angular motion of UoSAT-2 has been estimated from the magnetometer data extracted from the pass over Guildford on orbit 1076.

This reveals a dominant transverse motion, a spin state approximating a 'flat spin' or 'tumbling', defined by a rotation of the z-axis about a spin axis in the plane of the x and y axes of the spacecraft. This arbitrary spin axis is the direction of the overall angular momentum vector and is parallel, within 1 or 2 degrees, to the plane of the orbit. The period is 42 seconds.

The motion is complicated by a slow z-spin oscillation with a period of 165 secs and an amplitude of+/- 45 degrees. This oscillation couples to the dominant transverse motion causing the flat spin to modulate into a nutation in one of a wide half-angle varying between 84 and 96 degrees, in synchronism with the z-spin oscillation. Every half-cycle this cone flattens for an instant to the pure flat spin and then inverts.

Further analysis using other orbital data is required to test for possible precessional change in the angular momentum, also to test for any continuous advance in the z-axis rotation in

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addition to its angular oscillation

** UoSAT-Oscar-9 Schedule **

The 21MHz beacon will be in use this weekend. In addition, the bulletin will run until Tuesday morning due to (yet) another public holiday in the U.K., preventing access to the ground station.

Friday	Load bulletin
Saturday	Bulletin / 1200 bd telemetry / Digitalker
Sunday	Bulletin / 1200 bd telemetry / Digitalker
Monday	Bulletin / 1200 bd telemetry / Digitalker
Tuesday	Checksummed telemetry
Wednesday	1200 bd telemetry and Digitalker
Thursday	Whole-orbit telemetry data
Friday	Load bulletin

** Spacecraft orbital data **

Orbits for 25th May

	UoSAT	UoSAT-2	NOAA-8	
Orbit no :	14608	1239	6027	
Eqx time :	15:10:43	14:20:37	14:39:40	GMT
Eqx long :	350.0	249.5	287.9	deg.w
Mean hgt :	491.5	690.1	850.0	km
Xeriod :	94.4316738	98.5621149	101.2899590	mins
P-drag :	6.181E-05	3.550E-06	9.000E-06	*N-ref
Long inc :	23.6060682	24.6396004	25.3299302	degs
L-drag :	1.555E-05	8.931E-07	2.000E-07	*N-ref
Incl :	97.590	98.242	98.900	degs
Freq :	145.825	145.825	137.500	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey, England - Thank you

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 034F received by DB2OS

**** UoSAT Bulletin-77 1st June 1984 ****

** G3YJO returns! **

Martin, G3YJO, has returned from his travels in India and Nepal where he monitored UoSAT-1 (but not UoSAT-11!) from the Himalaya.

** UoSAT-Oscar-11 Status **

Over the weekend of 11th to 13th May, dedicated radio amateurs at Stanford Research International in California and their outpost in Greenland (headed by Bob Leonard, KD6DG, at Stanford and Finn Steenstrup, OX3FS, at Sondre Stromfjord) heard very weak signals emanating from Oscar-11's microwave command RECEIVERS which, by their nature of operation, generate low-level signals on a frequency near to that which they normally listen. The reception of these signals at last allowed the Surrey Team to confirm that the spacecraft was still alive, although at this time the chances of complete recovery were still not known. Although this observation, the first one confirmed since the advent of the problems following launch, did not lead directly to recovering the satellite, it did provide an essential confirmation that the orbital predictions supplied by the NASA tracking organisations were correct and that the ocject being tracked by the Surrey team was indeed UoSAT-2.

On the morning of 14th May at 10:24 GMT, Neville Bean, G8NOB, and Roger Peel, G8NEF, continued to command the satellite using its 144MHz uplink, to no effect. At 11:01GMT (12:01 BST), Neville made further command attempts on 438MHz, and after a brief stream of initialisation commands, the main UoSAT-2 beacon (145.825MHz) was successfully powered up at 11:05.

The signals from the spacecraft were as strong as the last ones heard from it on the 1st March, when it stopped transmitting, under computer control, shortly after launch. Telemetry data, from the initial two orbital passes over Guildford, appeared to be very encouraging, with temperatures around -5 to 0 degrees centigrade, as expected, and a battery voltage of 14.6 volts. The spacecraft was still spinning, but this had stabilised since the previous data rececved immediately after launch, ready for attitude control manoeuvres. These manoeuvres will not start until after the causes of the 11 week silence have been investigated, a process that itself may take many weeks in order to exercise the caution necessary in this situation.

The UoSAT-2 spacecraft will be transmitting telemetry data continuously whilst initial checks are made on the telecommand system, but after this other data formats will be generated using the spacecraft computer to check further the spacecraft's health and to provide navigation data.

