# AMSAT Newsletter

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## AMSAT Officers

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AMSAT
P.O. Box 27
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EDITORIAL -- OUR RESPONSIBILITY
by Tom Mitchell, WAI3TBD

At their January meeting, the ARRL Board of Directors selected the League's December Goals for 1973. Following the general principles of promoting amateur radio nationally and internationally came fostering the growth of the amateur satellite program.

Coming from the Board of the nation's representative amateur organization, this goal carries the concern of all amateurs. The reason is responsibility.

Those of us who are involved in amateur satellites carry even more responsibility than that of every amateur: to contribute to advancing the state of the art. This quest is morally imposed on all hams; imposed in a special way on satellite experimenters.

This program is the state of the amateur art: it is in bold contrast to "appliance operators" who derive only enjoyment and contribute nothing to their hobby. This program is in the best traditions of amateur radio.

Those who use the OSCAR satellites have a responsibility to level-headedly obey the rules, particularly the power limitation rule. (FCC has already made a specific statement on this matter.)

Activities like OSCAR DXCC have their place, especially to promote the use of OSCARS, but it will be scientific experimentation and public service which will be the deciding factor for the future of our avocation. Just as the very use of any frequency at all for amateurs must be rigorously justified by public interest, convenience or necessity, so will frequencies for the Amateur Satellite Service.

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AMSAT Nets

All interested amateurs are invited to check into one or more of the following AMSAT nets:

- Sundays 1800Z 14280 KHz
- Sundays 1900Z 21280 KHz
- Mondays 7:00 P.M. EST (0000Z Tuesday) 3855 KHz

Note that beginning April 30, the 3855 KHz net will be held at 9:00 P.M. EDT (0100Z).

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FROM THE PRESIDENT'S DESK

By Perry Klein, K3JTE

The AMSAT Experimenters Meetings

During late January AMSAT hosted international experimenters meetings to finalize the design of AMSAT-OSCAR-B (A-O-B)*, AMSAT's follow-on satellite to OSCAR 6. Brought over especially for these meetings were Dr. Peter Hammer, VK3ZPI of the WIA-Project Australis group from Melbourne, Australia, and Karl Meinzer, DJ4ZC of the EURO-OSCAR group from Marbach, W. Germany. Also attending were John Goode, W5CAY from Texas (developer of the Morse code telemetry encoder and Codestore units now aboard OSCAR 6), Lance Ginnet, K6GSJ of Project OSCAR from California (one of the constructors of the early OSCAR satellites), and Dick Kolkbly, K6HLJ of the California Jet Propulsion Lab. Radio Club, an AMSAT Member Society. During a period of three weeks an intensive series of meetings, design reviews and equipment lab tests took place. Many of the details pertaining to the configuration of A-O-B were established.

Karl Meinzer brought with him the flight unit of the 70 cm input, two meter output EURO-OSCAR translator which he and DJ5KQ have constructed. The March 1971 "AMSAT Newsletter" carries a technical description of this unit. The operation of this unit was demonstrated in the laboratory. Peter Hammer brought over one of the new Mark II Australis command decoders for A-O-B, and also the flight unit of the WIA-Project Australis teletype telemetry encoder, which was demonstrated to us in transmissions over the AMSAT 146.85 MHz Washington area FM link. This latter unit was returned to Australia for final completion and environmental tests.

The results of the experimenters meetings are significant because they firm up the design of AMSAT's next satellite (A-O-B) and make plans for an additional spacecraft to follow it into orbit. As decided at the meetings and subsequently approved by the AMSAT Board of Directors, the following experiments are now planned for A-O-B:

--The DJ4ZC/DJ5KQ EURO-OSCAR translator. This is a 10-14 watt PEP linear translator which accepts uplink signals between 432.125 and 432.175 MHz, and retransmits them between 145.975 and 145.925 MHz. The passband is inverted, i.e., an upper sideband uplink signal is transmitted as a lower sideband signal on the downlink and vice versa. The translator has a low power mode (approximately 2.5 watts PEP) for operation when battery power is low.

--A five-watt version of the two-to-ten meter linear translator now flying in OSCAR 6. The uplink frequency range will be 145.9 to 146.0 MHz as in the present satellite, but the downlink frequency range may be changed from that used in OSCAR 6 (see "Frequency Selection for AMSAT-OSCAR-B" elsewhere in this issue).

--A one-watt two-to-ten meter linear translator identical to the OSCAR 6 translator but with the same frequency plan as the five-watt version. This translator will only serve as a backup to the five-watt unit and will be used only if the higher power unit fails or during periods when battery charge is low.

--A 435.1 MHz telemetry beacon.

--Two redundant Australis Mark II 35 channel command decoders.

--The WIA-Project Australis RTTY telemetry encoder. This unit has a 60-channel capability plus an additional dozen channels of binary logic status indicators. Standard 850 Hz AFSK teletype is used at 60 wpm (45.5 baud), with phase coherent 2125 and 2975 Hz audio tones to permit the use of phase lock loops for reception.

--A 24-channel Morse code telemetry encoder identical to the one now in OSCAR 6.

--A Codestore Morse code telemetry encoder identical to the one now in OSCAR 6.

*A-O-B will be given an OSCAR number designation once successfully in orbit.
An experiment control logic system.

The experiment control logic will switch A-0-B between four basic modes:

Mode A - five-watt 2/10 translator
or one-watt 2/10 translator
(the selection between units is made by ground command).

Mode B - 432/146 MHz translator in 10-14 watt mode.

Mode C - 432/146 MHz translator in 2.5 watt mode.

Mode D - Recharge mode.

The 435.1 MHz telemetry beacon may be operated in Modes A or D, but only when switched on by ground command. A 24-hour clock in the experiment control logic will switch between Mode A and Mode B each 24 hours. An automatic battery undervoltage sensor switches A-0-B into Mode C if the battery charge drops to some predetermined cutoff level, and Mode D is activated by this same sensor if a further battery discharge condition is reached. It is expected that the A-0-B power system will be capable of 3 to 4 times the power available in OSCAR 6 and that we can keep the spacecraft in operation 100% of the time, hopefully throughout its three year design lifetime.

Another significant result of the experimenters meetings was the agreement that the WIA-Project Australis group would undertake the development of a new satellite, A-0-D, built around the Australis four-channel 146-to-435 MHz FM repeater and RTTY telemetry encoder. AMSAT will provide solar panels, batteries, the structure, and possibly two-to-ten meter repeater, Morse code telemetry and Codestore units for integration in Australia. As a result, two satellites were decided upon (A-0-B and A-0-D) to be built for the worldwide amateur community.

OSCAR 6 Quirks

On January 9 a problem developed in OSCAR 6's 435.1 MHz beacon transmitter and its power output dropped considerably. Now, only the best equipped 70-cm stations having antennas with 20 dB or more of gain can hear the beacon. The cause of this problem is yet undetermined. It is thought that possibly the driver or final amplifier transistor has failed, or else that high temperatures in the spacecraft have cause the beacon's gain to drop off sharply.

The temperature of OSCAR 6, especially the battery temperature (channel 3D) continues to run increasingly high. It has now reached as high as 47°C. (117°F.) and is a cause for concern. This may be a limiting factor on OSCAR's useful lifetime, since battery life is shortened drastically at elevated temperatures. We have not yet found a satisfactory explanation of what is happening since OSCAR was designed to stabilize at 15-20°C. (60-70°F.). Fortunately, however, there is not yet any sign of degradation in the spacecraft's power system.

The 29.45 MHz beacon transmissions now appear to be quite readable on many passes, especially when the repeater AGC is kept on by the ground control stations. Since this beacon is now the only source of OSCAR 6 telemetry data, the two-to-ten meter translator (which contains the beacon transmitter) is turned on daily for brief periods to obtain telemetry information. It is very important that all stations refrain from transmitting through the satellite on the scheduled OFF days (currently Tuesdays through Wednesdays GMT) to permit telemetry data to be taken and the battery to recharge. It is difficult to copy the beacon if the translator is loaded with signals in the passband, since the same power amplifier stage in the translator must share the limited power between the beacon and communication signals. It is also important that all users on the scheduled ON days keep clear of 145.900-145.910 MHz, as transmissions at these frequencies can result in interference at the 29.45 MHz beacon frequency.

Internally generated, random switching of OSCAR's experiment control logic circuits, evidently caused by electrical transients, continues to be a problem, but has now been largely overcome through the intensive use of ground command to reset the spacecraft's logic into its correct states on each orbit. To this end, the primary control station in Canada has succeeded in automating his station to automatically send a programmed list of commands to the spacecraft every 2-1/2 minutes during each pass, the instructions coming from punched teletype tape.
Some amateurs observing the telemetry have noticed that according to telemetry channel 2A, the -Y solar panel does not seem to be working and is possibly intermittent. It is suspected that this panel may be introducing the transients into the power system, particularly as OSCAR enters sunlight at about 40°N. and 20°S. latitude during each orbit. The theory is that thermal stress on the panel may be causing intermittent spikes to be produced in the power system.

The Codestore system appears to be working properly, but has not gotten a large amount of use due to the existence of only one ground loading station. Additional ground loading units are being constructed and should be in operation soon. Keep listening to Codestore transmissions on the 29.45 MHz beacon for operational data on when OSCAR's translator is scheduled to be in operation.

F9FT REPORT: December 12, 1972

Remarks about the 70 cm beacon:

It's signal is very strong here, quite often, and even most of the time 35 to 40 dB above noise. But there is from time to time quite a slow and very deep QSB, which makes the signal disappear for a couple of minutes.

According to the telemetry system, the panel -Y does not seem to work; it is always sent "296," which means there is practically no load current. We would like to know if this is the reason why the translator is off so often.

It seems that "codestore" does not work well; at the beginning of the experiment, it was only sending very slow speed RTTY signals, but now, it sends information in "clear" morse code. That information is clear at the beginning of the transmission but a few hours later, it becomes almost unreadable; we think it is probably cosmic bombardment which degrades signals stored in the memory, although we are not quite sure; maybe you can give us some more details about it. This would be helpful for us, to explain thereafter what is OK and what is wrong about the satellite, to our many friends here in France who wait for information!!

We also note propagation anomaly on the 70 cm signal: it is very often heard 2 to 3 minutes BEFORE AOS and also 2 to 3 minutes AFTER LOS. Some short computation indicates that the maximum distance, theoretically speaking, is about 4100 km, and in those cases, the 70 cm signal was still heard when the satellite was as far as 5500 km ground distance; at those moments the signals on ten meters were already in the noise.

Late information about signal quality on 10 m: quite often, at LOS in the 1200/1400 MHz range, signals become extremely rough, as though reflected by aurora; we think it could be interesting to investigate. CW signals are about T4, T5, and SSB signals are unreadable. The phenomena happens about 80% of the time at LOS always around the time mentioned above. We never notice that phenomena at AOS, and also at LOS at other time, and other directions.

Miscellaneous:

On November 22, 1972, a storm destroyed half of the antenna system, the 4x9 element for 144 MHz; since November 25, a new antenna system has been operational: for 2m, it is a single 16 element antenna and for 10m, a 5 element full size yagi, as there was room enough on top of the tower!!

Results on the receiving side are terrific with the new 10m beam although this antenna is not tiltable; at AOS and LOS back signal is always about 40 to 45dB above noise, and signal from other stations are also very strong, and quite often heard BEYOND the horizon, when our own signal is not readable, because the 2m signal does not reach the satellite.

But unfortunately, we have not been able to do all the tests and measurements that we would have done, because the translator is off too often. So far it has not yet been possible to get exact information concerning what is wrong with the on/off system; some people say there is a safety device which switches off the translator when temperature is too high, on the PA stage; others say that the safety device switches off when the battery voltage is too low; others say it switches off when it is too high; and as a final information, some people also say that guys at ground stations are crazy!!
So far it is impossible to get any official information concerning the switching device. W1AW sends information too late in the night, and the official AMSAT station was never heard here. QST magazine comes here with one or two months delay, and so we are quite in the dark.

Due to this fact, many stations got rid of listening to noise, and specially those who have no orbital data available. We got several letters from fellows who were quite enthusiastic at the beginning, who said that they have not so much time to lose by listening to the "void," and so they gave up. It is the case of some friends of "Eastern" Europe, some Swedes, Dane, French and some German. Now, in Europe, it only remain the "hard-to-give-up" fellows, those who are accustomed to listen to nothing but nothing!! Those fellows who are always QRV, 100% of the time are: EI6AS, HG5A1R, SM6FU, F1YS, F3NB, DKZ2F, GW3FSF, LA1ZK, E44AO, DL9GU, FC6A6P, G6RH, G3PWW, L21BW. Some other stations are also about 50% of time QRV: UA1DZ, UG6AD, UT5DL, OK3CDI, OK1MBS, SVE1AB, SM5LE, SM5AII, SM3BU, SM2CFG, LA8WF, many F's and D's, DM2ZEL, I13DS, T4NU and so on. Many others only appeared once or twice: TF3EAP, UW6MA, SM5AIE, F5P, OK1BNW/P, HG2RG, HG2RD, LA4YG, HB9OP, HB9QQ, 4X4MH and many others that we have forgotten.

Stateside, the most often heard and worked station here is K2RTH; then comes K1HTV; all others were worked or heard only once. From Canada, activity seems to be more regular: stations VE3QB, VE2BYG, VE3GUA and VE2BFO are very often heard but not so many QSO's with them, because they are often heard AFTER loss of back signal here!

It also seems to us that operating practice is very poor in the States, at least during a pass which can provide contacts with Europe: many W's call CQ CQ CQ CQ; , giving their call-sign only once and then ...K... so you send a legitimate...?... then the OM comes back QR6edging or sending your call-sign only but not his! One day, we heard W4FJ calling CQ for 4 minutes!! Probably most of them are quite anxious to make a QSO with Europe, and so they keep calling as soon as they get some reply. Therefore, when you are in QSO with a W, you are called by another one right when the one you are in QSO with gives you your report! We think that very short CQ's, not longer than 10 seconds, as well as short listening periods between CQ's are much better practice; on CW a speed of about 18 to 20 wpm is also a good value; faster CW is quite often "smoothed" by fast QSB, and are difficultly readable; slow speed CW is OK for very weak signals, but with good signal strength, it takes too much time to achieve a QSO. In SSB, due to Doppler shift, it is not easy to tune the signal, specially with fast speaking people; do not forget that people in Europe don't speak English as their mother tongue.

F5SE, REIMS

Notice to all Users of OSCAR 6

The OSCAR 6 satellite has been in orbit since October 15, 1972. Many hundreds of amateurs throughout the world have QSO'ed thru it. Design lifetime is one year and it is hoped that this goal will be exceeded, so many more contacts lie ahead. Many more contacts lie ahead, that is, if the satellite's nickel cadmium batteries can be kept charged. If discharge should proceed to a critically low point, one or more battery cells will become reversed. Once this happens the battery is ruined and OSCAR 6's life will quickly come to an end.

Due to the small dimensions of OSCAR 6, there is less space for solar cells to recharge the battery than the satellite's designers would have liked. As a result, a rather modest operating schedule has been established. This schedule, which will be adhered to until further notice, is as follows:

Satellite 2/10M translator ON 0000Z Thurs— 2400Z Mon
Satellite 2/10M translator OFF 0000Z Tues— 2400Z Wed.

There may be instances, during the OFF times, when the satellite may be found ON. This can be a result of a number of things. The translator may have been turned ON to receive telemetry data via the 29.45 MHz beacon. A problem which has occurred with the 435.1 MHz beacon now leaves 10M as essentially the sole source of telemetry data. Information from telemetry is crucial in assessing the condition of the satellite's battery and other vital parts. The translator could have been turned ON to conduct a controlled test. A clear satellite is important to the proper running of such tests. It is also possible that the translator may be ON unintentionally.
Use of the OSCAR 6 satellite when it may be encountered ON during a scheduled OFF period may hamper collection of telemetry data from the very weak 29.45 MHz beacon, may obstruct a special test and will lead to discharge of the battery when it should be charging. In all cases operation thru the satellite should be avoided during scheduled OFF periods. Please do not contact other stations to tell them to get off. You will only increase the load, and the stations may be participating in a controlled test. Instead of contacting them please send their calls and the time that they were logged to AMSAT.

AMSAT requests that now that you have this background information you will help out by refraining from operation during scheduled OFF periods in the future and that you will pass this information along to other stations.

A PREAMPLIFIER FOR 29.5 MHz

by Jack Colson, W3TMZ

Probably the greatest problem most amateurs have with obtaining satisfactory two-way communications via the OSCAR 6 satellite is in hearing the 29.5 MHz downlink. If you are not able to copy the beacon on 29.45 MHz on an overhead pass or even passes that are somewhat removed from overhead, then your receiving system is not as good as it can and should be for satellite communications. Generally, most receivers' sensitivity is reduced considerably at 29.5 MHz for numerous reasons (poor noise-figure, inadequate gain, and poor impedance match). A good antenna will help, but a low noise preamplifier will do more to improve the receiving system than an elaborate antenna system. Generally, most receivers have noise figures ranging from 8 to 20 dB at 29.5 MHz (a good guess). With a properly operating and designed preamp the noise figure can be reduced to 2.5 dB and 15 to 20 dB of gain can be realized. Such a preamp will improve the receiving system sensitivity greatly. One important factor that must be dealt with now that the receiving system has been made super-sensitive is the susceptibility to overload, cross-modulation, etc. Unfortunately, this is almost always a problem with very sensitive receiving systems. This situation is even more profound with regard to OSCAR communications, i.e., simultaneous receiving and transmitting. Depending on the transmitters' operating characteristics (unwanted products) and proximity of the receiving/transmitting antennas; this problem will vary with each installation.

A number of preamps of the following design have been built. These have had measured noise figures ranging from 2.5 to 4.5 dB and power gains ranging from 15 to 22 dB. An absolute best design has not been attempted, but what has been built performs quite well.

The schematic for the preamp is shown below.

![Schematic of the preamplifier for 29.5 MHz]
L₁ - 2T No. 24E close wound over cold end of L₂
L₂ - 10T No. 24E spaced wire diameter; 1/4" dia. slug tuned (RED)
L₃ - 10T No. 24 close wound; 1/4" dia. slug tuned (RED) form, winding approx. 1/4" long
L₄ - same as L₁
Q₁ - RCA 40673

The layout of the components are not critical, but a shield partition across the device (dual-gate MOSFET) is desirable. Almost any dual gate MOSFET will work in this circuit. The devices that have protective diodes will have slightly poorer noise-figures but they do offer good transient protection and are easy to use. These devices are: 3N187, 3N200, 40673, 40819, 40820, etc. The 40673 is normally priced at $1.01.