The most likely cause of the last 10 weeks silence is indicated by the poor command uplinks - indeed, only 8 commands were loaded into the spacecraft in the first 2 days after recovery. This appeared to accompany a decrease in command decoder and battery temperatures, which cycle between -5c and -12c with a period of about 10 days. Commands also appear to be received - albeit infrequently - over only about 2-3 days of this cycle,

explaining why the current investigations are proceeding cautiously. Since temperature fluctuations are connected intimately with sun-angle, and hence attitude, the command difficulties could be due purely to the spacecraft antennas pointing away from the earth during some parts of the precession cycle.

Further investigations are continuing with efforts to characterise the signals received by the spacecraft receivers, which subsequent tests (on the 438 MHz uplink only so far) shew to be operating as expected. In addition, experiments to evaluate the performance of the data decoders (which convert the audio signals received into digital data for use by the telecommand logic) are under way. Stephen Hodgart, our attitude control expert at Guildford, has been working on an elementary magnetorquing manoeuvre which can be controlled to improve the average sun angle (and hence the temperature), the antenna pointing (always towards the ground over the Northern antenna pointing (always towards the ground over the Northern Hemisphere), and hence the command success rate, given a minimum of ground interaction in the process. This will be attempted on one of the next few 'warm' cycles, once all the possible side-effects have been evaluated.

** Oscar-11 Attitude - from Stephen Hodgart (UoS) **

The angular motion of UoSAT-2 has been estimated from the magnetometer data extracted from the pass over Guildford on orbits 1076 - 1304.

These reveal a dominant transverse motion, a spin state approximating a 'flat spin' or 'tumbling', defined by a rotation of the z-axis about a spin axis in the plane of the x and y axes of the spacecraft. This arbitrary spin axis is the direction of the overall angular momentum vector and is parallel, within 1 or 2 degrees, to the plane of the orbit. The period is now 51 seconds.

The motion is complicated by a slow z-spin oscillation with a period of 165 secs and an amplitude of +/- 45 degrees. This oscillation couples to the dominant transverse motion causing the flat spin to modulate into a nutational cone of a wide half-angle varying between 84 and 96 degrees, in synchronism with the z-spin oscillation. Every half-cycle this cone flattens for an instant to the pure flat spin and then inverts.

Further analysis using other orbital data is required to test for possible precessional change in the angular momentum, also to test for any continuous advance in the z-axis rotation in addition to its angular oscillation

The spacecraft z-axis magnetorquer was activated and left ON on orbit 1302 to attempt to capture and align with the geomagnetic field vector. This alignment will not occur until the transverse spin angular momentum has been considerably reduced.

** UoSAT-Oscar-9 Schedule **

The 2.4GHz beacon will be in use this weekend.

Friday	Load bulletin
Saturday	Bulletin / 1200 bd telemetry / Digitalker
Sunday	Bulletin / 1200 bd telemetry / Digitalker
Monday	Radiation Data
Tuesday	Checksummed telemetry
Wednesday	1200 bd telemetry and Digitalker
Thursday	Whole-orbit telemetry data
Friday	Load bulletin

** UoSAT Questionnaire **

Notwithstanding the now hectic activity with UoSAT-Oscar-11, the UoSAT group at the University of Surrey is looking, once

feeling for what amateur space facilities are required and appreciated, we have put a questionnaire on the UoSAT bulletin this weekend. Comments and suggestions for the best usage of UoSAT-1 would be most helpful as we will soon have time for more on-board software effort. Many of the suggestions and comments already received also apply to UoSAT-2, and are noted for the prospective two-satellite service we hope to provide.

Name:

Address:

Radio Amateur callsign?

Station details - what types of receivers and antennas on 145MHz, 435MHz, 2.4GHz and 21MHz?

Antenna tracking - fixed antennas, azimuth rotation only or azimuth and elevation?

Data demodulator - Purchased as built unit, kit or magazine article reference or brief description of active circuit elements if home-built?

Data processing or display - type of computer or VDU used - if any?

Data storage - audio data stored on magnetic tape or digital data on disc?

Orbital elements: Where do you get your orbital data from? Do you use circular EQX/EQCT or Keplerian elements? Whose computer program is used for processing the az/el figures for tracking?

Do you have automatic data capture available to take data transmitted overnight?

Data formats: Which of the following do you use (and for what)?

- Telemetry (unchecksummed)
- Telemetry (checksummed)
- Whole-orbit radiation data
- Whole-orbit telemetry
- Digitalker
- Bulletin
- CCD "images"
- RTTY telemetry
- Morse code

Please rate the above data formats in order of interest.

Other possibilities: We are considering the following and would be interested in your comments:
Morse code bulletins (any speed possible!) on 21MHz or 145MHz.
Generation of different data at night, transmitted using heavy checksumming for stations to receive automatically (maybe even with non-tracking antenna).
Checksummed telemetry with Digitalker & bulletin at weekends.
Automatic chaining between programs to give greater availability of downlink over longitudes around 0 and 180.

Do you use any of the other amateur radio satellites? (e.g. Oscar-10, RS series, etc). Digital or audio communication?

Do you receive data from the NOAA or Meteor series of weather satellites?

We thank you for your efforts in replying to this questionnaire - we always aim to please and need the feedback! Please send your contribution to the UoSAT team, University of Surrey, Guildford, Surrey GU2 5XH, England.

** Keplerian Orbital Elements - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84143.09104858
Tue May 22 02:11:06.597 1984 UTC
Element set: 640
Inclination: 97.5902 deg
RA of node: 117.2607 deg
Eccentricity: 0.0002293
Arg of perigee: 165.2693 deg
Mean anomaly: 194.8648 deg
Mean motion: 15.25699258 rev/day
Decay rate: 5.655e-05 rev/day†2
Epoch rev: 14556
Semi major axis: 6863.789 km
Anom period: 94.382952 min
Apogee: 488.576 km
Perigee: 485.429 km
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84140.56935458
Sat May 19 13:39:52.235 1984 UTC
Element set: 102
Inclination: 25.5982 deg
RA of node: 198.7006 deg
Eccentricity: 0.6092883
Arg of perigee: 272.6685 deg
Mean anomaly: 23.5121 deg
Mean motion: 2.05844992 rev/day
Decay rate: 3.9e-07 rev/day†2
Epoch rev: 702
Semi major axis: 26106.528 km
Anom period: 699.555518 min
Apogee: 35638.768 km
Perigee: 3825.964 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84139.06865379
Fri May 18 01:38:51.687 1984 UTC
Element set: 27
Inclination: 98.2426 deg
RA of node: 201.3545 deg
Eccentricity: 0.0014348
Arg of perigee: 25.3613 deg
Mean anomaly: 334.8282 deg
Mean motion: 14.61861825 rev/day
Decay rate: 1.57e-06 rev/day†2
Epoch rev: 1130
Semi major axis: 7062.386 km
Anom period: 98.504522 min
Apogee: 698.217 km
Perigee: 677.951 km
Beacon: 145.8250 mhz

** Spacecraft orbital data **

Orbits for 1st June

	UoSAT	UoSAT-2	NOAA-7
Orbit no:	44744	4342	15446

Orbit no	:	14714	15142	15155	
Eqx time	:	14:00:08	15:32:29	14:02:03	GMT
Eqx long	:	332.2	267.4	336.2	deg.w
Mean hgt	:	491.5	690.1	850.0	km
Period	:	94.4251220	98.5617493	101.9627550	mins
P-drag	:	6.181E-05	3.550E-06	7.500E-06	*N-ref
Long inc	:	23.6044196	24.6395084	25.4899108	degs
L-drag	:	1.555E-05	8.931E-07	2.000E-07	*N-ref
Incl	:	97.590	98.242	98.900	degs
Freq	:	145.825	145.825	137.620	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey,
England - Thank you

A>↑

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 0172 received by DB2OS

**** UoSAT Bulletin-78 9th June 1984 ****

*** UoSAT-OSCAR-11 Spacecraft Operational Status ***

Dr.M.N.Sweeting, University of Surrey, UK. 1200 gmt 7th June 1984

The UOSAT Team at the University of Surrey successfully re-established command over the UOSAT-2 spacecraft at 2135 gmt 6th June on orbit 1418 using the hitherto inoperative VHF command uplink.

Following a successful launch by NASA on 1st March, UOSAT-2 performed perfectly for the first 4 orbits, switched off the 145 MHz downlink under computer control as instructed and then refused to respond to ground commands. A lengthy series of tests to attempt to home in on the nature of the spacecraft's problem were undertaken over a period of 10 weeks - culminating in the successful reception and tracking of the known very low level microwatt signal which is continuously radiated from the microwave receivers on the spacecraft. This breakthrough, by an outstation of SRI International in Greenland, confirmed, for the first time after UOSAT-2 fell silent, that the spacecraft primary power systems were functioning and that the Surrey groundstation was indeed tracking the spacecraft accurately.