A simplified component layout for this preamp is shown below:

The gain will decrease as G₁ is biased positively (6v maximum). In summary, this preamp will in most cases be a welcome addition to the receiving system.
"Range Measurements with OSCAR 6 Using Slow-Scan TV Equipment"*

by Karl Meinzer, DJ42C

Trying to determine a satellite's equatorial crossing time, and particularly the longitude of equatorial crossing by simple means is a rather difficult job. On the other hand, with range data, these orbital parameters can be calculated after a single pass of the satellite.

Range information can be gathered by using the satellite's transponder. By measuring the time a radio wave takes to travel to the satellite and back, the distance to the satellite can be determined, since the speed of light is known to be 300 meters (1000 feet) per microsecond.

The range to the satellite will be between about 1500 and 4000 km (900 to 2500 mi.), giving delays from 5 to 13 milliseconds for one way, or 10 to 26 milliseconds for the round trip. If the desired accuracy of the satellite's equatorial crossing time and longitude is 10 seconds and 2/3 degree, respectively, then a ranging accuracy of 75 (~45 mi.) km is desirable, since the satellite travels at a speed on the order of 7 km/second (4-5 mi./sec.). In order to achieve this accuracy, the ranging timing error should not exceed 0.5 ms. From this, it is evident that the signal-delay within the satellite transponder, which is on the order of 10 microseconds, can be neglected. On the other hand, the delay introduced by the ionosphere over the ten meter downlink cannot be neglected, as will be seen later.

In order to investigate the ranging concept, a very simple arrangement was tried. Standard slow-scan television equipment has a line frequency of 15 Hz, corresponding to a 66.7 ms. period. The horizontal sync-pulses last 5 ms. It was felt that slow-scan test transmissions could provide a useful means to carry out ranging experiments.

The sync-pulses of a test transmission are used to trigger a scope line. The received sync-pulse is displayed on the scope (see Fig. 1). To do this, the output of the sync-separator of the monitor has to be made available. The line flyback pulse was tried, but it was found that this had too much jitter and it was impossible to tell the quality of the recovered pulse.

![Diagram of SSTV Configuration](image)

By using the sync-separator output of the monitor, any poor return quality is immediately evident on the pulse shape (it is shortened).

The systems must be calibrated in order to account for the various delays in the station. It was found that the transmitter and receiver introduce about 2 ms. delay, and the monitor another 2 ms. delay.

*Preprinted from QST.
By placing a converter in front of the ten meter receiver, the system can be run in a short-circuit or "back-to-back" mode. The line start of the scope should be adjusted in such a way that the displayed pulse starts at a grating reticle on the oscilloscope screen. Line start and pulse start should be noted.

![Scope Pattern in Short-Circuit ("Back-to-Back") Mode](Fig. 2)

If the system is operated through the satellite repeater, the pattern will look like this:

![Scope Pattern in Ranging Mode](Fig. 3)

During a period of good reception, the start of the received pulse should be marked and the time noted. (It's best to have a second operator do the writing and time recording for you). Now note the time delay \( t_d \) from the scope. About ten good measurements per pass are sufficient to get the necessary information.

In order to calculate orbit information from these measurements, it is desirable to have a calculator. At first, the \( t_d \)'s are converted to distance by the formula

\[
t_d(\text{ms.}) \times 150 = d \text{ (km)}
\]

or

\[
t_d(\text{ms.}) \times 93 = d \text{ (mi)}
\]

where \( d \) is the slant range distance to the satellite. In order to be able to transfer this distance into a chart, it has to be turned into a great-circle distance (Fig. 4)

\[
E = r \cos^{-1} \left( 1 - \frac{d^2 - h^2}{2rh^2} \right) \approx \sqrt{\frac{d^2 - h^2}{1 + r/h}}
\]
where \( E \) is the great circle distance between the subsatellite point and the observer, \( r \) is the earth's radius, and \( h \) is the height of the satellite above the earth.

These \( E \)-values now can be used to construct a graph. First start by drawing a vertical line to represent the subsatellite track. Next, divide this line into about 25 equal distances, representing 1 minute intervals corresponding to 425 km (265 mi.) each. Choose a scale that is practical for the size of the page. Now set a compass to the first radius \( E_1 \), and draw a circle from the first time mark. The next distance is then taken by moving up an appropriate amount of time and drawing a circle with radius \( E_2 \). You will finish having a figure as shown in Fig. 5.
The circles do not meet in one point, because the ionosphere introduces errors as high as 500 km (300 mi.) at ten meters, if the satellite is at a low angle above the horizon. Part of this error is cancelled by the approximations implied in the planar construction of this actually spherical problem, and by the approximation for the arc-cosine given in the above equation. In addition, you must make an educated guess at the station's position indicated by the small circle in the figure, the nearest measurement being the most accurate. From this graph it is easy to find the distance of closest approach and the time of closest approach, which can be used to set the orbital semicircle on a meteorological satellite plotting map. Working backwards, equator crossing time and longitude can be found. (Note that there are actually two ambiguous solutions, only one of which is correct).

South-to-north passes are most useful for calculating equator crossing data, while northeast-to-northwest passes can be used to check the system with known inclination, or to determine inclination.

The accuracy obtained is about one millisecond, which falls slightly short of the desired value, but nevertheless the system provides a reasonably accurate way available to amateurs to determine equator crossing information.

An advanced system is under construction using a 30 Hz tone modulated onto an audio subcarrier. By measuring the phase shift, it is hoped to increase the accuracy to the theoretical limit consistent with the ranging signal-to-noise ratio, this limit being about 0.3 ms.

Here are some results, taken by DJ4LC on Orbit 215, on November 3, 1972 (station location: 50°49' North Latitude, 351°16' West Longitude).

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Using these data in the preceding equations, the following results were calculated:

Time of closest approach: 2049:30 GMT

Time of equatorial crossing: 2034 GMT

Longitude of equatorial crossing: 356.8° West.

These results compare favorably with NASA orbital predictions, which gave the time and longitude of equatorial crossing for Orbit 215 as 2033:26 GMT and 356.16° West, respectively.

AMSAT Board of Directors Meeting
January 11, 1973

The Board of Directors meeting was called to order by President Klein at 8:20 PM at the home of Jan King.

In attendance were Perry Klein K3JTE, Jan King W3GEY, George Kinal WA3TRL, Bill Tynan W3KMI, Charles Dorian W3JFT, Bill Hook W3QBC, Ray Soifer K2QBW, Dick Daniels WA4DGI and John Gregory W3ATE.
It was agreed that the next meeting would be on 30 January following the Experimenters Conference and prospective meeting of the Amateur Satellite Service Committee later this month.

Mr. H. Yoneda, JALANG was appointed as AMSAT liaison representative for Japan.

The attention of the Directors was called to the planned ARRL Technical Symposium on September 14th to be held in the Washington, D. C. area and the call for papers contained in the January issue of QST. It was agreed that AMSAT would encourage its members to submit papers and make a particular effort to solicit speakers from its more knowledgeable and active members. Secretary Dorian was appointed to coordinate these efforts.

President Klein reported on his informal meeting on January 10th with the officials of the American Satellite Corporation. A formal written report is under preparation. AMSAT is waiting for a formal reply to our letter sent to the Corporation concerning their use of the trademark "AMSAT." This item was tabled pending receipt of the letter.

Bill Tynan advised of a planned display of amateur satellites at the Johns Hopkins University Applied Physics Laboratory. He solicited the loan of various items for the exhibit.

The status of command stations for control of OSCAR 6 was discussed. It was agreed that Jan King should discuss with Dave Robinson K7BBO Dave's offer to assist as a second command station for the West Coast. Dave has also accepted the task as Chairman of the AMSAT Fund Drive activity.

Approval was granted to expend funds not to exceed $100 for necessary expenses of the Canadian command station.

The Directors wish to acknowledge the service of many stations and individuals who have been responsible for the success of OSCAR 6. Larry Kayser and Dick Kolhby are particularly commended for their help during the past months in keeping OSCAR 6 operating.

Jan King made a presentation on the forthcoming Experimenters Conference scheduled for the end of the month. Karl Meinzer DJ42C of Germany, Dr. Peter Hammer VK32PI of WIA-Project Australis, Dick Kolhby of JPL California, John Goode of Texas and Lance Ginner of OSCAR California are expected to join in a series of intensive planning conferences and design reviews in preparation for AMSAT -OSCAR 7.

A short presentation was made on the present status of OSCAR 6. A reduction in the 435 beacon signal has just occurred. The reasons for this problem are being investigated.

The meeting adjourned at 11:45 PM.

Charles Dorian, W3JPT

AMSAT Board of Directors Meeting
January 30, 1973

The Board of Directors meeting was called to order by President Klein at 8:10 p.m. at the home of C. Dorian.

In attendance were Perry Klein K3JTE, Jan King W3GEY, Bill Tynan W3KMY, Chas. Dorian W3JPT, Bill Hook W3QBC, Ray Soifer K2QBW, Dick Daniels WA4DGU, Peter Hammer VK32PI and Karl Meinzer DJ42C.

President Klein reported on current activities, OSCAR 6 operations and the status of discussions with American Satellite Corporation. Appreciation was expressed for the allotment of funds from the ARRL and the donation of $100 from the Foundation for Amateur Radio.
Bob Clark, the editor of the AMSAT Newsletter, advised he must resign due to the press of work. All Directors joined in expressing their appreciation for the excellent job Bob has done over the past two years.

President Klein reported on his meeting with the Patent Office representatives concerning the register of our mark -- AMSAT. The Patent Office was expected to act on this sometime in February.

The possibility of holding the Annual AMSAT meeting at either the ARRL Roanoke Division Convention, 15 - 16 September or the Cape Cod - New England Convention mid-September, was discussed. The Directors were inclined to believe the Roanoke Convention was a preferred choice. This will be further discussed and resolved at the next Directors meeting.

Summarized recommendations of the Experimenters Conference were received from Jan King. After discussion the recommendations were approved by the Board.

They are:

OSCAR A-O-B will have 3 translators, a 432/146 MHz unit by DJ4ZC and DJ5KQ, a 5-watt 146/29.45 MHz by AMSAT and a 1-watt 146/29.45 MHz by AMSAT. Additional equipment will be a beacon on 435.1 MHz, a Code-store unit and Morse code and RTTY telemetry encoders.

A second satellite, designated A-O-C will be built in Australia by the WIA - Project Australis group and will contain the Australis two-meter-to-70 centimeter FM repeater and other repeater and telemetry systems to be supplied by AMSAT.

Dick Bulley KB6HDJ, was appointed as Spacecraft Structures Manager for A-O-B.

Charles Dorian, W3JPT

MINUTES OF AMATEUR SATELLITE SERVICE COMMITTEE MEETING

February 17, 1973

Arlington, Virginia

Status Report on AMSAT-OSCAR 6: Mr. Klein presented a status report on the AMSAT-OSCAR 6 satellite, noting that some problems with spacecraft temperatures have been encountered. The sporadic internal generation of command functions has required extensive planning and coordination among the several ground control stations to assure that the satellite is available during the advertised weekend periods, but is idled for recharging of batteries the remainder of the time. Present indications are that the one-year life expectancy will be reached and perhaps exceeded. Amateurs in fifty countries have sent signals through AO-6 thus far, and DJ4ZC has performed some ranging experiments, using SSTV, for elementary orbit measurement.

Status of Talcott Mountain Space Educational Program: Mr Dannals reported that the third draft of the curriculum for use by teachers, contracted by AMSAT with Talcott Mountain Science Center, is now being reviewed. AMSAT carries responsibility for contract fulfillment, although the cost of the contract ($2000) will be borne by A.R.R.L., as agreed previously. Delivery of a completed draft to A.R.R.L. Headquarters at the earliest possible date is considered imperative, so that arrangements can be made to reproduce copies and distribute them to schools throughout the U.S. and to other countries for experimental uses. Mr. Waters advised that A.R.R.L. has a promotional draft ready for use in connection with the curriculum when the latter becomes available for distribution.

The following committee position was adopted:

The Amateur Satellite Service Committee urges the earliest possible completion of the curriculum being prepared by the Talcott Mountain Science Center, in order to optimize opportunities for its effective use during the current and ensuing school year.
It was agreed that the initial distribution should be at no cost to the teachers, but that a nominal price might be assigned to the curriculum and an actual charge made by A.R.R.L. for furnishing additional copies (or in other special circumstances.) AMSAT is to undertake to expedite completion of the manuscript.

A.R.R.L. Progress Report: Mr. Dannals advised that the A.R.R.L. Board of Directors ad hoc Satellite Committee has been directed to study the possible establishment of a tracking station at A.R.R.L. Headquarters (Minute 52, January 1973 Board Meeting). He reported that there are severe interference problems at the Headquarters site because of the several WIAW transmitters in use there, and that consideration will also be given to the possibility of remotely-controlling the Talcott Mountain facilities from the Headquarters site.

Mr. Waters described the results of his visits with AMSAT and OSCAR officials and indicated that general concurrence was obtained from the two groups regarding A.R.R.L. plans to obtain both press coverage of satellite activities and to seek means for attracting and involving young people in amateur satellite activities through local clubs and by means of newsletters to secondary school science teachers.

Mr. Dannals advised that Captain Charles Dorian, W3JPT, has agreed to manage the A.R.R.L.'s Technical Symposium, which is to be held on Friday, September 14, 1973, at Reston, Virginia (near Washington, D.C.). The symposium will have space communications as a central theme and is being held in conjunction with the Roanoke Division A.R.R.L. Convention (which will occupy the same site the following two days).

Mr. Klein affirmed that AMSAT plans to assist in the planning and staging of the symposium, and may reschedule its annual meeting to coincide with the symposium/convention weekend, to immediately follow the termination of convention activities on Sunday afternoon.

AMSAT Progress Report: Mr. Klein described the status of AMSAT organizational affairs, reporting that a proposal to create a salaried position for an executive director of AMSAT had been extensively discussed but has not been implemented for financial reasons. Career preoccupations by key AMSAT personnel may bring about some deceleration of program activities on AO-7 and AO-8, although he emphasized that there is no lessening of enthusiasm or determination. AMSAT membership now is nearly 1000. Design and construction of future satellites will be aimed at achieving three-year lifetimes. Preempting of AMSAT's abbreviated title by a commercial concern, the American Satellite Corporation was described. AMSAT is exploring its legal claim to the name.

OSCAR Progress Report: Mr. Vincent provided copies of OSCAR's new organization chart and described reorganizational activities. He stated that OSCAR will continue to be essentially volunteer in make-up, although employment of technicians will be considered if OSCAR goes into an operational mode. Any such step would be in close cooperation with the efforts of AMSAT. Mr. Vincent indicated that OSCAR encourages the establishment of a satellite station (or control point) at A.R.R.L. Headquarters, and advised that contact will be made with Mr. Pete Hoover regarding the resumption of discussions on the Hoover Memorial Station as a possible west coast control point for amateur satellite programs. Mr. Vincent reported that OSCAR will continue to be alert for launch possibilities for future satellites, adding that two launches per year is regarded by OSCAR as a desirable goal. Cooperation from industry will be sought in connection with obtaining donations of components and use of test facilities.

Mr. Vincent also provided copies of OSCAR's recently-developed Spaceframe Proposal, which is intended to minimize risks and uncertainties associated with the physical adaptation of AMSAT and OSCAR space hardware to the resources available in the launch vehicle. This effort at standardization is regarded with enthusiasm by the AMSAT representatives, and direct coordination between AMSAT and OSCAR of the technical details will follow, pending an opportunity for AMSAT study of the proposal.
Possible Space Use of 1215 to 1300 MHz Region: Mr. Klein described efforts being made by AMSAT to foster use of the 1215-1300 MHz and 2300-2450 MHz amateur bands for low-power beacon use. The desirability of supporting efforts to secure support for these efforts was acknowledged, inasmuch as the potential for interference to shared users of these bands is negligible and the effectiveness of earth station control of amateur satellite transmissions has been conclusively demonstrated.

Mr. Vincent indicated that OSCAR supports this probing approach to the use of new frequencies for amateur satellite work. It was the sense of the participants in the meeting that these voluntary efforts should be supported and encouraged. Direct and continuing coordination among AMSAT, OSCAR and A.R.R.L. is urged in support of their objectives.

Publication of Amateur Space Activity: Mr. Klein stressed the need for additional coverage of satellite equipment and techniques in the Radio Amateur's Handbook, noting that fewer than three pages are devoted to this in the 1973 issue. Mr. Huntoon explained the basis for allocating space in the Handbook to the various areas of amateur specialization, and it was noted that consideration is being given to publication of a "special techniques" handbook which could include more extensive coverage of satellite and space communications. He noted that no satellite article has yet been rejected for use in QST.

The forthcoming A.R.R.L. Technical Symposium was cited by Mr. Dannals as a promising vehicle for bringing attention to the activities of radio amateurs in the satellite communications field. Following a discussion of the matter, Mr. Dannals requested Mr. Clark to prepare a letter to the chairman of the A.R.R.L.'s Contest Advisory Committee to ask that group to study and make recommendations for changes in the A.R.R.L. Field Day and VHF Contest Rules (but not Sweepstakes or DX Contests) to encourage making of contacts through AO-6 during those affairs.

The next ASSC meeting will be held at 9:00 a.m., June 16, 1973, at Arlington, Virginia.

Operations

by Bill Tynan W3RMV

The happy word has pretty well gotten out by now but for those who haven't heard it, the OSCAR-6 operating schedule has been increased two days. The satellite is now ON for two-way contacts from 0000Z Thursdays to 2400Z Mondays.

Satellite users are reminded not to attempt to use OSCAR-6, even if they should hear it ON during the scheduled OFF periods, 0000Z Tuesdays through 2400Z Wednesdays. The satellite may be ON for special experiments, telemetry data collection or because of some inadvertent cause. Collection of telemetry data, the success of special tests and sufficient battery charge require stations to refrain from using the satellite during scheduled OFF periods. As reported elsewhere in this Newsletter, the 435.1 MHz beacon has ceased to function properly. Therefore, the 29.45 MHz beacon is now the only source of telemetry. Use of the satellite often makes copy of this beacon difficult because of the power sharing nature of the 2/10 meter translator power amplifier stage.