The next day - May 14th on orbit 1076 - the Surrey command station succeeded, with difficulty, in switching the 145 MHz transmitter back on using the UHF command uplink. The data subsequently transmitted from the spacecraft allowed the command team to proceed with cautious diagnostic routines to attempt to pinpoint the cause of the problem. After four weeks of exhaustive and painfully slow tests and analyses, the problem has been identified and isolated to a small area of circuitry - about 5 components - that directs command data received by the spacecraft from the VHF uplink to the command decoder. This crucial circuit has triple redundancy, one for each of the three command receivers, and the same fault has not yet occurred on the other circuits. In keeping with the design philosophy of 'redundancy through different technologies', there are also two routes whereby this area of circuit can be bypassed using either the primary spacecraft (1802) computer or the Digital Communications Experiment (DCE).

Once the problem had been fully understood, the DCE was programmed - using the UHF uplink - to provide a 'bypass' around the fault and, when activated on orbit 1418, restored the VHF uplink back to full capacity. The DCE was chosen to do this task firstly as it would leave the primary spacecraft computer free to concentrate on the complex navigation and attitude control & stabilisation tasks now imminent, and secondly as the DCE requires a shorter 'start-up' sequence transmitted to get it going! The final configuration will depend on operational requirements and the by-pass may be provided by either (or both) computers.

Initial results indicate that the VHF/UHF antennas, antenna feeds, hybrid and diplexers are all performing exellently supporting low error-rate full duplex operations at 145 MHz.

the current unfavourable attitude of the spacecraft gives rise to a marginal UHF uplink due to antenna directivity - aggrevated by low temperatures. This should improve if the spacecraft becomes earth-pointing following attitude control manoeuvres and stabilisation.

In the immediate future, UOSAT-2 operations will entail a checkout of the spacecraft functions; detailed navigation analyses and attitude manoeuvres to prepare for gravity gradient stabilisation before the various experiments can be activated on a regular basis.

In a demonstration of the flexible design of the spacecraft, the UOSAT-2 mission has been revitalised. The result is that we are now back to where we were on orbit 3 after launch and we have to proceed with the commissioning of the spacecraft and its experiments. We do not yet know whether there are any other 'gremlins' in the spacecraft nor what the operational implications of the use of the on-board computers for the 'bypass' will be on the planned experiments.

The UOSAT Team would like to thank all those who have given support through the dark passages of the last months and particularly to Bob Leonard and his team at SRI International and to Harold Price (AMSAT/VITA) for providing the necessary software for the DCE at short notice - transferred from California by electronic mail!

** Initial UOSAT-OSCAR-11 Recovery Summary **

Over the weekend of 11th to 13th May, dedicated radio amateurs at Stanford Research International in California and their outpost in Greenland (headed by Bob Leonard, KD6DG, at Stanford and Finn Steenstrup, OX3FS, at Sondre Stromfjord) heard very weak signals emanating from Oscar-11's microwave command RECEIVERS which, by their nature of operation, generate low-level signals on a frequency near to that which they normally listen. The reception of these signals at last allowed the Surrey Team to confirm that the spacecraft was still alive.

Although this observation, the first one confirmed since the advent of the problems following launch, did not lead directly to recovering the satellite, it did provide an essential confirmation of the orbital predictions supplied by the NASA tracking organisations.

On the morning of 14th May at 10:24 GMT, Surrey continued to command the satellite using its 144MHz uplink, to no effect. At 11:01GMT further command attempts were made on 438MHz and the main UoSAT-2 beacon on 145.825MHz was successfully powered up.

** Oscar-11 Attitude - from Stephen Hodgart (UoS) **

The angular motion of UO-11 has been established from magnetometer data revealing a dominant transverse motion - a spin state approximating a 'flat spin' or 'tumbling', defined by a rotation of the z-axis about a spin axis in the plane of the x and y axes of the spacecraft. This arbitrary spin axis is the direction of the overall angular momentum vector and is parallel, within 1 or 2 degrees, to the plane of the orbit. The period is now 59 seconds.

The spacecraft z-axis magnetorquer was activated on orbits 1302 through to 1426 when it was switched off to conserve battery power. The restoration of communications with the spacecraft will now allow us to commence commutated magnetorquing to reduce the transverse spin rate and rotate the z-axis into the orbit plane.

** UoSAT-OSCAR-11 Operations Schedule **

Experiments with loading a shortened telemetry format in DWELL mode were carried out between orbits 1425 and 1442 in preparation for the final navigation analyses prior to & during imminent magnetorquer manoeuvres.

If all goes well, commutated attitude control will commence this weekend - so watch the telemetry! Initial manoeuvres will occur under ground command, but later manoeuvres are likely to be placed under on-board computer control.

(Anm. v. DB2OS: 1802-Computer wurde am 9.6.84, Umlauf 1461 eingeschaltet. In den folgenden Umlaeufen wurde die Software fuer die Fluglagereglung erfolgreich geladen)

Transmissions of whole-orbit-telemetry data are likely next week to assess the performance of spacecraft systems and the results of attitude manoeuvres.

** UoSAT-Oscar-9 Schedule **

The 21MHz beacon will be in use this weekend.

Friday	Checksummed telemetry
Saturday	Load bulletin (Delayed due to technical problems)
Sunday	Bulletin / 1200 bd telemetry / Digitalker
Monday	Radiation Data
Tuesday	Checksummed telemetry
Wednesday	CCD image
Thursday	Whole-orbit telemetry data
Friday	Load bulletin

** GENERAL NEWS **

G8NEF has been away from UoS this week attending a conference but will be back next week.

UOSAT-OSCAR-11 QSL cards are being prepared - we hope they will appear sooner than the UO-9 cards and will be coloured! Cards will be backdated for earlier reports!

** UoSAT Questionnaire **

Notwithstanding the now hectic activity with UoSAT-Oscar-11, the UoSAT group at the Univessity of Surrey is looking once again, at plans for the future. In Order to get an updated feeling for what amateur space facilities are required and appreciated, we have put a questionnaire on the UoSAT bulletin this weekend. Comments and suggestions for the best usage of UoSAT-1 would be most helpful.

** Thanks for Reports & Questionnaire Returns **

ZN1MO, ON6UG, ZL4KW, W4AUZ, VK4XV, G3UMF, VK4ZF, WA5ZIB, W2RS, KA9Q HA5WH, G8ISI, OZ1GBY, G8TZJ, VK2ZAZ, VK2WB, VK2ZHM, HB9RKR, VK5AGR G3HMO, ZL4TIQ, N4HY, I2KBD, K1KSY, KA1FAD, G8UNO, G3YMC IV3TKI, IW3ER, G3VYV, G6YFF, VK2WB, G6TPQ, GM6JVC, ON7VQ, ZL3QL, VK2AVH ZL1AOX, JA4GVA, G6ESK, G2UK, G4XKR, OZ1WN, G6GWR, I2KBD

N.Clayton (ZL), M.Oslender (ON), B.Lindholm, Milham Ford School

Name:

Address:

Radio Amateur callsign?

Station details - what types of receivers and antennas on 145MHz, 435MHz, 2.4GHz and 21MHz?

Antenna tracking - fixed antennas, azimuth rotation only or azimuth and elevation?

Data demodulator - Purchased as built unit, kit or magazine article reference or brief description of active circuit elements if home-built?

Data processing or display - type of computer or VDU used - if any?

Data storage - audio data stored on magnetic tape or digital data on disc?

Orbital elements: Where do you get your orbital data from? Do you use circular EQX/EQCT or Keplerian elements? Whose computer program is used for processing the az/el figures for tracking?

Do you have automatic data capture available to take data transmitted overnight?

Data formats: Which of the following do you use (and for what)?

Telemetry (unchecksummed)
Telemetry (checksummed)
Whole-orbit radiation data
Whole-orbit telemetry
Digitalker
Bulletin
CCD "images"
RTTY telemetry
Morse code

Please rate the above data formats in order of interest.

Other possibilities: We are considering the following and would be interested in your comments:
Morse code bulletins (any speed possible!) on 21MHz or 145MHz.
Generation of different data at night, transmitted using heavy checksumming for stations to receive automatically (maybe even with non-tracking antenna).
Checksummed telemetry with Digitalker & bulletin at weekends.
Automatic chaining between programs to give greater availability of downlink over longitudes around 0 and 180.

Do you use any of the other amateur radio satellites? (e.g. Oscar-10, RS series, etc). Digital or audio communication?

Do you receive data from the NOAA or Meteor series of weather satellites?

We thank you for your efforts in replying to this questionnaire - we always aim to please and need the feedback! Please send your contribution to the UoSAT team, University of Surrey, Guildford, Surrey GU2 5XH, England.

** Keplerian Orbital Elements - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84155.35502310
Sun Jun 3 08:31:13.995 1984 UTC

Element set: 847
Inclination: 97.5912 deg
RA of node: 129.7084 deg
Eccentricity: 0.0003830
Arg of perigee: 131.7528 deg
Mean anomaly: 228.4027 deg
Mean motion: 15.25824165 rev/day
Decay rate: 4.491e-05 rev/day†2
Epoch rev: 14743
Semi major axis: 6863.414 km
Anom period: 94.375226 min
Apogee: 499.592 km
Perigee: 494.335 km
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84155.14064979
Sun Jun 3 03:22:32.141 1984 UTC
Element set: 105
Inclination: 25.6378 deg
RA of node: 196.2423 deg
Eccentricity: 0.6089574
Arg of perigee: 276.7795 deg
Mean anomaly: 21.6381 deg
Mean motion: 2.05850652 rev/day
Decay rate: -1.36e-06 rev/day†2
Epoch rev: 732
Semi major axis: 26106.044 km
Anom period: 699.536283 min
Apogee: 35629.315 km
Perigee: 3834.378 km
Beacon: 145.8100 mhz