Remember also that effective radiated power in excess of 100 watts is unnecessary and unsportsmanlike. All excessive power does is to depress the gain of the satellite's translator and reduce the strength of the other signals in the passband. Many successful users have found that a 50-100 watt transmitter and a dipole or crossed dipoles make a good combination. Such an installation eliminates the need for pointing the antenna. This facilitates operating through the satellite considerably.

Observation indicates that a consistent problem is poor ground receiving installations on 10 meters. This may be one reason why some users run too much power. They keep turning up the wick until they hear a good signal on the downlink. There is a better approach, one which also helps in the reception of other stations through the satellite. That is improvement of 10 meter receiving performance by the use of a better antenna or the installation of a preamp in
front of the old receiver. Jack Colson, W3TMZ, has developed a very effective FET preamp costing less than $10 to build and requiring only a couple of hours to put together. See his article describing it in this issue.

Again, in this Newsletter, we are publishing one reference orbit per day for the next six months. Comparison with data in the last Newsletter will show slight differences. The data contained in the accompanying table represents new updated information from that published in December.

To produce orbital information for other than the reference orbits, simply keep adding 115 minutes and 28.75 degrees for each succeeding orbit.

The following are a few tips for computing orbits.

W5XKD suggests that, for those using calculators, to compute the time for the next orbit, add 195. At the point where you get an obviously incorrect answer such as 0595, simply subtract 40 and the next orbit time is 0555. You can then continue adding 195 for succeeding orbits.

W3LUL suggests that for those who wish to calculate the longitude for the descending node (north to south equator crossing) from the usual ascending node data, use the following formula:

\[ \text{Lat}_D = 194.375 + \text{Lat}_A \]

where

- \( \text{Lat}_D \) is the descending node latitude
- \( \text{Lat}_A \) is the ascending node latitude.

If the answer is over 360°, subtract 360°.

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NOTE: "I" indicates that the OSCAR 6 satellite is in sunlight.

**Frequency Selection for AMSAT-OSCAR-B (OSCAR 7)**

As presently envisioned, AMSAT-OSCAR-B (A-O-B) will incorporate three communication translators -- a 70 cm-to-2m translator and two covering the 2m-to-10m range, one with somewhat higher power than the present OSCAR 6 plus another, more or less identical to OSCAR 6, which will be used as a "backup" system should it become necessary during A-O-B's projected lifetime of three years. Of the three translators, only one will be operative at any one time.

Present plans call for the 70cm translator to incorporate an uplink range of 432.125 to 432.175 MHz and a downlink range of 145.925 to 145.975 MHz. The unit will employ frequency inversion, so that, neglecting Doppler shift, an input signal at 432.125 will be retransmitted by the satellite at 145.975; an input signal using upper sideband will be retransmitted as lower sideband. When this translator is in use, a telemetry and Codestore beacon will be heard at 145.980 MHz.

The 2m-to-10m translators will employ identical frequency bands. The uplink range will be the same as OSCAR 6, 145.900 to 146.000 MHz. As with OSCAR 6, frequency inversion will not be used. The 2-10 mode will incorporate two beacons, as with OSCAR 6--one at 435.100 MHz, the other at a frequency in the 10m band to be decided.

In addition to the OSCAR 6 configuration, in which a beacon at 29.450 MHz is used in conjunction with a downlink range of 29.450 to 29.550 MHz, two other alternatives are under active consideration. Were it to be deemed desirable for the beacon to remain at 29.450, the downlink range could be shifted to 29.150 to 29.450 MHz. Alternatively, the beacon could be moved to 29.500 and the downlink placed at 29.400 to 29.500 MHz. Many users have expressed regret that the OSCAR 6 downlink extends above 29.500 MHz, since tuning that range is inconvenient with several popular receivers in current use. As a consequence, OSCAR 6 activity has been concentrated in the lowest 50 kHz of its passband.
AMSAT welcomes comments and suggestions from the amateur community concerning these frequencies planned for OSCAR 7. Please address comments to K2QBW in care of AMSAT, Box 27, Washington, D. C. 20044.

ANOTHER SYSTEM FOR TRACKING OSCARS

by Wally Lamb, WF8H

It has been suggested that more information should be made available on how to track OSCAR 6. There have been a number of articles written on the subject but it appears that they leave something to be desired to the newcomer in the ability to visualize the orbits and determine when and where it is in relation to their QTH.

Here is the system which we have been using since OSCAR 3, and it is versatile enough to be used for other future OSCARs that have a near circular orbit. We have also found out that with the aid of this calculator students can easily grasp the concept that the orbital plane is stationary and the earth revolves within it.

The calculator is made up of four boards and a metal globe. First you drill holes into the globe at the north and south poles and insert a shaft thru these holes forming a North-South Axis. This shaft is then mounted on a base in such a manner that it is free to rotate. On the side of the base are two triangular supports which hold the board we call the orbital plane. This plane is made to tilt from near vertical to horizontal, thus any orbital inclination can be simulated. The orbital plane board contains calibrations that mark the time interval that has elapsed from the time of the ascending orbital crossing to any latitude. In the case of OSCAR 6 we know that it travels at the rate of 115 minutes per orbit (360 degrees); therefore, we can figure that the satellite travels at the rate of 3.13 degrees per minute and use this figure to mark off the time on the orbital plane board. In our case we mark off at 9.4 degree increments (3-minute intervals). In addition we know that the earth moves in a westerly direction at a rate of 15 degrees per hour, so for every four minutes of orbit the earth moves in a westerly direction one degree. This is also marked off on the orbital plane.

The globe is also calibrated in the following manner: you mark off a circle whose radius corresponds to the limit at which you can see the OSCAR. In the case of OSCAR 6 this is about 2500 miles. This corresponds to roughly a circle whose diameter is 62 degrees as measured on your globe at the equator. The center of this circle is at your QTH. Now, around the periphery of this first acquisition circle you mark off the compass bearings: N, NNE, NE, etc.

This is how it works: you locate the point on the equatorial crossing in degrees West Long. You place the globe in this position so that the orbital plane crosses the equator at this point on the ASCENDING node. You then observe where the orbital plane first touches your first acquisition circle and the bearing. Note also the number of degrees the earth has rotated while reaching this point and rotate the earth a like amount to correct for the earth rotation. We can also get a pretty good idea of the elevation by noting how far the orbit path is from our location to the line of first acquisition; if it is half-way in, we know that the OSCAR will appear at about 45 degrees above the horizon at this point. You can also tell where you can expect to work someone from any given area by noting when their acquisition circle laps over yours giving you the bearing and duration of the path that will be most productive. With a little practice you will come up with a series of notes on a path like this. With an equatorial crossing of 30 degrees the orbital plane comes into contact with my first acquisition at plus 15 min. in a NNE direction, will be NE at 20 minutes, NNE at 23 minutes, North at 25 minutes and LOS at 30 minutes after crossing in a NNW direction. The beams will have to be elevated at about 30 degrees at mid-point of the path, and we have a good chance of working Europe when in the E and NNE.
Dear Sirs:

I am writing on behalf of the Council and members of the Radio Society of Great Britain to offer you and your fellow amateurs, particularly your associates in AMSAT, congratulations on the successful launch of OSCAR 6 in October of last year. I personally believe that if amateur radio is to flourish and our continued occupancy of spectrum space is to be preserved, we must keep up with the times and make our contribution to developing communications technology. The progress which you and your colleagues have achieved is greatly to be admired and we in the RSGB wish you further success in your future endeavours.

Yours sincerely,
J. A. Saxton, President
London, England
Jan. 23, 1973
Dear Sirs:

I would like to make a few comments on the future goals of AMSAT, if I may. The editorial in the newsletter provoked a few thoughts. Since Amateur Radio is (or should be to some degree) devoted to communication in the interest of public service worldwide, I feel that communication via Amateur satellites should tend to provide this same service through emergency communications, international phone patching (of a non-commercial unimportant nature) plus serving as a reliable means through which to discuss the technical aspects of radio communication in general (nets, round-table discussions, etc.).

This should not be the whole story, however. Those of us who are interested in the technical side of our hobby should endeavour to provide the best quality communication system through which others will be able to provide this public service. As Bob Clark mentions in his editorial, this will provide satisfaction in the form of a well engineered satellite for the technically minded and the satisfaction of being able to provide a public service, in whatever form via a reliable medium, for the public service minded Amateur.

The possibility of reliable public service/educational communications via Amateur satellites is a very real probability. The use of geo-stationary satellites developed by Amateurs and situated over oceans or continents will be able to provide a continuous medium without the present problems of Doppler shift, antenna tracking and limited communications time. This type of project could provide a very interesting and major goal for AMSAT membership.

As for the present I feel some of the challenges are to investigate all forms of HF propagation which may affect satellite communication; to provide some form of tracking system for antennas (especially VHF and UHF highly directional arrays) by "programming" in orbit data; and to investigate forms of AFC suitable for reducing the drastic effects of Doppler shift, particularly to SSB signals. These should help improve the quality and reliability of signals through future orbiting OSCAR satellites--most worthwhile goals indeed.

Bill Shrimpton
VE7AZL
Jan. 9, 1973

Dear Sirs:

Concerning the letter by WA9HCG:

The second paragraph refers to a type of operation that may exist in some countries. Myself, for one, I enjoy the freedom that Amateur Radio has to offer, talking when I please and to whom I please, and on what frequency I pick (operating under the Government rules).

We have done a good job in the past of policing ourselves and I see no reason why we can't do so in the future.

As far as the bedlam goes, this past weekend (January V.H.F. Contest) was a beautiful example of Q.R.M.; you couldn't find any worse on any band, and with 10 watts E.R.P. I worked stations. I think one major problem is operating technique. I'm not advocating that I know how to operate but 800+ QSO's on OSCAR 6 must mean something; 95% have taken place with 100 watts E.R.P. There are lots of good operators, I could list dozens, all I have to do is breathe and they hear me.

Please don't get me wrong when I say that I can operate when I please or that I disagree with AMSAT's shutdown times, I think that this is a real necessity.

Concerning the letter by K4TI (whom I've chatted with many times):

A bigger turnout, I think, really should be the last thing you would have in mind, after viewing the activity that OSCAR 6 has enjoyed since coming to life on Oct. 15. I think participation has been greater than expected.
Contest-wise, I don't feel any special consideration should be given to the operating times of the satellite, special points or what have you. If the stations wish to use the satellite as a means of getting extra points, etc., then it should be of his own doing, not by dangling a carrot in front of the rabbit trick. This rabbit doesn't need the carrot. I'm 250 miles away from the nearest V.H.F. station and in a contest that's murder. I took Quebec in June 1972 VHF contest, not by much but it was there for the taking.

As far as DXCC satellite, and WAS satellite go, WAS is a problem because of KH6 being out of range. It doesn't stop me from trying, I think it can be done.

If there was more activity from other countries, I'm sure DXCC might even take place with the existing spacecraft, at an altitude of 910 miles. All we can do is try.

Now, a few words of my own. OSCAR 6 to me is a new experience; not having much to do with the previous OSCARs, it's a new frontier for most of us. A lot of us have to review our thinking along the lines of, the more power the better, the bigger the antenna the better, horizontal and vertical polarization, these are gone with the spark gap. Circular is the way to go. Tracking the satellite from AOS to LOS is a chore in itself, but it's possible, and I still have time to operate although at times I wish I had 4 hands and 2 heads.

In writing I want to wish AMSAT the best of luck in 1973 with OSCAR 6 and future endeavors with my continuing support.

73
Randall S. Smith
VE2BYG
Alouette, P.Q., Canada
January 8, 1973

Dear Sirs:

I concur with others that the power of the AMSAT 2-10 meter repeater should be increased to five or ten watts. The downrange signals of OSCAR 6 are quite weak, even with good receiving set-ups. Also, it is apparent to me that most Europeans do not use good receiving equipment. I have called many of them but have not received any replies. Many of these times OSCAR was closer to them than to me, and I could still hear my own downlink signal. A six to ten dB increase in repeater output power should help this situation.

Second, I would like to see the frequency of the proposed ten meter auxiliary beacon moved to outside the main bandpass of the repeater, say 29.35 MHz. This way it won't get clobbered by other stations using the repeater. Along the same lines it should also be possible to move the internal beacon down to about 29.42 MHz, feeding a somewhat stronger oscillator signal to the driver transistor. I have never heard anybody down that far, yet it is not down very far on the passband skirts. It would also be helpful if the auxiliary beacon could be operated simultaneously with the 2-10 repeater. If, then, the internal beacon failed, the auxiliary beacon could be turned on without interrupting repeater operation.

The uplink to the Euro-OSCAR linear repeater should be moved to the new satellite band at 435-438 MHz. This would reduce the possibility of interference from casual operations on 432 MHz. It would also be more consistent, i.e., all satellite operations in the 70 CM band will be at 435 MHz, not split, as now.

Lastly, I am opposed to including the 146-435 MHz FM repeater. There is going to be extreme competition for its four channels, judging by the activity of OSCAR 6. This, in turn, will precipitate a power race such that only those with kilowatts and large beams will be able to work through the repeater. Its weak downlink signals will also contribute to the power race. The operation of this repeater simultaneously with a high power AMSAT 2-10 meter repeater would create such a heavy demand on the power system that the entire satellite would have to be shut down as or more frequently than OSCAR 6. The alternative, cycling the three repeaters, one each day, would be very confusing to the average amateur. Many antennas are still having difficulty keeping track of OSCAR 6; if they also have to keep track of which repeater is on, I think many will just give up.

23
Thanks for listening and hope to hear you on OSCAR 6.

73
Robert Crumrine
WB2DNN
January 20, 1973

Dear Sirs:

Enclosed are 6 report sheets (3 for QSO's and 3 for stations heard) covering the period October 15, 1972, to February 4, 1973, and a photograph of antennas used for communications via OSCAR 6.

Here are a few comments:

1) OSCAR 6 signals were first heard on October 15, at 18:35Z, i.e., a few minutes after orbital injection.

2) Telemetry signals are received on 29.450 and 435.1 MHz and complete sequences are now obtained, as QSB is slower than it was during days following launch.

3) Satellite rotation is becoming slower and slower, but it seems to me that the Magnetic Attitude Stabilization System has taken a longer time to stabilize the satellite than it did with OSCAR 5.

As a matter of fact, OSCAR 5 has been stabilized in 7 or 10 days, and it took more than a month to achieve same stabilization with OSCAR 6.

4) During the 2 first days following launch, I tried to make contacts with low power (10 watts in the 2x crossed g Elements). I heard sometimes my signal but could not complete a QSO.

So, from Oct. 17 to Oct. 19, I used relatively high power (80 watts to antenna) and completed several 2 way QSO's, and became more acquainted with azimuth and elevation tracking.

Since Oct. 20, all QSO's have been completed using low power (10 to 25 watts): so I think lack of practice in tracking satellite and in operations was the reason why I could not succeed during 2 first days.

Another reason was perhaps lack of practice of other stations, too, because I received QSL's from SWL's reporting reception of my signals during this period (Oct.15 to Oct. 17.).

5) I think a lot of stations are using too much power and poor receivers (some stations are often overloading the satellite, specially during near overhead pass).

6) Telemetry values seem normal (except sometimes for unusual high current and battery discharge). However, one of the batteries is less charged than the other one.

Translator is working fine, without any troubles: actually, its output is very often between 500 mW and 800 mW.

7) I retransmitted on 2 meters news of launch as received from K1LPL/3 and now I transmit one time a week orbital predictions calculated here. So a lot of stations are interested in AMSAT activities, and I have sent them membership applications (F5XU, F5XW, F5SN, F1A0D . . .).

I would thank the stations W32M, K1LPL/3, W6AB and their operators, who transmitted news before and during launch of Thor Delta vehicle, on 14.280 and 21.280 MHz.

I congratulate AMSAT headquarters and the people who contributed in successful construction and launch of OSCAR 6.
For the first time, we have a satellite really operating, and 2 meters band is now a DX band with "openings" every 115 minutes, 6 or 7 times a day.

F2DC
Beaumont, France
Feb. 4, 1973

Dear Sirs:

I feel that I must register my thoughts concerning some of the proposals for future satellite programs presented in the December, 72 AMSAT newsletter.

I cannot agree with the concept of a vehicle designed primarily for "DX and Contests," NOR would it be wise to provide "telemetry only" capabilities. Somehow, amateurs occasionally lose sight of the reason we have been provided a sizeable chunk of the RF spectrum; PUBLIC SERVICE!

I agree that the public will be served via a synchronous satellite which provides reliable communications over a wide area, utilizing low powered, inexpensive ground equipment. The public will also be served by the scientific contributions stemming from studies and experiments associated with a satellite in polar orbit containing a comprehensive telemetry system.

I cannot convince myself that the public's best interests will be served by a "DX and Contest" satellite! Conversely, such a program would only further encourage the ILLEGAL use of excessive power, the same bad manners and lack of respect for others' rights as now displayed on the HF bands, coupled with the resultant QRM which would obviate use of the repeater for emergency or public service communications!

I feel that AMSAT has done an excellent job of orbiting a satellite which "has something for everyone" in OSCAR 6. We must not allow individuals or groups representing a narrow range of interests to dictate what programs or experiments should or should not be included; rather, input must be sought from all interested parties, followed by a comprehensive analysis resulting in future satellites which will continue to "have something for everyone," including the public.

In regard to one of the other proposals, the "drifting balloon carrying amateur radio" concept warrants further study. This program would allow not only intriguing communications possibilities, but immense potential for valuable weather studies as well. Certainly, some difficult problems would have to be addressed, such as the possible aeronautical hazards and the random travel habits of such a package.

One further sensitive item that I must address is the financial burden associated with all these programs. I am sure that there are currently many amateurs utilizing OSCAR who are not members of AMSAT, or who have not yet made any contribution to the program. I do not agree with those who would classify these individuals as "free-loaders;" rather I imagine that many have never considered the tremendous amount of time and money involved in the satellite programs to date. To those individuals I extend this plea: if it is within your financial means, please consider either joining AMSAT (dues $5/year), or making whatever contribution you can manage. It will greatly enhance future efforts.

I apologize for having lapsed into sermonizing; keep up the good work, and my sincere appreciation to all those whose efforts have made OSCAR 6 a reality!

Sincerely,
Ron Dunbar, WQMJS
Burnsville, Mn. 55337
Jan. 6, 1973

Dear Sirs:

I am sending you my first report about the OSCAR 6 activity.

I have tried to work during all the satellite evening orbits, but the QSO's have been poor.
My greatest handicap is the noise that I have on the 29 MHz band from the local car traffic.

I couldn't hear the AMSAT NET-DOM on 14 and 21 Mc bands; besides, I don't know when and why the OSCAR 6 is deactivated.

I can tell that during the evening orbits it will be better to work OSCAR 6 after 20:00 Z because the QRM in reception is lower than during the other orbits. This is right for all the OM's who live in the cities where the industrial and automobile QRM is very strong; these problems do not exist for the OM who lives in the countryside.

My working conditions are sufficient for good contacts via OSCAR 6; by my two 144 Mc antennas I can translate on repeater in the most of orbits.

I think that a translator 144/432 Mc is more useful about the noise on the RX. However, I am very glad for OSCAR 6 and I send you my congrats for the wonderful job!!

Rest 73,
Michele Senestro
ILTEX
Torino, Italy
Dec. 21, 1972

Dear Sirs:


I am currently working on a research project in the 24 GHz range. We suffer quite a lot of signal loss due to O₂ resonance in the air so I feel quite certain that any earth based station would find extreme difficulty in getting signals to an orbiting satellite. It would be more likely to work from satellite to satellite or from satellite to moon.

A training issue on spectrum characteristics might be informative to those amateurs who are not involved in the field of radar and remote sensing.

Also, planning comment:

Unless suitable operational precautions can be incorporated in a synchronous repeater/translator, I suggest that future repeater systems remain non-synchronous.

The attractive features of a synchronous satellite (fixed location, wide coverage) are, in my opinion, far outweighed by the disadvantage (continuous access to an enormous number of ground stations) resulting in problems similar to those faced by fixed repeaters in large metropolitan areas.

It is indeed unfortunate that overcrowding cannot be avoided; no matter how courteous the large majority of users there are always a few who abuse the system and degrade its usefulness for everyone.

73,
Larry Eichel, WA2HSP/Ø
Lawrence, Kans.
Feb. 21, 1973

Dear Sirs:

I read with interest your proposal to use atmospheric balloons to carry repeaters. You're probably in a better position in Washington than I to know what the chances of getting FCC approval are for such a project. Possibly good, especially if the frequencies employed are 1215 MHz or more, where there is little chance of causing harmful interference. The definition of spacecraft in the US regulations might cover a balloon that reaches an altitude of 15 miles or so, as it's beyond the major part of the atmosphere.
One thought came to mind as I was reading your piece in the AMSAT newsletter. There's a lot that we don't know about winds in the upper atmosphere, and tracking these balloons, especially if they have gear to telemeter temperature and pressure could make a significant contribution to knowledge of the upper atmosphere.

73,
Rev. Benjamin Clark, WB4OBZ
Mepkin Abbey
Moncks Corner, S. C.
Feb. 2, 1973

Dear Sirs:

I received today your letter with enclosed membership application form and the December issue of the AMSAT newsletter. I was very pleasantly surprised to get this paper, because I am very interested in amateur satellites in all their aspects. Just a week ago I published in the Bulletin of the Central Radioclub of Bulgaria a large article about OSCAR 6 giving all available details on the launching, the mean technical parameters of the repeater, the parameters of the orbit, a table with all data of orbits No. 1001 till 1024, which can be used as base for prediction calculations, and a method for easy calculations to predict the future movement and traffic possibilities of OSCAR 6. At the moment I'm writing another article on OSCAR 6, especially for the German QRV-magazine, which shall be completed with rotating two sheet map, giving the northern hemisphere and the path of OSCAR 6 in polar-azimuthal projection. I think it will be a very clear, simple and practical aid for predictions on OSCAR 6 and all future satellites in sun synchronous orbit. Anyway, the papers you sent to me will give excellent material and data for my future work on this field and thank you sincerely again!

Up today 6 Bulgarian amateur stations have operated via OSCAR 6. These are: LZ1DW, LZ1FO, LZ1BW, LZ1AG, LZ2FA and LZ1AB. About 280 QSOs with 30 countries have been logged.

Sincerely 73,
Wassil Tersiew, LZ1AB
Sofia, Bulgaria
Jan. 24, 1973

WANTED: ALL STATES OPERATING THROUGH OSCAR 6

Our information indicates only 41 of 50 states have amateurs communicating through OSCAR 6.

Operation from the following states is badly needed:

Kentucky Nebraska New Mexico Vermont
Louisiana Nevada South Dakota West Virginia Wyoming

We urge amateurs in these states to equip for OSCAR 6 operation, or else organize weekend "OpEditions" to put these states on the air. (Oscar 6 is currently operated Thursdays through Mondays, GMT). Also, Field Day (June 23-24) might be an ideal time to put these states on the air. This is a chance to be the object of a pileup.
THIS IS A TEST TRANSMISSION FROM VK3YDB TO VK6HK THROUGH THE 144/29 MHZ REPEATER ON THE OSCAR 6 AMATEUR RADIO SATELLITE.

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THIS IS A TEST TRANSMISSION FROM VK3YDB TO VK6HK THROUGH THE 144/29 MHZ REPEATER ON THE OSCAR 6 AMATEUR RADIO SATELLITE.

1234567890 1234567890 1234567890 1234567890

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The teletype messages above represent the first successful transmission of RTTY data through an amateur radio satellite in Australia. The test was conducted between George Long, VK3YDB in Melbourne and Don Graham, VK6HK in Perth. The message was transmitted from VK3YDB to the 29/144 MHz repeater on the OSCAR 6 amateur radio satellite at 1320 GMT on Wednesday, 29th November, 1972. The test was conducted on the satellite's 561st orbit. The uplink frequency used was 145.95 MHz. The transmission was FM, with deviation of ± 10 KHz. The signal quality received by VK6HK was good, peaking to 15 dB above the noise. As can be seen from the above copy of the received message (2), there are few errors, and most of them were caused by speed variations in the three tape recorders used in the experiment. This type of problem can be overcome by using teleprinter units at both ends of the link. Doppler shift also posed problems and can best be coped with by the receiving station retuning the receiver between messages.

The success of this initial experiment is the most satisfying when it is realized that only narrow shift was used in the audio tones for the RTTY. The center frequency was 3145 KHz, with mark and space being ± 42.5 Hz from that center frequency.

For information and a membership application, send a self-addressed, stamped envelope to:

Membership Committee
AMSAT
P.O. Box 27
Washington, D.C. 20044
USA

TM

AMSAT
NEWSLETTER

Volume V  Number 2  June 1973

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WASHING r
D.C.

FIRST CLASS MAIL
EDITORIAL -- "97.1(b)"

by Tom Mitchell, WA3TBD

"Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art..."

These words, which should be familiar, are one of the major fundamental purposes of the Amateur Radio Service as set forth by FCC. They are words we can be proud of...especially if enough of us continue on in this tradition.

In this issue we have some information of investigation and research into a phenomena which, if its existence is proven, will no doubt be considered a major contribution to knowledge in the physical sciences. (See the article on "Inverse Doppler" elsewhere in this issue.)

Those of us who, for one reason or another, are unable to assist in this type of investigation should highly commend those who can and do. Taking the time to make the meticulous observations and calculations needed to document a phenomenon of this type takes a real dedication.

Whether or not these efforts, or similar ones, result in significant contributions to knowledge, everyone who supports AMSAT can feel that they are supporting one of the most worthwhile of amateur radio's scientific quests in pursuit of the above mentioned "fundamental purpose."

AMSAT Nets

The following AMSAT nets are now in operation:

North America East Coast 75 Meter AMSAT Net
Mondays 9:00 p.m. EDT (01:00Z Tues)
3855 KHz LSB
Net Control: W3ZM or W3TMZ

North America West Coast 75 Meter AMSAT Net
Mondays 8:00 p.m. PDT (03:00Z Tues)
3850 KHz LSB
Net Control: W6DMN or W6BGJ

International 20 Meter AMSAT Net
Sundays 1800 Z
14,280 KHz USB
Net Control: W3ZM or others

International 15 Meter AMSAT Net
Sundays 1900Z
21,280 KHz USB
Net Control: W3ZM or others

European 40 Meter OSCAR 6 Net
Sundays 0930Z
7070 KHz LSB

European 80 Meter OSCAR 6 Net
After passes on ON days
3780 KHz LSB
In addition, the frequencies 3855 KHz (LSB) and 14,280 KHz (USB) are being used as general watch frequencies for satellite information after passes.

In the Washington area AMSAT traffic is handled via 2 meter FM on 146.85 MHz simplex and through the AMSAT repeater 146.25 to 146.85 MHz. Those interested in satellites in other parts of the country are urged to use these same frequency combinations where possible. If a repeater is already on 25/85, get on it. If not, try to set one up or use 146.85 simplex. In this way we can all communicate more easily with each other when traveling.

FROM THE PRESIDENT'S DESK

By Perry I. Klein, K3JTE

OSCAR 6, first in the series of AMSAT-OSCAR-B missions, continues to operate satisfactorily after eight months in orbit. During the first week in May, the operating schedule was modified making the translator available for communications on Thursdays, Saturdays and Mondays, Greenwich Mean Time, and Off on other days. The purpose of this change was to subject the nickel-cadmium battery to shorter, more frequent charge-discharge cycles. This procedure appears to be working well, and may well extend the useful lifetime of the spacecraft.

The temperature of the battery, which had risen to as high as 47° C. (117° F.) in early February and had been a cause for concern, has now dropped to a more comfortable value. There is now no reason to believe that we will not achieve the one-year planned lifetime, and possibly even exceed it, although we may find it necessary to further modify the operating schedule from time to time in an attempt to extend OSCAR's operating life to the maximum possible.

As many of the users of OSCAR 6 have noticed, we have initiated AMSAT official bulletin transmissions through the satellite translator, and these are generally given on the reference orbits (the first orbit of each Greenwich day, the same orbit during which the satellite is turned on briefly for telemetry recording on the Off days). VE2BYG, K1HTV, W3TMZ and K7BBO have been serving as AMSAT Official Bulletin Stations for these transmissions, which include reports of special experiments and any changes in the operating schedule.

We can now identify the calls of some 1,100 stations who have made one or more contacts via OSCAR 6, very nearly half of these stations being outside the USA. These include stations from 59 countries, including CT2, DL, DU, EA, EI, F, FC, FP8, G, GI, GM, GW, HA, HB, HG, HK, I, JA, KP4, KK6, LA, LX, LU, LZ, OE, OH, CHQ, OK, ON, OX, OZ, PA, PY, SM, SP, SV, TF, UA1, UB5, UC2, UG6, UJ8, UR2, UW6, VE, VK, VKQ, VP2V, VP9, VU, W, LX, YU, ZE, ZL, BS, 4X, 6Y, and BP.

In the United States, all 50 states except the state of Nebraska have been on at one time or another, although more activity is needed in Idaho, La., Kentucky, Montana, Nevada, Vermont and Wyoming, as only spotty activity has been reported from these states. The number of stations on from each of the US call areas is W1: 38; W2: 64; W3: 47; W4: 64; W5: 34; W6: 91; W7: 53; W8: 30; W9: 61; W8: 52; KH6: 2; KL7: 5. We have one report of operation from VB8, and activity in Africa, South America and the Far East also seems to be very sparse. We urge members in these regions to equip for satellite operation during the coming months.

The operator apparently leading with the most reported satellite contacts is K7BBO with over 3,300 QSO's (Dave is averaging about 500 satellite QSO's a month), and several stations now have over 45 states confirmed through the satellite.
A special message commemorating World Telecommunication Day was transmitted over OSCAR 6's Codestore message storage system on May 17 using the 29.45 MHz beacon.

The first reported aeronautical mobile communication via OSCAR 6 was by W6OAL, who reported working K7BBO April 27th on Orbit 2431 over a distance of approximately 5,000 miles. The transmitter aboard the aircraft was a Gonset Sidewinder operating on SSB with less than 5 watts PEP to a simple whip antenna.

W2GN for the past several months has been quite successful with an automobile OSCAR terminal, and has been very popular with his special state DX-peditions to Vermont and Kentucky to put these rare states on the air. AMSAT is encouraging more mobile terminal operation with OSCAR 6. In particular, operation from small private aircraft, small boats and automobiles (especially on SSB) would provide a very effective demonstration of the usefulness of amateur satellites for small-terminal communication. In addition, operation using totally hand-held equipment or operation from a bicycle or motorcycle would be impressive "firsts," and we urge anyone interested in these activities to give it a try. If possible, make tape recordings of some of the mobile contacts and send them to AMSAT.

AMSAT gratefully acknowledges recent donations of $25.00 or more from the following:

The American Radio Relay League
S. M. Bedford, Jr. - WB4SJT
Robert E. Crumrine - WB2DNN
Lloyd Ferns - VE3BZF
Hank Fitz - W4URU
Foundation for Amateur Radio (Washington, D. C.)
George H. Gray - W7JWV
Stephen J. Hay, Jr. - K5RZU
John L. Hill - WØZW
International Amateur Radio Union - Region 1

C. Stanley Leaf - K8MYN
Richard E. Lee - K4BAP
R. S. Long - WA4JID
McIntosh Laboratory, Inc.
Fred J. Merry - W2GN
George M. Orr
Ottawa Amateur Radio Club
Edgar C. Steebe, Jr. - WA2RDE
Jerry S. Stover - W5KZN
Paul S. Warren - WA9ZDL
J. W. Heather, Amarillo, Texas

We also thank the many others who made financial contributions to assist the AMSAT-OSCAR-C and AMSAT-OSCAR-B projects.

AMSAT Board of Directors Meeting
March 1, 1973

The Board of Directors meeting was called to order by President Klein at 8:18 p.m. at the home of Charles Dorian.

In attendance were Perry Klein K3JTE, Bill Tynan W3KMW, Charles Dorian W3JPT, Bill Hook W3QBC, Ray Soifer K2QSW, Dick Daniels WA4DGU, John Gregory W3ATE, Cap Petry W3AWN, and Tom Mitchell WA3TBD.
President Klein reported on the results of the recent ASSC meeting. A draft copy of the minutes was circulated for the Board to read. Continued participation in the ASSC was concurred in.

Discussion followed the present status of OSCAR 6. It was agreed to continue the 4 days (Friday - Monday GMT) on and 3 days off schedule. The beacon is to be kept in the telemetry mode and Codestore only used for special purposes. The Codestore loader at Talcott Mt. is to be returned for overhaul and use in the Washington area.

Bill Tynan reported on the current status of Skylab and possible amateur involvement.

Approval was given for an AMSAT representative to go to the Dayton Ham-vention in April and the Rochester VHF Convention in May to speak on AMSAT matters.

Material for the March issue of the Newsletter was solicited.

John Gregory reported on net activities and advised the present schedules would continue until further notice. He also advised that the AMSAT "hotline" was being called from 185 to 225 times per week.

Bill Tynan advised that work is continuing on the local AMSAT repeater.

AMSAT Board of Directors Meeting
April 28, 1973

The Board of Directors meeting was called to order at 10:30 a.m. at the home of Perry Klein.

In attendance were Perry Klein K3JTE, Dick Daniels WA4DGUI, Bill Dunkerley WA2INB, Bill Hook W3QBC, George Kinal WA3TRL, Jan King W3GEY, and Bill Tynan W3KMV.

A discussion was held on the policy regarding reimbursement of automobile travel expenses. Bill Dunkerley recommended that the policy be consistent with ARRL policy and this concept was approved. The rate is 10¢ per mile, or the equivalent air fare, whichever is lower. Prior board approval will be necessary. Lodging but no meals are included. The policy covers local travel, but applicants should use judgment and discretion, considering modest amounts as a goodwill contribution to the cause.

Perry Klein reported on the visit by Jan King and himself to the offices of American Satellite Corporation concerning containing claims to the use of our trademark "AMSAT." The various alternatives are for us to essentially sell them rights to exclusive use of the mark, work out an arrangement for both organizations to use it (dual use), or retain "AMSAT" for our exclusive use. The topic was tabled pending a formal reply from American Satellite Corporation to our correspondence. AMSAT has filed in opposition to American Satellite's attempted registration of our trademark.

Discussion was held as to which day we should have our annual meeting. It will be held in conjunction with the Roanoke Division convention on September 14-16, which includes a technical symposium on space communications. Chuck Dorian is in charge of the activities in connection with the ARRL Technical Symposium to be held in conjunction with the Roanoke Division Convention and will make the final determination.

Jan King introduced the topic of a proposed airborne repeater test of the DJ42C repeater prototype by the JPL club. August 25 is scheduled for a pre-flight; the actual test flight will be Sept. 22. The board approved AMSAT support on a 50/50 basis up to $100 maximum. The JPL club will make all arrangements and handle all publicity, however.
A discussion was held about the recent incorporation of AMSAT (Germany), A. G. The relationship between AMSAT (US) and AMSAT (Germany) is not clearly defined at this time. While they might become a member society of AMSAT (US), the status of DASC, which is a member society of AMSAT (US) would then be somewhat ambiguous. Jan King was requested to discuss and coordinate this matter on his upcoming trip to Germany.

Bill Dunkerley pointed out that there have been rumors that OSCAR 6 was near the end of its operational life. These rumors are not based on any real facts. Nevertheless, a consistent and less confusing operating schedule is needed. Jan King suggested one day on, one off, but this would result in opposite schedules from one week to the next. A different schedule, namely Thursday, Saturday, and Monday (GMT) ON was suggested and agreed upon. This is tentative, of course. It was also decided to adopt a policy of bulletin broadcasts over the satellite at 29.5 MHz and VE2BYG, K1HTV, W3TMZ and K7BBQ were designated as AMSAT official bulletin stations. Perry Klein mentioned that additional funding was needed by one of our control stations. An additional $100 was allocated, and separate attempts will be made to obtain improved antennas also required by that station either by contribution or at discount.

A request for supplemental funding from ARRL was discussed. A request will be submitted to the July ARRL board meeting.

Bill Hook alluded to complications in accepting new memberships at hamfests where AMSAT has representation. However, Bill Tynan pointed out that there is an important "enthusiasm" or "impulse buying" factor involved. The majority of the board seemed to agree that the policy of signing up members at these meetings should be continued. Bill Hook will make up a "packet" or "kit" to minimize the difficulties in the future.