G = 2980.111451

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84148.10356205
Sun May 27 02:29:07.761 1984 UTC
Element set: 29
Inclination: 98.2421 deg
RA of node: 210.3619 deg
Eccentricity: 0.0014072
Arg of perigee: 358.1468 deg
Mean anomaly: 1.9676 deg
Mean motion: 14.61867821 rev/day
Decay rate: 2.58e-06 rev/day†2
Epoch rev: 1262
Semi major axis: 7062.366 km
Anom period: 98.504118 min
Apogee: 694.181 km
Perigee: 674.305 km
Beacon: 145.8260 mhz

** Spacecraft orbital data **

Orbits for 8th June

	UoSAT	UoSAT-2	NOAA-8	
Orbit no :	14821	1444	6226	
Eqx time :	14:26:01	15:05:46	14:36:11	GMT
Eqx long :	337.7	260.6	288.6	deg.w
Mean hgt :	491.5	690.1	850.0	km
Period :	94.4287814	98.5613872	101.2881680	mins
P-drag :	6.181E-05	3.550E-06	9.000E-06	*N-ref
Long inc :	23.6027554	24.6394173	25.3298904	degs
L-drag :	1.555E-05	8.931E-07	2.000E-07	*N-ref
Incl :	97.590	98.242	98.900	degs
Freq :	145.825	145.825	137.500	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey,
England - Thank you

UoSAT Spacecraft Control Centre
University of Surrey, Guildford, Surrey, England
****

Frame counter : 0352 received by DB20S

**** UoSAT Bulletin-79 15th June 1984 ****

** G8NEF Back! **

Following a day's leave and a week at a conference, I return to continue editing the bulletin. The two bulletins from Martin, G3YJO, break a run of over fifty by myself. I must try to get away more often!

** UoSAT-OSCAR-11 Status **

Work continues apace to continue the investigations into the initial problems with Oscar-11, to commission other parts of the spacecraft and to start commutated attitude control manoeuvres.

Major milestones achieved this week include the successful re-powering of the 1802 main computer, the use of the programmable dwell features of the telemetry system and the transmission of a number of new data formats which will be used to help the commissioning procedure.

A daily account explaining the downlink formats transmitted follows:

Saturday 9/6/84

The 1802 computer was powered up (on G8NEF's return) and the power consumption in various reset and load states checked. No success was made in loading the more complex of the on-board PROM loaders. Due to the reticence of the team to turn off the 2m beacon, the simpler loader was not tried.

Sunday 10/6/84

The loader was eventually booted and it transmitted its bit map requesting data. The format of this is shown below, and is similas to that used to load the longer programs (including this bulledin) onto Oscar-9.
1xxxxxxxxxxxxxxxxcA2xxxxxxxxxxxxxxxxcB
4xxxxxxxxxxxxxxxxcD7xxxxxxxxxxooooooxH
The 'x' character here represents ASCII hex 60, and the line has been split above to fit this bulletin. The complex loader transmits continuously, unlike the Oscar-9 one, so the format was new to many international listeners. No packets of program data were received by the loader once the configuration byte has been sent. This problem is currently unresolved and thought to be a problem associated with the use of the DCE in the command chain.

Finally on Sunday, a whole orbit telemetry collection and dump program was loaded and run, starting at 21:30:05. See below for details of this format, which is also identical to that transmitted by Oscar-9 on Thursdays.

Monday 11/6/84

The whole-orbit telemetry program was re-run to collect a pass

at 09:28:56. On Monday evening, an 1802 test program to scan all memory-mapped I/O ports was run. It showed up no problems. A number of telemetry system speed checks were also carried out.

Tuesday 12/6/84

An 1802 program to check the operation of the I/O ports was run successfully, as was another to check the output sent from the telecommand system to the 1802, enabling it to check on commands executed.

A program to check the sun sensors using their digital port to the computer failed to initialise properly due to insufficient conversion from the ground-test version. The data generated was undecodable, having been sent at the wrong speed!

Wednesday 13/6/84

A problem occurred which disabled the linking effect of the Digital Communications Experiment computer around the malfunctioning part of the telecommand system. Commanding using the 438MHz uplink restored full command after the cause was diagnosed.

A program on the 1802 to time streams of commands was tested and used to switch the downlink multiplexers for various periods of time. This program forms the spacecraft section of the overall system which will be used for the manual tests of the attitude control magnetorquing.

Thursday 14/6/84

The timer program was used to turn the 145MHz beacon off, then on again a number of times. There were no obvious indications that the power-on current surge was causing any problems.