Receipt of a letter proposing the establishment of a Petry memorial fund was acknowledged. This is the idea of WB1BG and was approved with the understanding that it will be administered by him.

Bill Dunkerley discussed the progress of the educational program developed by ARRL and Talcott Mountain Science Center, and the critical importance of the continued availability of a working satellite. He asserted that if the probability of having a working satellite is not high for next year, the educational program will have to be phased down. Bill Tynan suggested that AMSAT take the position that the educational program be continued with the same emphasis. Perry Klein and George Kinley made comments to substantially the same effect. The problem appears to be that it is difficult to say whether OSCAR 6 will still be in operation throughout the 1973-74 school year, and A-O-S cannot be accelerated in time for launch much earlier than the second half of 1974. Bill Dunkerley then recommended that a decision to develop a replacement satellite must be made if the educational program is not to be jeopardized. Furthermore, the League feels that the educational aspect is most important in the field of satellite communications. However, Perry Klein and Jan King felt that an interim satellite effort would retard the A-O-B program. It appears that two avenues for launching amateur repeaters in the near future exist, and so a compromise was agreed upon which would accelerate procurement of one or more two-to-ten meter repeaters. These would then be "on the shelf" for immediate availability should a special launch opportunity arise with a short lead time. The hiring of a skilled technician to perform the rapid assembly was authorized.

Larry Kayser and his group in Canada have proposed to construct a 435 MHz beacon for flight on A-O-B. The proposed project was approved on the same terms as all other A-O-B experimenters, namely that specifications must be met. There was no consensus on whether they could be promised the flight use of this beacon, some feeling that if a substantially higher quality beacon were received from another experimenter, it should be used instead. George Kinley pointed out that the specification is quite rigorous, and the chances of a different design being far superior to the one in question are quite remote. Therefore, Mr. Kayser's group will be given highest priority of flight but not 100% ironclad assurance.
A beacon system at 2304 MHz has also been proposed by the San Bernardino Microwave Society for flight. A possible difficulty is that this band does not have international approval for amateur satellite use. Bill Dunkerley pointed out that Radio Regulation 115 could be used to justify operation. Perry Klein said that a request to the FCC has been made for approval, and that the positive command feature would eliminate many objections.

The meeting was adjourned at 7:45 p.m.

George Kinal, WA3TRL

IN MEMORY OF OUR FRIEND CAP PETRY

by Lowell Croysdale, W8IRG

March 26th may soon be forgotten but like the immortal Lincoln stated at Gettysburg: "The world may soon forget what we say here, but will long remember what we did here." On this date the amateurs of the world lost another extraordinary man -- the late Cap Petry, W3AWN, passed away in Hong Kong, China.

The press releases, for the first time, revealed to many of us who knew Cap, his accomplishments in the business world of radio and electronics. Like many of the other Silent Keys, Cap never bragged on the air or in personal contact of his business success.

Cap was born in Bowells, North Dakota, 67 years ago. In 1932 he became communications engineer for United Air Lines, and along with Herb Hoover, Jr. and others spearheaded that great advancement in modern communication. Later he was advisor to the New York Port Authority where he assisted in the communication planning of the original La Guardia Airport. Being a pioneer in air traffic control, which was adopted by United, American, and TWA, he was well known in Washington. This latter recognition caused him to be sent in 1945 to foreign countries for the Chief of Staff as American representative at the rank of Colonel. At his retirement last year he was special assistant to the president of Aeronautical Radio, coordinating future planning of satellite communication with NASA as well as other government agencies.

Licensed in 1921, Cap had long ago received the fifty year award. In the years as an amateur he organized and was the first president of the Dayton Amateur Radio Club. Later he organized the Airing Amateur Radio Club. A supporter of AMSAT, he was one of the original directors and greatly responsible for organizing the worldwide net of hams interested and reporting on OSCAR. You might also say he had his private net, of some twenty former Daytonites, and others which met twice to three times weekly to keep alive that bond of personal friendship enjoyed in their days of living in Dayton. The recent Dayton Hamvention paid tribute to him and those left behind carried on his Amateur Space Communication Forum.

Never to be forgotten by amateurs all over the world is that Friend Cap, a truly 80 operator respected by all and admired for his interest and humanitarian response to any and all he heard. During illness and tragedy, which befell many of us, Cap was always around with personal condolence and thoughtful encouragement. On the air, and in personal contact with him, amateurs rallied around and received advice, counsel, encouragement, and instruction. Many of today's operators remember his patience and assistance during the agonizing years of getting a novice license and that valued assistance going up the ladder in our amateur world.

In conclusion, quoting his brother, Edwin, "He was a builder and a hard taskmaster, most of all on himself, as he always strove for perfection. He was always gracious and appreciative of the smallest things." And all amateurs are indebted to his lovely wife, Florence, who so graciously shared his time with us all during the years.
OSCAR 6 Operating Schedule
By Bill Tynan, W3KMV

The regular operating schedule of OSCAR 6 is now as follows:

ON -- Available for two-way contacts:
0000Z - 2400Z Thursdays, Saturdays and Mondays.

OFF -- or if ON, not available for two-way contacts:
0000Z - 2400Z Fridays, Sundays, Tuesdays and Wednesdays.

ON -- not available for two-way contacts for about three minutes
about ten minutes after the first ascending node (S-N
equatorial crossing) on each scheduled OFF day. This
operation is for the purpose of collecting telemetry data.
Those copying telemetry data at any time are urged to send
the raw numbers to:

AMSAT Telemetry Data Dept.
P. O. Box 27
Washington, D. C. 20044 USA

Modifications to this schedule will be made should it become necessary
or if special operating situations make it desirable. Also, the operating
schedule may be extended for DX-peditions and other worthy causes.

Word on schedule changes and other pertinent data can be obtained from
any of the following sources:

AMSAT Nets (See Page 2)
AMSAT Hot-Line (301-654-1166)
W1AW Bulletins (See QST)
AMSAT Bulletin Stations VE2BYG, K1HTV, W3TMZ and K7BBQ
(These stations transmit on the satellite on about
29,500 KHz on the reference orbits.)

SATELLITE OPERATING AWARDS
By Raphael Soifer, K2QBW

To pirate somebody's recent ad for SSTV gear, OSCAR 6 really is "the
newest activity in amateur radio." As of May 1973, no less than five awards
have been offered for OSCAR work, ranging in difficulty from the most basic
to the nearly impossible. Here are the details, in approximate order of
difficulty:

Satellite Communicators' Club (S.C.C.)

Sponsored by AMSAT, this attractive certificate is offered to any licensed
amateur station making a two-way contact through the OSCAR 6 satellite. To
receive yours, send QSO details including date, time (GMT), station worked,
modes and signal reports for both stations to AMSAT, Telemetry Department,
Box 27, Washington, D.C. 20044. There is no fee, but an SASE marked
"Satellite Communicators' Club" would be appreciated. A special OSCAR 6 QSL
card will also be enclosed, if you haven't already received one. If possible,
please use the "OSCAR 6 Communication Report" form for reporting your contact(s).

WVE Satellite Award

Sponsored by the Northern Alberta Radio Club, this award (Worked Canadian
VE Call Areas Via Amateur Satellite) is designed primarily to develop a
greater interest in amateur satellite communication. The Award is available to any licensed amateur in the world. W/VE stations must contact, on any mode, any four Canadian call areas (VO1, VO2, VE6, 1, 2, 3, 4, 5, 6, 7, 8) via an amateur satellite. DX stations, including KH6 and KL7, must contact any two such Canadian call areas. Only contacts after January 1, 1973, will qualify for this award. An application will consist of the required QSL cards accompanied by a fee of 25 cents for W/VE or one IRC for DX stations. Include sufficient IRC's if cards are to be returned by registered mail. Send cards and fees to the Committee Chairman: Ray J. Nadeau, VE6SF, P. O. Box 52, Barrhead, Alberta, Canada.

Satellite DX Achievement Award ("1000")

Sponsored by ARRL, the "1000" recognizes two-way communication via OSCAR 6. To qualify, a station must accumulate 1000 points as follows: Each contact with a new station counts 10 points, each new country counts 50 points, each new continent counts 250 points. For example, the first European contact for a W/VE would normally count 310 points -- 250 for the new continent, 50 for the new country and 10 for the new station. A station having 15 different stations (150 points), 3 countries (150 points) and two continents (500 points) would have a total of 800 points and still need 200 to qualify. QSL cards must confirm 2-way communication via OSCAR 6, contain a date of December 15, 1972, or later, plus usual QSL information. Photocopies of the QSLs are not acceptable. Only one contact per station, regardless of mode. Postage of one dollar is required if you wish cards to be returned via registered mail. When you're about ready to apply for the award, request the appropriate application form from ARRL Headquarters, 225 Main Street, Newington, Conn. 06111.

OSCAR 6 WAS (Worked All States)

Sponsored by AMSAT, this award has yet to see its first claimant. Regular ARRL rules for Worked All States apply, with the following exceptions: WAS Rule 3, prohibiting contacts made through repeater devices, is of course waived, and is replaced by a rule requiring all QSL cards to confirm two-way communication via OSCAR 6 on or after October 15, 1972. There is no fee, but sufficient postage should be sent to cover return of the cards. To apply, secure a copy of the WAS application form (Operating Aid No. 8) from ARRL Hq. and send it, with your 50 QSL cards, to AMSAT, WAS Award, P. O. Box 27, Washington, D. C. 20044. Please note that this is an AMSAT award, not an ARRL award, and endorsement of ARRL WAS to show satellite operation is not available. The form of the award has not yet been decided, but it will be suitably impressive.

CQ DX Award OSCAR Endorsement

Sponsored by CQ Magazine, this award likewise has yet to be won. As an endorsement, it is available to holders of the CQ CW or SSB DX Award. To qualify 50 countries must be worked and confirmed via amateur satellite since November 15, 1945; be advised that any cards submitted showing dates before March 9, 1965, will be carefully scrutinized, hi! Rules are, in all other respects, the same as those for the CQ DX Awards; note that while single-mode confirmations are necessary for the basic DX Award and for country endorsements, confirmations submitted for the OSCAR Endorsement may be on any mode. Further information may be obtained from CQ, 14 Vandeverter Avenue, Port Washington, New York 11050, or from K41IP, WA6GDL or a member of the CQ DX Advisory Committee in your area.

AMSAT is pleased to publicize these awards because they assist in stimulating activity via OSCAR 6. As for this writer, he still needs one Canadian call area, 19 states and 43 countries. We hope you're doing better!
Preliminary Observations on Oscar 6 Inverted Doppler

By Ron Dunbar, W0MJS and John Fox, WØLER

Editor’s Note: A more complete report on this subject will be presented by the authors at the technical symposium mentioned elsewhere in this issue.

The flight of Oscar 6 has been a tremendous success; it has challenged the imagination and ingenuity of countless individuals by presenting the opportunity to devise and test new modes and methods of VHF communications, simple yet extremely reliable telemetry systems, accurate ranging systems utilizing commonly available equipment, new methods and findings in the area of propagation research, as well as countless other benefits.

It is this last subject, propagation, which we will address in some depth, concerning a UHF propagation anomaly first discovered while observing the 435.1 MHz telemetry beacon aboard Oscar 6. For lack of a more descriptive term, we have chosen to christen the anomaly "Inverted Doppler."

Under normal circumstances, if one plots received frequency versus time for one satellite pass, a curve similar to the one depicted above by the solid line will result. With only minor variations, this curve is representative of that which is predicted by the "Doppler Effect" theory. The apparent shift in frequency is due to the change in the satellite's velocity relative to the observer on Earth. Although many factors influence the amount of apparent frequency shift (such as tropospheric and ionospheric effects, variations in electron density and the plasma surrounding the satellite itself), all these combined effects will normally create a shift of only 40 Hz or so at a frequency of 400 MHz according to theory. Therefore, the effect may be practically stated in a slightly simplified form as follows: As the satellite approaches the observer, its velocity is added to the velocity of propagation of the radio signal, creating an apparent upward frequency shift on the order of 8 kHz above the true (transmitted) frequency at 435 MHz. The amount of upward shift gradually but steadily decreases until the instant when the satellite is nearest the observer, or "TCA" (Time of Closest Approach). Its velocity relative to the observer is then zero, and at that instant the observed frequency is the same as that transmitted from the satellite; i.e., no frequency shift, either up or down.

As the satellite recedes from the observer, its velocity is subtracted from the velocity of propagation, resulting in a total apparent downward frequency shift of approximately 8 kHz, for a shift during one orbital pass of ±8 kHz, or 16 kHz total.

This normal effect had been noted on all previous Oscar satellites. However, on October 24, 1972, WØLER (John Fox, Minneapolis) noted an unusual occurrence immediately following AOS (acquisition of signal) on Orbit 118. Instead of the normal downward frequency shift, the signal was climbing in frequency at a rapid rate. The climbing effect gradually decreased, stopped, and then was followed by normal Doppler shift for the duration of the pass. Since no one else in the Minneapolis area was tracking the 435 MHz beacon at that time, WØLER was unable to verify the observation and assumed the
strange behavior to be caused by drift in his receiving system. A thorough equipment check revealed no malfunctioning components, however. Subsequent orbits occurring later that evening exhibited only normal Doppler characteristics.

The following evening, the same upward shift was noted! This time, both the amount of upward shift, as well as the duration of the effect were measured and recorded as being approximately +450 Hz and 7 minutes following AOS.

At this juncture, WJLER contacted W8MJ5 (Ron Dunbar, Minneapolis) who had been observing signals on the 146/29 MHz translator aboard OSCAR 6. After discussing the anomaly at length, W8MJ5 proceeded to perform modifications to his receiving equipment which would allow reception of the 435 MHz beacon.

With two tracking stations now in operation, the rate of data collection was greatly increased, and with the stations on a North-South line only 25 miles apart, it was readily verified that both stations observed exactly the same phenomena.

After approximately three weeks of tracking and data analysis, it became evident that the Inverted Doppler anomaly was roughly confined to an equatorial crossing between 60°W and 90°W longitude. Due to the painfully slow eastward precession of the orbits, it was not possible to closely define the exact boundaries of the effect at this time.

Further analysis revealed that the duration of the effect was related to equatorial crossing time and showed an average duration of approximately 7.5 minutes past equatorial crossing on the northbound nighttime passes of OSCAR 6.

Our attention was then turned to the southbound daytime orbits passing over the same area in which the effect had been noted on the northbound passes. We anticipated that we would see an "Arrested Doppler" effect on the southbound passes; i.e., we expected the Doppler curve would be perfectly normal from AOS through TCA, but as the satellite approached the equator and LOS (Loss of Signal), we had reasoned that the normal downward shift, algebraically combined with the anomalous upward shift would probably cause the observed shift to be zero; i.e., the normal downward shift would appear to be "arrested" (see drawing below).

![Diagram](image)

Extensive investigation proved fruitless. Absolutely no abnormal effect was observed on the southbound daytime passes, even though they crossed exactly the same area as the nighttime passes had.

Continued investigation of the nighttime passes resulted in further refinement of the available data. The effect was found to encompass an area between 50°W and 105°W longitude as observed from our location in Minneapolis (45°N, 93°W). The magnitude of the upward shift varied from 20 Hz to 550 Hz, with the greatest majority of measurements falling in the range of 200-500 Hz. Duration of the effect past equatorial crossing averaged 7.43 minutes, with 91% of the readings falling within the range of 6-9 minutes.
Due to operational procedures designed to conserve battery power, OSCAR’s 435 MHz beacon was not run continuously, leaving several gaps in our data. We then turned to reception of signals from the NOAA-2 Weather Satellite operating on 137.5 MHz in order to speed up data collection. (NOAA-2 was launched by the same vehicle which carried OSCAR 6; therefore, both satellites were in an essentially identical orbit.)

Results were negative on 137.5 MHz. Several concurrent tests were conducted by tracking OSCAR 6 on 435 MHz and NOAA-2 on 137.5 MHz. Even though the two satellites were only 20 minutes apart, with practically identical equatorial crossings, no Inverted Doppler was noted on NOAA-2’s signal, even when it had been observed only 20 minutes earlier on 435 MHz.

These new findings led to the suspicion that the upward frequency shift might be caused by oscillator drift in the OSCAR transmitter, probably resulting from thermal effects associated with the satellite’s passing from sunlight into the Earth's shadow.

Two other stations who had been tracking the 435 MHz beacon were then contacted; W4FJ (Ted Mathewson, Richmond, VA) and W5SXD (Dick Allen, Houston, TX). Neither station was able to detect the anomaly that was being observed at our more northerly location. One possible explanation is that the anomalous effect may occur near TCA for these stations, at which point it would be most difficult to detect.

When the 435 MHz beacon’s output power dropped drastically on orbit 1081 (1/10/1973), we immediately built equipment for the 400 MHz satellite band. After a week of construction and testing, we commenced tracking operations on 400 MHz. We soon discovered that most of the satellites in that band are only turned on for short periods in order to retrieve stored data and then immediately shut down, yielding no data useful for our purposes.

Finally, after many fruitless hours involved in tuning, tracking, calculating of orbits, etc., we experienced success on January 30, 1973. Inverted Doppler was observed on a satellite named Gopernicus, operating on approximately 400.562 MHz. Spurred on by this new evidence, and assisted by many other amateurs who suggested possible frequencies, satellites, and orbital parameters, we finally located a group of five satellites which were in continuous operation and in a near circular orbit inclined only ±2° off the poles. These satellites are part of the Navy’s "NavSat" (Navigational Satellite) System, transmitting on 149.988 and 399.968 MHz simultaneously, by multiplying a common frequency source at 49.996 MHz times 3 and 8. One important difference between these satellites and OSCAR 6 is their orbits’ relation to solar time. At the time we commenced tracking the NavSats, their northbound pass occurred in the daytime; southbound at night; exactly the opposite of OSCAR 6!

The "Arrested Doppler" was indeed observed on the southbound nighttime passes, occurring almost exactly as predicted earlier! The normal downward shift merely tapers off and ceases, followed by several minutes of absolutely stable, steady signal until LOS! Absolutely no abnormal behavior was observed on northbound daytime passes.

Now came the task of refining our measurements of the orbital period of the five satellites. Accurate calculations concerning the time of equatorial crossing also had to be generated from sequential TCA observations.

Finally, all the necessary data was collected and a new set of computer listings containing orbital predictions was rapidly prepared by W6RLI (Hank Oredson). As the fates would have it, the effect ceased abruptly on the next day, February 5, 1973! As of May 5, 1973, the effect has not been observed again at this location.

Since that time, we have continued the research by reviewing any material even remotely associated with possible causes of the Inverted Doppler effect. One very promising item which recently came to light is contained in Part 2 of an article by Dr. Roger Harrison, VK2ZTB, of the Ionospheric Prediction Services Division of the Commonwealth Bureau of Meteorology in Darlinghurst, Australia. The article was printed in the February 1973 issue of the VHF Communicator, and is entitled "VHF TransEquatorial Propagation."
There appears to be several possible correlations between the Inverted Doppler effect and an effect mentioned by Dr. Harrison, called "Evening," or "Class II" TEP (TransEquatorial Propagation). In the article Dr. Harrison mentions that Class II TEP "shows a maximum occurrence between 2000 and 2300 LMT (Local Mean Time) with a pronounced peak for different seasons and particular paths." (OSCAR 6's northbound equatorial crossings occurred at approximately 2049 LMT.) He further states that maximum Class II TEP occurs during December and January from North and South America. The magnitude of the Doppler shift observed in connection with Class II TEP is definitely in the right ballpark. Further, VK22TB says that "Class II TEP is dependent on many factors (season, sunspots, geomagnetic latitude, etc.) that seem to have no bearing on true scatter mode propagation." He also offers the possibility that "Class II TEP is probably supported in some way by field guided ionization; the closer a ray can be launched to tangency with the magnetic field, the more favorable are its characteristics; i.e., higher frequencies will be supported." This last statement may well hold valuable clues concerning the Inverted Doppler anomaly!

At this point it would seem beneficial to summarize some of the findings concerning the anomaly:

1. Inverted Doppler is apparently a nighttime effect.
2. Inverted Doppler is apparently a seasonal effect, perhaps centered on the Winter Solstice.
3. Inverted Doppler seems to be frequency selective, since its effect was never observed at 137.5 MHz.
4. Inverted Doppler effect apparently ceases when the satellite reaches the vicinity of 23.24°N latitude (average) computed from the satellite's velocity and the average duration of the effect. (The Tropic of Cancer is located at 23.5°N latitude.)
5. The apparent eastern boundary (from Minneapolis) at 50°W longitude is explained by the fact that orbits crossing the equator further east than this point would have been more than 7.5 minutes north of the equator before we acquired the signal. This explanation does not, however, satisfy the western cutoff at 105°W, since we should still receive some part of the first 7.5 minutes past equatorial crossing out to approximately 123°W.
6. There may be a possible correlation between maximum shift magnitude and minimum "A-Index" as shown in Solar Geophysical Reports. More data is necessary to confirm this theory.

Our investigation continues, utilizing data gathered by research satellite such as ARIEL I (NASA SP-119), giving us profiles of electron, ion, and magnetic effects in the area of interest. No conclusions have been reached; however, theories abound. W2LER and W7MJS welcome any offer of assistance in the effort, since several questions still must be answered:

Do observers further east or west, but located near 45°N latitude observe the effect?

How far south is the effect detectable?

On what dates does the effect commence and terminate?

Is it somehow related to Class II TEP, and are both effects related to the "A-Index" and Solar conditions?

Could VHF/UHF communications via this mode be possible over vast distances?
The list of questions is endless. We solicit reports from any stations which were involved in tracking the 435 MHz beacon on OSCAR 6, be they positive or negative. All reports will assist in pinning down the area of the effect, and will be most welcome.

Ron Dunbar, WØMJS  
110 S. Heritage Circle  
Burnsville, MN 55337

John Fox, WØLER  
321 109th Lane NW  
Coon Rapids, MN 55433

NARROW-BAND FACSIMILE THROUGH OSCAR 6

By E. R. Angle, WA6GUY, and  
E. L. Arnn, WA3FVG/6

To date, and our knowledge, this is the first recorded successful transmission and reception of a facsimile picture through an amateur satellite.

To accomplish this, certain design goals were set forth.

1. **Low duty cycle** -- non-audio tone modulated carrier. For satellite power conservation.

2. **Narrow bandwidth** -- to minimize QRM. A signal compatible with high speed teletype.

3. **Simplicity of generating signals** -- within the capability of most hams.

4. **Compatibility with normal receiving equipment** -- tuned as a CW signal.

With the following system we met these requirements. Refer to block diagram. Basically, a CW transmitter is keyed on and off by a fax signal such that a spot on the fax paper produces a CW keyed output. This signal is transmitted (WA6GUY) to the satellite, sent back out on the down-link, received (WA3FVG/6) as if a CW signal and fed into the receiving fax machine.

Standard desk fax units were used for transmission and reception. Various message formats were tried. Typewritten material was selected for half of the picture since fading of OSCAR 6 signals previously proved to be quite rapid with existing antennas. It requires five seconds for a single typewritten line to be transmitted. The other half of the picture used larger characters for better contrast definition in the event signals were strong over the entire two minute twenty second period required for a complete picture. It's also easier to resolve.

See schematic diagram. Video out of the fax unit is normally of negative polarity and is amplitude modulated on a 2400 Hz carrier.\(^1\) It is fed to the threshold detector where it's compared with an adjustable DC voltage (threshold) and inverted, thus producing positive video, meaning, a black line on the message gives a positive signal cut whenever the input is larger than the threshold voltage. This signal is bursts of 2400 Hz square waves. The signal is then run into the digital detector which is a one-shot multivibrator with its pulse width set for one and one-half cycles of 2400 Hz, resulting in a maximum system bandwidth of 1 KHz.\(^2\) The output (Q) of the one-shot goes high when 2400 Hz is present at its input. However, because of the pulse period, no 2400 Hz is present. The output is TTL

\(^1\)"Conversion of Telefax Transceivers...," QST, May 1972, p. 23.

compatible as is the keyer used here. CW keying or fax signals will produce an output keying of the keyer. All keying is solid-state because some of the smaller lines on the picture produce pulse widths as short as one millisecond. Relays aren't usually this fast and they produce contact bounce, not very desirable here. Transmitter keying characteristics are important in that they should be slightly rounded off but not excessively or video on short pulses will be lost. With too fast a rise time the key clicks of the signal will be excessive.

Sync pulses are obtained from the sync contacts in the fax machine. They run directly to the threshold detector strobe input. When S2 is closed, a 2.2 msec pulse appears at the output of the transmitter every time the sync contacts open. This is a useful output since it is a low duty cycle and it gives the receiving station a signal by which to track under conditions of fading and Doppler. Since the transmitted video pulses are so short they produce little if any perceptible pitch for the receiving station. Bursts of tone shorter than 10 msec have no pitch. Switch S1 disables video during periods of synchronization. Deskfax units don't like the extra pulses while trying to sync.

A good reliable liaison (220 MHz) between transmitting and receiving stations was required for the success of this experiment.

Transmitting equipment consists of a Heathkit Pawnee 2 m transceiver, driving a 4CX250 linear amplifier (Ep 1250 V, Ip max 250 mA) for a DC input of 300 watts. Assuming 50% efficiency, this gives approximately 150 watts output. 1.5 dB feedline loss yields 105 watts to the antenna, a 2 dB over isotropic quarter-wave ground plane; 157 watts ERP. With the satellite at an elevation pointing angle of 45° there is approximately 3 dB antenna pattern loss or in this case, about 75 watts ERP. The enclosed picture was made with the satellite in this approximate position on Orbit #2460.

The receiving system utilized for facsimile via OSCAR 6 reflects the budget-minded nature of the writer. The heart of the system is a venerable, much-modified Knight Kit R-55A all-band receiver. This unit is preceded by a 6AK5 rf amplifier. The 20 dB gain of this amplifier lowers the noise figure of the receiver to 17 dB, allowing antenna (galactic) noise^1 to be heard. The receiver is followed by a 3.5 KHz sharp-cutoff low-pass filter which makes up for some of the shortcomings of the receiver's broad 1500 KHz IF amplifier. The output of the filter is fed to the facsimile transceiver and is monitored by ear using a Heathkit signal tracer to sample the filtered audio. During transmission of the message, it was necessary to listen to the recovered tone and close an AFC loop using the BFO control to maintain the pitch near 2 KHz in spite of Doppler shift and receiver drift. During some tests, a Knight Kit scope was used to evaluate signal quality at the fax machine input. The antenna is a 10 meter inverted-vee turnstile designed to provide circular polarization with good high-elevation coverage.

To save time and insure good message registration on the receiving blank, phasing (synchronization) signals were obtained by copying WA6GUY's 2 meter uplink frequency directly. Thus, the fax machine could be synchronized before AOS (acquisition of signal) or during a deep fade. An intercom link on 222.75 MHz which provided voice liaison proved extremely helpful in coordinating the operation. Confirmation of successful phasing, cries of joy, and tears of frustration were exchanged over this link.

The communication was conducted near the upper end of the OSCAR 6 downlink around 29.54 MHz since this part of the passband is seldom used. At least it seemed so until we tried using it! Some strong CW QRM did raise a cloud of smoke from the fax drum during a pass on 29 April, but generally things were in the clear.

Several obvious steps can be taken to improve the received signal. Among these is repairing the R-55. The vertical lines in the received fax message are 60 Hz power line interference caused by FM in the receiver BFO. Switching BFO tubes has since improved matters by some 12 dB. Another more fundamental change would be to incorporate a bandpass filter in place of the low-pass filter to limit the bandpass to the minimum required by the transmitted signal (less than 1 kHz). Also, since the transmitted signal has no grey scale but represents only black or white, threshold detection could be used to more perfectly recover the signal during periods of high signal-to-noise ratio. Use of a high-gain receiving antenna also comes to mind, but runs counter to our frugal nature. Additionally, there is strong evidence in the received message that the noise level at the output of the receiver fades with the signal from the satellite. This says that the satellite output signal-to-noise ratio limits the system for short slant ranges. Finally, a narrower IF bandpass would remove the audio image and improve the S/N ratio by as much as 3 dB.

Now, some comments on the more obvious (and less obvious) features of the received copy are in order. Firstly, and most obviously, the satellite did a fine job of repeating the words "VIA OSCAR 6." Also obvious are the vertical bars caused by the FM hum in the receiver BFO.

The strong vertical black line at each edge of the message is the sync/manual APC pulse of 22 msec duration. This pulse is strong enough that synchronization could be obtained via satellite with minimal signal processing. The lighter portions of this bar represent the periods of fade in the received signal. Note the deep fades in the beginning (top) and middle of the copy. A much shorter fade period was observed during an earlier daytime test. The slope of the edge of the sync bar shows that the satellite was getting closer during the transmission. The edge of the bar is nearly vertical at the end of the pass indicating it was nearly TCA (time of closest approach). If the direct 2 meter sync pulse had been written on the receiving blank, a comparison of its position with the position of the received sync bar would allow absolute time delay (and hence range) measurement.

Finally, to return to the transmitted text, the astute reader has probably noticed that there is no evidence in the received message of the vertical line which is so obvious in the original message. This, astute and suspicious reader, is because not all of the deficiencies were on the receiving end! The vertical line and handwritten text on the right were written in blue ink and consequently exhibit less contrast than the typewritten text. The threshold adjustment in the transmitting system is somewhat tricky, and in fact it was set too high to pass the blue vertical line. Many of the partial dropouts in letters such as the W and C in WEB5ARC during periods of good signal are in fact transmitting dropouts due to light printing on the original message.

We would like to express our appreciation to the other members of the WEB5ARC (West End of Building 5 Amateur Radio Club), A. A. Grey, WA6RQP, and R. L. Prakken, K7ZSB, at Hughes Aircraft, for their many helpful criticisms, suggestions and encouragement. Spirited discussions during our noontime meetings aided greatly in the development of the overall concept, video digitizer circuitry, and communication strategy.

OSCAR 6 QSL LISTS NEEDED!

Marc Pressman, WB4DRB, has developed a computerized AMSAT OSCAR 6 Communications Information Retrieval System which lists participating stations, states and countries that use OSCAR 6. Updating is done periodically, and all users of OSCAR 6 are invited to send an alphabetized list of the QSL cards they have received for QSOs through OSCAR so that we can bring the user list up-to-date. Reports from stations in IARU Regions 1 and 3 are particularly needed. Please send your list to AMSAT, P. O. Box 277, Washington, D. C. 20044, USA.
Dear Sir:

On Monday, 26th March, Mr. Gowing explained to us about a satellite and he said that it would probably appear that night. As we were standing there Beverley spotted a very dim light moving slightly. Beverley pointed it out to us. We talked a while about it and decided it was the satellite. The next evening we told Mr. Gowing we thought we had seen the satellite and described it to him and showed him where it was. He told us to write a letter to you.

Samantha Nobbs
Beverley Nobbs
Ann Goulding
(Ages 6, 8 and 11 years old)

ELEVATION -- HOW IMPORTANT IS IT?

By Wally Lamb, W5HPD

I am sure that all the fellows tracking OSCAR 6 would like to know how to get into it the greatest percentage of the time that it is within their range and with the equipment they have or plan on having. So far we have learned through previous articles on how to figure out where to point the beam (azimuth) and when. The next factor to learn is where to point the beam above the horizon (elevation) and discover if this is really as important as we might think.

First of all we must realize that any antenna pointed at the horizon does have some coverage in the vertical direction as well. How much coverage in the vertical depends on the gain of the antenna and its polarization. For the sake of this discussion we will assume that you can still get into the satellite when it is at an elevation of 25 degrees above the horizon. If this is the case, then you can hit 50% of the passes within your range 100% of the time. The other passes are only above 25 degrees less than 50% of the time so you can also get into them better than 50% of the time. In total then you can get into all the OSCAR 6 passes that come within your range 75% plus of the total time they are in your area (range) without the need for any elevation control.

The most important thing you can do to upgrade your station’s capabilities is to go cross polarization on both receiving and transmitting antennas!

To get the longest time into OSCAR you can elevate your antenna to the point where you start drawing in on your range of first acquisition; going beyond this point will cut down on your total time into OSCAR. In the case of the antenna we have mentioned this would be no more than 20 degrees elevation. You will then gain about 3 additional minutes of QSO time.

Now that you have made these changes and it still appears that you are missing those times when you can't hit the satellite because it is above the elevation range of your antenna, it is time to think about elevating the antenna system. If possible both the receiving and transmitting antenna should be elevated, no small task on a ten meter beam. If you do not want to go that route the next best thing would be to elevate the transmitting antenna only. The elevation should be variable but if that is too much work then the next best thing is to settle on two transmitting antennas, one that is fixed in the horizontal plane and the second fixed at the angle of elevation that takes over where the first beam leaves off. In the case of our example antenna this would be at an angle of about 40 degrees giving you full access to the satellite anytime from the horizon to an elevation of 60 degrees. You will still lose about 3 minutes on a directly overhead pass but the chances are that if you didn't elevate the ten meter beam you would lose it anyhow on the receiving end.

I have found a "Bible" for OSCAR work. It is called Satellite Tracking by Stanley Macko and is published by Rider Publications. The graph shown below is calculated on information from this book and the OSCAR 6 parameters.
You find the angle of elevation by knowing the distance the suborbital point is from you in degrees or miles. For an example, we find that when the satellite is half-way to us from the point of first acquisition, a distance of 16 degrees or 1100 miles, OSCAR will appear 24 degrees above the horizon. The time scale on the top shows the time it takes to go from first AOS to overhead on an overhead pass.

For another example, the satellite will be at an angle of 45 degrees when it is 600 miles or 8 degrees from your QTH.
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EDITORIAL -- ARRL Technical Symposium

by Tom Mitchell, WA3TBD

By now, everyone concerned -- and everyone SHOULD be concerned -- no doubt knows about the ARRL Technical Symposium on Space Communications, September 14, which will occur in conjunction with the Roanoke Division Convention, September 14-16. We urge everyone who possibly can to attend. Details have appeared in QST and on page 5 of the June Newsletter, as well as further details in this issue.

If you still have that center section in your copy of the June Newsletter, you shouldn't have -- the other side is a ballot for the four positions on the Board of Directors which will be falling vacant. If you haven't done so, mail your ballot IMMEDIATELY, as ballots will be counted at the AMSAT annual meeting, September 15, 1973.

Besides the election, the agenda is to include the AMSAT Annual Report and OSCAR 6 and 7 Progress Reports.

We especially urge members to attend this meeting along with the other activities being held in conjunction with it. As we hope you have already mailed in your ballot, you may need the following information repeated: The AMSAT Annual Meeting and Forum is scheduled from 11:00 a.m. to 1:00 p.m. at the Sheraton Inn and International Convention Center, Reston, Virginia (about 20 miles west of Washington, D.C.).

FROM THE PRESIDENT'S DESK

by Perry Klein, K3JTE

AMSAT 1973 Annual Report

AMSAT, the Radio Amateur Satellite Corporation, was established in 1969 to provide amateur satellites and satellite experiments for the Amateur Satellite Service. The purposes and objectives of the corporation, as given in the Bylaws are:

A. To provide satellites that can be used for amateur radio communication and experimentation by suitably equipped amateur radio stations throughout the world on a non-discriminatory basis.

B. To encourage development of skills and the advancement of specialized knowledge in the art and practice of amateur radio communications and space science.

C. To foster international goodwill and cooperation through joint experimentation and study, and through the wide participation in these activities on a noncommercial basis by radio amateurs of the world.

D. To facilitate communications by means of amateur satellites in times of emergency.

E. To encourage the more effective and expanded use of the higher frequency amateur bands.

F. To disseminate scientific, technical and operational information derived from such communications and experimentation, and to encourage publication of such information in treatises, theses, trade publications, technical journals or other public media.
Membership in AMSAT is open to all radio amateurs and other interested persons. AMSAT encourages the participation of all interested individuals in its activities and invites licensed amateur radio operators of all countries to engage in radio transmissions to the satellites. Membership is international, and currently totals over 954 members and 60 member societies in 46 countries, representing a growth in membership of 47 percent since the OSCAR 6 launch in October 1972.

Accomplishments for the Year 1973

The most significant accomplishment during 1973 was the continued successful operation of OSCAR 6, launched on October 15, 1972. With the exception of a drastic drop in output of the 435.1 MHz beacon since January 10, 1973, and the loss of output from one of the six solar panels, the spacecraft has continued to work well. A problem of transient switching of the satellite's functions, including the intermittent switching of the two-to-ten meter repeater on and off, continues to be present but has been largely overcome, at least in some parts of the world, by the intensive use of ground control stations. After some months of preparation, command stations in Canada, Australia, New Zealand, Germany and the United States are now reportedly prepared to provide the degree of control necessary to maintain the satellite in its desired operating mode.