A whole-orbit telemetry recording program run at 12:55:35 recorded no activity from the sun sensors in the current attitude, but the data was only available over the UK for a few minutes during the evening, with telemetry elsewhere.

Also on Thursday evening, the command timer program was used to actively control the magnetorquers under computer control from the ground. A number of 15-second bursts were 'fired' and the effects are still being analysed, although initial information is promising. The 3-axis magnetorquer coils on Oscar-11 make this particular manoeuvre much simpler than a similar one on Oscar-9.

Friday 15/6/84

More magnetorquing operations are in progress today.

** Oscar-11 Attitude **

Preliminary attitude control manoeuvres commenced on orbit 1535, 14th June, to reduce the transverse spacecraft spin and to nudge the z-axis up into the orbit plane ready for magnetic capture and subsequent gravity gradient boom deployment. The manoeuvres thus far have comprised commutated firings of the z-axis magnetorquer under on-board computer control initiated by ground command from real-time analysis of the spacecraft motion.

These manoeuvres will continue until the control algorithms have been verified, the magnetorquer effects calibrated and, hopefully, the spacecraft spin reduced. Oscar-11 is transmitting a selected number of telemetry channels to provide rapid sampling of navigation data and magnetorquer status.

transmitted in a one-line frame with the standard checksum, thus providing very fast data for ground analysis.

** UoSAT-OSCAR-11 Operations Schedule **

Further transmissions of whole-orbit-telemetry data are likely next week to assess the performance of spacecraft systems and the results of attitude manoeuvres. Magnetorquing data and diagnostics from automated procedures can also be expected. Various tones and transmissions of random characters indicate uplink tests and other esoteric activities!

** Oscars-9 and 11 Whole Orbit Recorded Telemetry **

The following is an extract from UoSAT bulletin no. 27, describing an 1802 computer program which can be run on Osoar-9 to collect telemetry data over the period of one or more orbits and repeatedly dump the stored information back to the ground.

DETAILS OF THE WHOLE-ORBIT TELEMETRY RECORDING PROGRAM ARE GIVEN BELOW. THIS PROGRAM CAN STORE UP TO 7 CHANNELS OF TELEMETRY FROM EACH FRAME OVER A PERIOD OF UP TO 100 MINUTES (OR 1 CHANNEL FOR APPROX. 700 MINUTES) FOR LATER TRANSMISSION. PLOTS OF THE TELEMETRY CHANNELS RECORDED BY THE SPACECRAFT THROUGHOUT A WHOLE ORBIT (INCLUDING ECLIPSE, ETC) ARE USEFUL INDICATORS TO THE CONDITION OF THE VARIOUS INTERNAL SYSTEMS. THE PROGRAM PRODUCES CHECKSUMMED LINES OF DATA, WITH SERIAL NUMBERS AND A VARIABLE NUMBER OF TELEMETRY DATA VALUES. EACH LINE HAS BEEN RECORDED FROM THE STANDARD TELEMETRY FRAME (5.28 SECONDS DURATION, EACH CHANNEL DIGITISED AT THE TIME IT WOULD BE TRANSMITTED IN THE STANDARD TELEMETRY FORMAT).

THE DOWNLINK FORMAT IS:
NNNNXYZXYZXYZXYZCC

WHERE NNNN IS 4-HEX DIGIT SERIAL NUMBER (UP TO 046DH LINES ARE SENT AS DATA IS ACCUMULATED)
XYZ ARE BCD TELEMETRY CHANNEL VALUES AS IN ORDINARY TELEMETRY (VARIABLE NUMBER FROM 1 TO 7)
CC IS 1 BYTE CHECKSUM (ADD NN, NN, 0X, YZ, CC BYTES USING 8-BIT BINARY ADDITION - RESULT SHOULD BE 0AAH).
NNNN=0000 GIVES CHANNEL NUMBERS RECORDED IN 0YZ POSITIONS.

THE LINE WITH SERIAL NUMBER 0001 WAS RECORDED AT THE PROGRAM LOAD TIME. NO COMPUTER-READABLE TIMESTAMP IS AVAILABLE, BUT WE WILL ATTEMPT TO GIVE THE PROGRAM LOAD TIME AND TELEMETRY CHANNEL NUMBERS IN FUTURE BULLETINS. DISPLAYING WHOLE-ORBIT DATA IN REAL TIME (OR FROM A TAPE RECORDING) IS AN IDEAL DEMONSTRATION FOR EXHIBITIONS, ETC.

Modifications for Oscar-11 include a different telemetry period (4.84 secs instead of 5.28 secs, caused by using 2 stop bits per character rather than 3) and the opportunity to insert a timestamp from the real-time clock to indicate when the data was recorded (not yet implemented!)