During the year, under a contract from AMSAT, curriculum material for the use of OSCAR in classroom instruction was prepared by the Talcott Mountain Science Center in Avon, Connecticut, for distribution to schools. This work has now been completed, and one class unit has already been distributed to educators throughout the United States. The American Radio Relay League has assumed the responsibility for administering the amateur satellite education program, and will also be assisting in the publicity and international aspects of amateur satellite activities.

In March 1973, a series of demonstrations of the use of OSCAR terminals in classrooms was conducted in Little Rock, Arkansas, as part of a NASA Community Involvement Program.

OSCAR 6, in its first ten months of operation has been used by approximately 1400 amateur stations, nearly half of them in the United States. Approximately half of the 1400 stations on the official AMSAT "OSCAR 6 Users List" have been confirmed by QSL's or written reports from these stations. The other half were compiled from two-way QSO's reported on OSCAR 6 communication report forms received by AMSAT. (Reports of stations heard rather than worked are not included in this compilation.) It appears from incoming reports that between 100 and 200 new stations are coming onto the satellite with each passing month, but that some of the original stations are no longer using OSCAR 6. As of early August, the ten countries with the largest number of users of OSCAR 6 were Germany (126 users), England (83), Japan (72), France (63), Australia (51), Canada (46), New Zealand (39), Sweden (35), USSR (23), and the United States (around 640). These countries represent about 85% of the calls of stations reported using the satellite. Stations in 64 countries have been operating successfully, and amateurs in at least five other countries are known to be preparing for operation.

Among the interesting and unusual operation reported with OSCAR 6 are dx-peditions by FP8AA, PJ7VL, PJ9JT and 2K1TA, automobile operation by W2GN, G3IOR and JA1VDV, and aeronautical mobile operation by W60AL. O27DX reports preparing for maritime mobile operation from the "Dana," a Danish research vessel. FE7FY operation has been reported by VK3YDB, G3CUO, W60AL and WA3EMJ. W8NTP, WASUHV and SM6Q1H all reportedly have been active on slow-scan television, and W86GUY reports successful facsimile transmission to WA3FVG/6 via the satellite. In addition, SSTV and audio tone ranging tests have been conducted by DJ4ZC, who uses the data for satellite orbit determination. Finally, all fifty U.S. states have been worked and confirmed by W3TMZ, who qualifies for the first OSCAR Worked All States award.
Current Activity

In support of OSCAR 6 operating activities, a number of AMSAT nets have been established throughout the world. These include the international AMSAT nets meeting Sundays at 1800 GMT (14,280 kHz) and 1900 GMT (21,280 kHz), the North America East Coast AMSAT Net meeting Mondays at 9 pm EDT (May through October) and 7 PM EST (November through April) on 3855 kHz, the North America West Coast AMSAT Net on Mondays at 8 PM PDT (3850 kHz), a European net on Sundays at 0930 GMT (7070 kHz), another European net after passes on ON days (3780 kHz), and other nets on 75 meters in Japan and New Zealand. These nets have proved an excellent means of communicating changes in the OSCAR 6 operating schedule, coordinating special satellite activities and experiments, as well as providing a forum for satellite users to compare notes on their operating activities.

The OSCAR orbital predictions generated by several different groups throughout the world have proved generally quite good. Using data provided by NASA, it was found possible after the initial two to three months of tracking experience to determine OSCAR's orbital period with an accuracy of ±0.0001 minute, corresponding to an error of ±0.1 minute after 60 days. Orbital predictions provided for WIAW bulletins, for example, are now generated for five to six-month periods and maintain an accuracy of better than ±1 minute.

In addition to the nets already mentioned and information relayed by bulletin stations, AMSAT maintains a telephone "hotline" (now at a new number in the Washington, D.C. area: 703-938-5678). Weekly recorded bulletins on the orbit and other information can be obtained by calling this number.

Turning now to other current activity, AMSAT's Board of Directors on June 30 authorized an acceleration of the AMSAT-OSCAR-B satellite project for completion in time for launch during the first quarter of 1974, and authorized additional expenditures (estimated at between $38,000 and $40,000) for the project. The required additional funding, which covers the salaries of two engineers and two aerospace technicians employed full-time by AMSAT, as well as funds for needed space-qualified components and ground support test equipment, is covered entirely by special funds provided by ARRL and individuals who have designated their donations specifically for the purpose of completing the A-O-B spacecraft as rapidly as possible. General membership dues and general donations are not being used to pay salaries.

Assisting with A-O-B development are several groups in addition to the Washington-area AMSAT members. These include the newly-incorporated AMSAT Deutschland e.V., AMSAT's affiliate in Marburg, Germany (under the leadership of Dr. Karl Heinzer, DJ4ZC and Werner Haas, DJ5KO), WIA-Project Australis in Melbourne, Australia (particularly Dr. Peter Hammer, VK3ZP1), the Jet Propulsion Laboratory Amateur Radio Club and San Bernardino Microwave Society in southern California, and a group headed by Larry Kayser, VE3QB in Canada. Other individual AMSAT members in other locations are also involved. For example, John Goode, W5CYA, is constructing another Codesetore unit.

Future Activity

AMSAT's activity during the coming year is expected to continue to focus on the OSCAR 6 and A-O-B satellite projects. Concurrently with this activity, AMSAT is exploring with WIA-Project Australis and AMSAT Deutschland, the development of new satellites to be constructed by these groups using some AMSAT-provided A-O-B series hardware, along with new communications repeater experiments. Additional projects showing excellent progress toward use for future OSCAR satellites include a new spaceframe structure under development by Project OSCAR, Inc. in California, and 144-to-435 MHz linear repeaters under development in Germany and Australia.
In addition to technical activities, efforts are now underway to secure funds for continued AMSAT projects, directed not only toward providing more advanced satellites of the A-O-B series, but also toward developing the capability of building AMSAT payloads for synchronous, near-synchronous and synchronous-transfer orbits. The funding for these projects, estimated to require nearly $100,000 per year, will necessitate additional donations from individuals, as well as contributions from other sources. Assisting with the fund-raising efforts will be the new ARRL Foundation recently established by the League Board of Directors. One of the first functions of this foundation will be to obtain donations for satellite projects. The directions future AMSAT projects take, and the overall level of amateur satellite activity in the years to come will be dependent upon the degree of financial support obtained by the new foundation.

AMSAT Board of Directors Meeting
June 30, 1973

The meeting was called to order by President Klein at 10:50 AM at his home.

In attendance were Perry Klein K3JTE, Jan King W3GEY, Bill Tyman W3KMV, Chas. Dorian W3JPT, Ray Soifer K2QBW, Bill Dunkerley WA2INB, Dick Daniels WA4DGU, Phil Sager WB4FPT and Marc Pressman WB4DRB.

The first order of business was to approve the appointment of Phil Sager WB4FPT as Corresponding Secretary replacing a role largely provided by Joe Gatti W4TRJ and Ollie DeZoute WB4EVT during the past 3 years. A vote of appreciation was expressed to Joe for his efforts in behalf of amateur satellites. Recognition was also given to his able assistants Ollie DeZoute WB4EVT and more recently Jack Farrance W3EIM.

Charles Dorian reported on the plans for the AMSAT Annual Meeting and Amateur Satellite Forum which will be held in conjunction with the ARRL Roanoke Division Amateur Radio Convention on September 15, 1973 in Reston, Va. Everything is proceeding well and the AMSAT Forum and Annual Meeting will be from 1100 to 1300 on the 15th. A report was also made on the planned ARRL Technical Symposium to be held on the afternoon and evening of September 14th, just preceding the Convention. The theme of the Symposium is "Space Communications." A total of 10 to 12 papers will be presented and some AMSAT members will be authors of the papers.

The next subject considered was the possibility of converting all membership renewals to 1 January rather than the present 6 dates - every other month. It was agreed a shift to a single date was preferable and approval was given for Treasurer Bill Hook to work out the details and place the conversion into action.

The possibility of Life Membership was raised and it was agreed to solicit the views of the membership on this subject.

Jan King reported on his recent trip to Germany including the two weeks spent on AMSAT business for which $200 was authorized as partial travel expenses. Jan advised on the latest developments on satellite construction, reducing 2 meter beacon interference. There are 15 beacons in operation which are expected to be shifted. A letter will be written to the Bochum Command Station acknowledging his assistance with the European command task.

Approval was given to the designation as a Command Station of DL3YBA for OSCAR 6 and to VE3QBJ for OSCAR 7. Approval was also given for the purchase of a 144 MHz transmitter for use in the Washington area as a back-up Command Station.
Jan outlined the background and function of a cooperative AMSAT organization in Germany known as AMSAT Deutschland e.V. Approval was given for its support in the development of OSCAR 7 hardware and an expenditure of $880 was granted for support of the work. This support would be partial with the remaining funds to come from other sources. It was agreed that there should be a periodic statement accounting for the money.

Considerable discussion was given to the efforts to prepare and launch A-O-B (OSCAR 7). The Board approved an accelerated effort and budget to provide an A-O-B type satellite for medium-altitude polar orbit, with a target hardware completion date of January 1974, to take advantage of the first suitable launch opportunity in the first quarter of 1974. Mr. King wished to go on record as stating that the time frame of this development effort is unreasonable.

The Board voted to employ a full-time President, commencing on July 2nd, contingent upon receipt of available funds during the month of July, and have delegated to him the authority, under the general direction of the Board, to employ such personnel as may be necessary for implementation of the accelerated A-O-B construction and test program. It was the sense of the Board not to employ Directors in salaried positions.

The meeting was adjourned at 7:00 PM.

Charles Dorian, W3JPT
and
Raphael Soifer, K2QBW

MINUTES OF AMATEUR SATELLITE SERVICE COMMITTEE MEETING
June 17, 1973
Reston, Virginia

A meeting of the Amateur Satellite Service Committee was called to order at 9:20 a.m. on June 17, 1973, at the Dulles Marriott Hotel, Reston, Virginia. Those present were:

*William Eitel, W6UF (Chairman)  
*Harry Dannals, W2TUK, ARRL  
*Perry Klein, K3JTE, AMSAT  
Charles Compton, W8BUD, ARRL  
Jan King, W3GEY, AMSAT  
Robert Booth, Jr., W3PS, ARRL  
*Ray Vincent, WA6CBX, OSCAR  
*Richard Daniels, WA4DGU, AMSAT  
*V. C. Clark, W4KFC, ARRL  
Herbert Hoover, III, W6APW, OSCAR  
John Huntoon, W1RW, ARRL  
William Dunkerley, WAZINB, AMSAT

*Members, ASCC.

AMSAT Report. Perry Klein related achievements with OSCAR 6, still operating effectively -- 50 states and 1100 separate calls have used the satellite; 100 have qualified for the Satellite 1000 Award. Automated ground commands have overcome spurious turn-on/off and OSCAR 6 is expected to reach one year lifetime goal in October. Jan King visited DJ42C and others recently and obtained full cooperation in protection from interference to OSCAR 6 uplink channel and OSCAR 7 downlink, probably by moving the German and Swedish beacons from those frequencies. Further coordination is being accomplished through IARU.

OSCAR Report. Ray Vincent reviewed progress on spaceframe design and presented both drawings and construction samples for committee inspection. The plan is to build six or eight units in the first run, subject to availability of materials; there will be 20 large and 20 small modules, as well as two battery compartments. The design has been coordinated with AMSAT for use after Oscar 7,
and meets space standards as well as EMI shielding requirements, with approved components and hardware throughout. The design is adaptable both to NASA and USAF vehicle requirements, since OSCAR sees many future possibilities for launch from the west coast, and believes it highly important to be ready for sudden "standby" opportunities.

ARRL Report. Harry Dannals stated that 2,000 copies of "Member's Guide to Amateur Satellites," reprints of selected articles from QST and the AMSAT Newsletter, had been printed and were being distributed. A similar quantity of an educator's preview of "Space Science Involvement," an interim curriculum for classroom work, was in distribution to affiliated clubs with educational institutions, and through the Talcott Mountain Science Center to about 250 science department chairmen in Connecticut schools. There is a response rate of about 10% from those seeking more information. Bill Dunkerley and ARRL Public Relations Consultant Don Waters went to Little Rock, Arkansas, in April in conjunction with a 3-week NASA spacemobile educational project in that city. Oscar lectures and actual demonstrations were presented to several school groups and civic organizations, with student response good. The test project indicated that local amateurs, who were of considerable assistance in making arrangements and assisting in the presentations, likely could be relied on for similar presentations in other cities to be visited by the spacemobiles. As to the Talcott Mountain Science Center curriculum assignment, the preparation is nearly complete and the final submission should be accomplished within a few weeks.

Space Foundation. Harry Dannals described the situation as concerns the possibility of ARRL involvement in a satellite foundation to fund amateur space communications efforts, pointing out that the ARRL Management & Finance Committee was currently studying the possibility of a general "foundation" to receive contributions, and the Plans & Programs Committee was currently studying the possibility of obtaining grants from major national foundations (such as Ford). He stated that any proposal to establish an "ARRL Satellite Foundation" must primarily be acceptable to the Board of Directors, and encompass benefits both to amateur radio and the League. He stated that Messrs. Compton, Booth, Clark, Huntoon and himself had discussed the general subject extensively and concluded that the following "areas of agreement" would be a suitable basis for recommendation to the ARRL Board:

That a fund raising and disbursing organization is required to support future satellite projects conducted by radio amateur groups.

That, for continuity of administrative support and to enhance its credibility, this organization should be identified with ARRL, preferably as a satellite foundation.

That ARRL officials should have a controlling influence in the affairs of the foundation.

That the foundation should be limited, at least for the present, to the securing and disbursing of funds to assure continuation of amateur radio space activities.

That any monetary advance to AMSAT authorized by the ARRL Board of Directors at its July 1973 meeting will constitute the first indebtedness of the fund-raising foundation.

Foundation personnel in key positions would be entirely volunteers. Ray Vincent pointed out, and the group concurred in, the need to involve and utilize at appropriate levels experts in the electronics, aerospace and fiscal communities to implement the aims of such a foundation. It was agreed that inclusion of the ARRL name in the foundation title was not mandatory but highly desirable, so that the League would be the sponsoring organization and provide administrative
support. As concerns the term "management and control" earlier proposed by OSCAR, those present agreed that fiscal control is what is intended. The group discussed advantages and disadvantages of a general versus a specialized foundation, with the conclusion that a specialized satellite foundation would offer a greater probability of attracting donors; such a foundation could expand to other purposes at a later date if the need arises. IRS clearance would require an estimated three months.

AMSAT Financial Status. Perry Klein reported that work was reasonably well along in design and construction of AO-7, which will be a sophisticated OSCAR 6, duplicating the 2-meter up/10-meter down repeater, with an additional 432-up/146-down German-built repeater, plus other features such as an Australian-designed command system for redundancy. General administrative tasks and operating control and supervision over OSCAR 6 consume much of AMSAT personnel time at present, and AO-7 normally would be one to three years in the future.

However, recognizing the strong desirability of continuity in the amateur space program—i.e., after OSCAR 6 likely dies out later in the year—an accelerated schedule could produce OSCAR 7 perhaps by January, but this would require full-time engineering management and technical development. Promising launch opportunities are available about that time, and this would avoid a gap between AO-6 and AO-7 during which momentum gained so far in the educational program in schools would be sacrificed. A tentative budget was presented indicating the need for assistance in the amount of $38,691 to fund such an accelerated project. This was stated to be a maximum, with the possibility of reduction thru advance donations; matching funds; simplification of the package; or contribution of expensive components. Under such an arrangement AMSAT would provide periodic status reports and funding requests, and would continue through February 1974 by using its own funds for the last two months.

Bill Eitel indicated he would confirm in writing his acquiescence to ARRL use of funds donated by him to apply to financing this accelerated program if the ARRL Board elects to do so.

The Committee set its next meeting tentatively for the September 14-16 period to coincide with the Space Symposium and Roanoke Division Convention in Reston.

The Committee adjourned at 3:00 p.m.

Respectfully submitted,
V. C. Clark, Secretary
W4XPC

OSCAR EDUCATIONAL PROGRAM

OSCAR represents a unique opportunity for the amateur service to dramatically illustrate its ability to provide experiences on the cutting edge of technology. And, as we're finding out, radio amateurs need not be the only ones to profit from this involvement. ARRL has embarked upon a joint project with NASA to encourage school use of amateur satellites for classroom demonstrations. Already, teachers in Freehold, New Jersey, Mansfield, Illinois, Russellville, Arkansas, Hartford, Connecticut, Santa Cruz, California, Hollywood, Florida, Redlands, California, Denver, Colorado, Juneau, Alaska, and Braunschweig, Germany, have designed classroom activities and projects involving OSCAR.

To assist these and similar efforts, a complete curriculum supplement developed by educators at the Talcott Mountain Science Center is in final preparation. It will assist educator and radio amateur alike in the preparation of classroom OSCAR activities. A preview edition of the supplement entitled "Space Science Involvement," is already available to interested AMSAT members.

To get yours, write to Bill Dunkerley, ARRL, 225 Main St., Newington, CT 06111.

With the start of the new school year, much more educational activity involving OSCAR 6 and later OSCAR 7, is expected.
AMSAT FINANCIAL REPORT

By William A. Hook, W3QBC

Statement of Receipts and Expenses
January 1 to June 30, 1973

Net Worth January 1, 1973 $ 17,948.89

Receipts:
Dues (Note 1) $ 2,401.36
Donations (Note 2) 6,104.98
Interest 320.45
Refunds 314.75
Total $ 9,141.54

Expenses:
Office Supplies $ 108.70
Postage, telephone and telegraph 1,725.22
Printing 1,125.95
Typing 228.70
Travel 906.10
Salaries & FICA tax (Note 3) 5,516.86
Components 824.89
Fees and Miscellaneous 150.25 $ 10,586.67

Excess of Expenses over Receipts $ 1,445.13
Net Worth June 30, 1973 $ 16,503.76

Notes to Financial Statement

Note 1: Dues received from: Individuals, $2,195.27; Family Memberships, $56.00; and Member Societies, $150.09.