** UoSAT-Oscar-9 Schedule **

The 2.4GHz beacon will be in use this weekend.

Friday	Load bulletin
Saturday	Bulletin / 1200 bd telemetry / Digitalker
Sunday	Bulletin / 1200 bd telemetry / Digitalker
Monday	Radiation Data
Tuesday	Checksummed telemetry
Wednesday	CCD image
Thursday	Whole-orbit telemetry data
Friday	Load bulletin

** General News **

UOSAT-OSCAR-11 QSL cards are being prepared - we hope they will appear sooner than the UO-9 cards and will be coloured! Cards will be backdated for earlier reports!

We have received an enquiry from NASA-HQ concerning the number and distribution of stations receiving the HF Beacons Expt on UOSAT-OSCAR-9. If you haven't returned a questionnaire but actively track the HF beacon(s) or would be interested in a future, higher power experiment, - please let us know!

** Thanks for Reports & Questionnaire Returns **

ZL1MO, ON6UG, ZL4KW, W4AUZ, VK4XV, G3UMF, VK4ZF, WA5ZIB, W2RS, KA9Q HA5WH, G8ISI, OZ1GBY, G8TZJ, VK2ZAZ, VK2WB, VK2ZHM, HB9RKR, VK5AGR G3HMO, ZL4TIQ, N4HY, I2KBD, K1KSY, KA1FAD, G8UNO, G3YMC IV3TKI, IW3ER, G3VYV, G6YFF, VK2WB, G6TPQ, GM6JVC, ON7VQ, ZL3QL, VK2AVH ZL1AOX, JA4GVA, G6ESK, G2UK, G4XKR, OZ1WN, G6GWR, I2KBD

N.Clayton (ZL), M.Oslender (ON), B.Lindholm, Milham Ford School

This week: G6ESK, ON4FI, OZ1IWS, G4GPQ, G4PSO, JA2GSD, G3HMO, OZ2LW, I2KBD, D Hudson (Sir William Turner's 6th Form College).

** Keplerian Orbital Elements - from KA9Q **

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84158.37169531
Wed Jun 6 08:55:14.474 1984 UTC
Element set: 648
Inclination: 97.5918 deg
RA of node: 132.7712 deg
Eccentricity: 0.0003783
Arg of perigee: 122.9760 deg
Mean anomaly: 237.1837 deg
Mean motion: 15.25848603 rev/day
Decay rate: 4.295e-05 rev/day†2
Epoch rev: 14789
Semi major axis: 6863.341 km
Anom period: 94.373714 min
Apogee: 502.580 km
Perigee: 497.387 km
Beacon: 145.8250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84155.14064979
Sun Jun 3 03:22:32.141 1984 UTC
Element set: 105
Inclination: 25.6378 deg
RA of node: 196.2423 deg
Eccentricity: 0.6089574
Arg of perigee: 276.7795 deg
Mean anomaly: 21.6381 deg
Mean motion: 2.05850652 rev/day
Decay rate: -1.36e-06 rev/day†2
Epoch rev: 732
Semi major axis: 26106.044 km
Anom period: 699.536283 min
Apogee: 35629.315 km
Perigee: 3834.378 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84148.10356205
Sun May 27 02:29:07.761 1984 UTC
Element set: 29
Inclination: 98.2421 deg
RA of node: 210.3619 deg

Eccentricity: 0.0014072

Arg of perigee:	358.1468	deg
Mean anomaly:	1.9676	deg
Mean motion:	14.61867821	rev/day
Decay rate:	2.58e-06	rev/day†2
Epoch rev:	1262	
Semi major axis:	7062.366	km
Anom period:	98.504118	min
Apogee:	694.181	km
Perigee:	674.305	km
Beacon:	145.825	Mhz

** Spacecraft orbital data **

Orbits for 15th June

	UoSAT	UoSAT-2	NOAA-7	
Orbit no :	14928	1546	15364	
Eqx time :	14:50:01	14:39:17	14:34:00	GMT
Eqx long :	344.5	254.0	343.0	deg.w
Mean hgt :	490.9	689.9	850.0	km
Period :	94.4274082	98.5616474	101.9771550	mins
P-drag :	4.318E-05	2.914E-06	7.500E-06	*N-ref
Long inc :	23.6049972	24.6394866	25.4899588	degs
L-drag :	1.086E-05	7.331E-07	2.000E-07	*N-ref
Incl :	97.590	98.242	98.900	degs
Freq :	145.825	145.825	137.620	MHz

Reception reports and UoSAT data is much appreciated
Send to: UoSAT team, University of Surrey, Guildford, Surrey, England - Thank you