Note 2: Donations included: $4,523.64 from the American Radio Relay League; $1,017.00 from individuals; $464.34 from the International Amateur Radio Union, Region 1; and $100.00 from the Ottawa (Canada) Amateur Radio Club.

Note 3: Salaries and 5.85% Social Security tax for AMSAT technicians.

MEMBERSHIP REPORT

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<td>Totals</td>
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LIFE MEMBERSHIP

Now that AMSAT will soon be five years old, it has been proposed that an AMSAT Life Membership be established for persons contributing above a certain amount (perhaps $100). If you think you might be interested in becoming an AMSAT Life Member, please indicate this in the space provided at the bottom of the tear-out sheet bound into the center of this newsletter.
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<td>France</td>
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**AMSAT Member Societies**

- Dayton Amateur Radio Association
  Dayton, Ohio
- COMSAT Amateur Radio Club
  Clarksburg, Maryland
- Goddard Amateur Radio Club
  Greenbelt, Maryland
- USCC Amateur Radio Club
  Alexandria, Virginia
- Radio Society of Sri Lanka
  Colombo, SRI LANKA
- Union Schweizerischer Kurzwellen-
  Amateure
  Seebraben, SWITZERLAND
- Radio Society of Great Britain
  London, ENGLAND
- VE2RM Incorporated
  Pointe Claire, Dorval
  P. Q., CANADA
- Sun City Amateur Radio Club, Inc.
  El Paso, Texas
- Montreal Amateur Radio Club, Inc.
  Westmont
  P. Q., CANADA
- Hampden County Radio Assn.
  Southwick, Massachusetts
- Deutscher Amateur Radio Club
  Kiel, GERMANY
- Mt. Airy VHF Radio Club
  Elkins Park, Pennsylvania
- Talcott Mtn. UHF Society
  Talcott Mtn. Science Center
  Avon, Connecticut
- Johns Hopkins APL Radio Club
  Silver Spring, Maryland
- ARINC Amateur Radio Club
  Annapolis, Maryland
- Central States VHF Society
  Boulder, Colorado
- Swedish Amateur Radio Society
  Enskede, SWEDEN
- Radio Club Argentino
  Buenos Aires, ARGENTINA
- Natl. Insts. Health Radio Amateur Club
  Bethesda, Maryland
- Philippine Amateur Radio Assn.
  Manila, PHILIPPINES
- Rome Radio Club, Inc.
  Rome, New York
- Verband der Funkamateure der
  Deutschen Bundpost
  Bamberg, WEST GERMANY
- JPL Amateur Radio Club
  Pasadena, California
- Kokomo Firebird Radio Club
  Kokomo, Indiana
- Huntsville Amateur Radio Club
  Huntsville, Alabama
Two Meter Association  
Tokyo, JAPAN

Spencer, Massachusetts

Ottawa Amateur Radio Club  
Ontario, CANADA

Battelle Columbus Radio Club  
Columbus, Ohio

Northstar Highbanders Amateur Radio Club  
Minneapolis, Minnesota

Lakehead University Amateur Radio Club  
Thunder Bay, Ontario, CANADA

Chicago Suburban Radio Club  
Brookfield, Illinois

Southern Illinois University Amateur Radio Club  
Edwardsville, Illinois

Department of State Amateur Radio Club  
Washington, D. C.

Conejos Valley Amateur Radio Club  
Thousand Oaks, California

MIT Radio Society  
Cambridge, Massachusetts

Montgomery Amateur Radio Club  
Gaithersburg, Maryland

Huron Valley Amateur Radio Club  
Ypsilanti, Michigan

Akademisk Radioklubb  
Trondheim, NORWAY

Roanoke Valley Amateur Radio Club, Inc.  
Roanoke, Virginia

East Lancashire Amateur Radio Club  
Clitheroe, Lancashire, ENGLAND

Opportunity School Amateur Radio Club  
Denver, Colorado

OK7ULZ VHF Group  
Praha, CZECHOSLOVAKIA

IBM Amateur Radio Assn.  
Gaithersburg, Maryland

Wireless Institute of Australia  
Brisbane, Queensland  
AUSTRALIA

Christchurch VHF Group  
Christchurch, NEW ZEALAND

Tidewater Amateur Radio Club  
Norfolk, Virginia

Newport County Radio Club  
Newport, Rhode Island

The New Zealand Association of Radio Transmitters, Inc.  
Christchurch, NEW ZEALAND

Radio Oscar Club Parma  
Parma, ITALY

Liga Mexicana De Radioexperimentadores A. C.  
Mexico D. F., MEXICO

Ambassador College Satellite Stn.  
Herts, ENGLAND

Goldcoast Radio Club  
Southport, Queensland, AUSTRALIA

Rock Creek Amateur Radio Assn.  
Chevy Chase, Maryland

Carone Philippe Radio Club  
Rouen, FRANCE

Volkssternwarte Clubstn.  
Bochum, Sundern, WEST GERMANY

San Bernardino Microwave Society, Inc.  
Corona, California

Mike and Key Radio Club of Seattle  
Tacoma, Washington

Circulo Nacional de VHF – Santiago  
Santiago, CHILE

The above clubs and associations are listed in the order of joining AMSAT.
ARRL
Technical Symposium
14 September 1973

2:00 - 5:00 P.M.    7:30 - 10:30 P.M.

SPACE COMMUNICATIONS

1400-1700

George Jacobs, W3ASK, Moderator
John Fox, W3LER and Ron Dunbar, W9KJS
    Inverted Doppler Effect
Larry Kayser, VE3QB
    System Multiplexing Amateur Radio Telecommands
Allen Katz, K2UYH
    432 MHz Moonbounce Communications
Tom McMullen, W1SL
    A Simple Ground Station for Amateur Satellite Work
Richard Kneale, K2RIW
    21 Centimeters and Down

1930 - 2130

Ray Spence, W4QAW, Moderator
Peter E. Cleall, G8AFN
    The Challenge of Oscar
Karl Meinzer, DJ4ZC and Jan King, W3GEY
    Orbit Considerations for Future Oscar Satellites
Raphael Soifer, K2QBW
    Frequency Planning for Amateur Satellites
Perry Klein, K3JTE
    Communications Experiments for Oscar Satellites
Joe Kasser, G3ZCZ and Jan King, W3GEY
    Oscar 7 and its Capabilities

2130 - 2230

Panel Session

The AMSAT-OSCAR-B Spacecraft
(shown with its Harmen clamp
ejection mechanism)
A PROPOSAL FOR TRANSMITTING PHYSIOLOGICAL DATA
VIA THE OSCAR 6 SATELLITE

by A. Vilensky, 4X4MH
P. O. Box 6342, Haifa, Israel

In the last few months there have been various articles published on the applications of OSCAR 6 RTTY, SSTV and facsimile transmissions.

I would like to propose an experimental study concerning the possibility of physiological data transmission. Such a link may be important in cases of isolated situations as ships at sea or disaster areas.

As a medical engineer, I would like to propose the following experiment.

The aim: To transmit ECG data.

THE TRANSMITTING END:

1. A man is connected to electrodes.

2. An ECG preamplifier, with line and VHF filters.

3. A frequency modulator around 1800 Hz with a frequency response between 0.1 - 100 Hz connected to the output of the ECG preamplifier.

4. SSB or AM transmitter on the two-meter band modulated by the signal derived from the frequency modulator.

THE RECEIVING END:

Alternative A

1. Ten-meter AM or SSB receiver.

2. Frequency discriminator around 1800 Hz fed from the receiver.

3. A standard ECG recorder connected to the discriminator output.

Alternative B

1. Ten-meter AM or SSB receiver.

2. A phone patch connected to the receiver.

3. A telephone line linked to a medical center.

4. A frequency discriminator connected to the telephone line at the medical center.

5. Input terminal to cardiological recording equipment or analog-to-digital input for an on-line computer.

Alternative C

1. Ten-meter AM or SSB receiver.

2. A high quality audio tape recorder.
   In this case data can be played back at any time after the contact. The information is then processed by the discriminator and treated as described in alternative 1 or alternative 2.
I suggest to assemble the transmitting end in my station (AM MODE). I would prefer partners in Europe who have access to medical centers and a technical background.

I would appreciate any comments, and volunteers to assist with this project.

COMPUTER PRINTOUTS AVAILABLE FOR TRACKING AZIMUTH-ELEVATION

by William D. Johnston, WB5CBC

There is considerable literature available pointing out the advantages of tracking OSCAR in both azimuth and elevation, and still more literature describing the construction of antenna rotating systems to carry this out.¹ The use of such a system for satellite communications will not only result in more consistent and more readable communications, but will permit maximum use of the satellite for any given orbit. Once this antenna system is built, however, pointing it in the right direction is no easy matter if one is to go simply by guesswork.

The easiest method is with the use of a computer printout which shows both azimuth and elevation angles at given increments of time (every two minutes, for example), for each available orbit. Unfortunately, the cost of running a highly accurate orbital prediction program ($5 per minute and up) has in the past made the cost of this method prohibitive to most hams.

Nevertheless, we can take advantage of several fortunate circumstances that permit any ham to have a printout for his station that will provide usable data for a full year, at a cost of only a few dollars.

The first important fact is that many university computing centers and research institutes sell computer time to individuals and non-profit organizations at a fraction of the commercial rate. Second is the fact that OSCAR is in a highly stable orbit, which means that the orbital prediction program can supply data for orbits far into the future with no loss of accuracy. Furthermore, this satellite has a repeating period of 263 orbits, which means that the azimuth and elevation angles are the same every 263 orbits. Consequently, a reference table of 263 orbits can be referred to for a long time into the future.

If that weren't enough in itself, 263 orbits just happen to come out to exactly 21 days. This means that the repeating orbit with the same azimuth and elevation angles will come at the same time of the day, on the same weekday, three weeks later!

Therefore, if provided with a printout of A2-EL data for all available orbits for 21 consecutive days, the same data can be used over and over, every three weeks, without the expenses of rerunning the orbital prediction program.

Actually, the repeating period is not precisely 263 orbits, and 263 orbits are not equal to precisely 21 days. But the error is so small that after several months the time is off by only 6 or 8 minutes, which is easy to correct for, and the angles are off no more than 4 or 5 degrees, which is less than the backlash in most amateur rotators.

Arrangements have been made to provide data for interested amateurs at a cost of only $2.50 plus a large self-addressed stamped envelope. (Stations outside the U.S. do not need to send the stamped envelope. See below for the total cost, which includes postage.) The price includes a computer printout of all available orbits for a reference period of 21 days. This 21-day reference printout will be generated so that it will begin about the time you receive it in the mail. Figure 1 shows a small extract from a typical printout. Note that the range to the satellite is also shown.

WB5CBC 15 SEP 73 (258) ORBIT 4188

<table>
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<td>3:11:43</td>
<td>119</td>
<td>67</td>
<td>1556</td>
</tr>
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e等。

Figure 1—Extract from an actual reference-orbit printout. Dates and times are GMT.

In order to receive the data, you will need to send the following:

1. Name and mailing address.

2. Latitude (indicate North or South) and longitude (East or West), as accurately as possible, in degrees, minutes, and seconds. If you cannot find this information, give the name of the town where your station is located. If under 10,000 population, or if a rural area, carefully describe the location with respect to other nearby larger towns.

3. Altitude above sea level (indicate feet or meters).

4. A self-addressed stamped envelope, 9" by 12" or larger. (The envelope is not required of stations outside the U.S.) This envelope should bear sufficient postage for 6 ounces (48¢ for First Class, or 66¢ for Air Mail).

5. Payment as follows:

   U.S.A.: (All locations with U.S.A. ZIP Code) $2.50. (Don't forget the SASE as per item 4 above.)

   Canada and Mexico: (No envelope required), The total cost is $3.00 for First Class Mail or $3.20 for Air Mail, which includes postage.

   All other locations: (No envelope required), The total cost is $3.50, which includes postage for Air Mail delivery. Surface mail is not recommended.

   Payment should be in U.S., Canadian, or Mexican funds, and may be in the form of a personal check, money order (bank, postal, international, etc.), international bank draft, etc.

   Send the above to:

   Bill Johnston, WB5CBC
   1808 Pomona Dr.
   Las Cruces, New Mexico 88001

15
OSCAR 6 ORBITS

The following data for OSCAR 6 are supplied by AMSAT. The times are in GMT and the Longitudes are in degrees west of Greenwich.

Period = 114.99455 Minutes

Longitude Increment = 28.748° per orbit.

Note that orbits repeat on a 263-orbit cycle every three weeks (i.e., every 21 days) but 3.6 minutes later and 0.9 degrees further west.

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**LETTERS**

Dear Sir:

I wish to apologize for any distress I may have caused anyone in my recent letter that was published in the Newsletter (Vol. IV, No. 4, Dec. '72). It was a case of me writing before thinking, as I was able to use the satellite on certain occasions to see if I could get a signal through it, which I did, so I guess I had no reason to complain.

I wish to thank AMSAT in their efforts as I realize the amount of work and time to get such a project going must be tremendous. The amount of financial support provided by the dues appears to be just a small part of the money, time and equipment donated by the various groups world-wide. We should be thankful that there are individuals who are willing to work on the project so that amateurs may get the chance to enjoy the benefits of satellite communications.

In the future I will attempt to refrain from getting too "carried away" in my correspondence and channel my energies in the areas of perfecting my operating technique, which is apparently not up to par for satellite communications.

Jerome C. Grokowski, WA9HCZ

La Crosse, Wisconsin
April 2, 1973
Dear Sir:

I heard some talk about plans or suggestions to put a future satellite in a synchronous "stationary" orbit. It sounds great; but it is my opinion that if such a satellite were made available for general use, it would become virtually useless. Imagine a 2M "repeater" available to anyone on two or three continents! QRM would be unbelievable. It could be expected that, aside from regular QSOs, many nets, phone patches and schedules would try to move in to take advantage of a circuit not affected by propagational vagaries.

Present OSCAR communication demands a great deal of expertise in tracking, operating, use of non-standard antennas and equipment. This makes OSCAR communication an exciting game. A stationary satellite would allow anyone to use it without effort.

In spite of above mentioned drawbacks, there is a dire need for such a satellite; not for "regular" use, however, but for emergency communications, especially with remote and isolated areas.

The problem is: how to police the use of an "emergency" satellite?

Possibly an international agreement can be arranged to restrict its use to emergency purposes only, where only authorized (specially licensed) stations would be allowed to communicate (for equipment test purposes) in non-emergency conditions.

K. J. Deskur, K2ZRO
Endicott, N.Y.
received April 12, 1973

Dear Sir:

I suggest specifying an emergency calling frequency for use with A-O-C. The life-saving possibilities for persons in remote areas, mountain climbers, explorers, and hikers is apparent. Government and public reaction the first time life is saved ought to be particularly favorable.

What are your thoughts?

Edward A. Johnson, KL1XT
Lowell, Massachusetts
May 24, 1972

Dear Sir:

I suggest that the Board of Directors and the Amateur Satellite Service Committee give consideration to having two or more satellites that make use of the same ground communications equipment. By this I mean rather than have one satellite that uses a 144 to 432 MHz repeater and then have the next one have a 432 to 144 MHz repeater, have two in a row with the same input/output. This would allow more test data and more kinds of tests to be run than by each satellite being one of a kind.

My other comment has to do with education and publicity for AMSAT. To begin with, I think AMSAT could probably convince the ARRL to scan through their past issues for articles that deal with OSCARS, tracking antennas, orbital tracking information, and other related space communications subjects. After having reprints made of these articles, they could offer them via QST as a packet. This could provide a beginning for newcomers' libraries.
Most of this material need not be in great detail, just some good basic information to get an amateur started off on the right path. Should the subject matter prove too great for one small pamphlet, then possibly two or three pamphlets could be published if the basic one has the appeal that I think it would. The education value and the flow of information both to and from AMSAT could do a lot to increase interest in Amateur Satellite Communications and bring many new members into AMSAT. It goes without saying that AMSAT would receive a lot of publicity and probably some financial gains could be realized that could aid in future projects. The idea is not to get AMSAT into the publishing business, but to do this on a small scale on the order of the newsletter.

Robert W. P. Patterson K5D2E/4
CPT U.S. Army
Columbus, Georgia
January 25, 1973

Editor's Note: A reprint booklet from QST and the AMSAT Newsletter is now available. See "Minutes of Amateur Satellite Service Committee Meeting," in this issue. Called "Member's Guide to Amateur Satellites," it is available from ARRL Headquarters, Newington, Connecticut 06111 on request "upon receipt of a 10¢-stamped, self-addressed 6" x 9" envelope.

Dear Sir:

In the past six months I believe that most of us that are users of OSCAR 6 have experienced a period of accelerated education or re-education. Quite a few subjects we studied in school, both scholastic and technical, have been brought into play. We have seen in action the laws of the physical sciences that we burned the midnight oil cramming into our heads.

Our mathematics and algebra have suddenly become very important to us in the calculation of orbital data and time computation. An object that travels 15,000 miles per hour leaves little room for mathematical error. We begin to pay more attention to propagation forecasts because, as we have observed, an unsettled condition at the high end of the HF band is not conducive to good downlink performance. Our antenna construction takes on a new approach. Such antennas as crossed yagis and helical beams are very commonplace today in practice where before they were only textbook illustrations for most of us. We have become proficient in the use of automatic-gain-control with satellite signals, which before was a hit or miss proposition when copying ionospheric reflection.

All in all, I believe there has been no other event in this century that has stimulated such aggressive learning as the launching of the AMSAT OSCAR 6 Amateur Radio Satellite.

Dave Clingerman
W6OAL - KH6HQ - WP4BDU
Oakview, California
received April 3, 1973
Dear Sir:

Included are several communication reports of OK Standa OK1MBS, President of OK7ULZ VHF GROUP - No. A039, Pavel OK1BMW and SWL reports of Mirek OK1FF, one of the foremost DX-men in our country.

We are very pleased to have the possibility to be one of many members of AMSAT, to participate in its activities and to get your AMSAT Newsletter. All hams here in OK land are regularly informed about OSCAR 6 in "Radioamatersky zpravodaj," where many informations from AMSAT Newsletter are reprinted. For this purpose your sending of some pictures - photos of OSCAR 6 - technical details - suitable for reprint in our RZ-Newsletter will be highly appreciated.

This year we want to make some RTTY QSOs through OSCAR repeater too, after finishing all home-made equipment for it.

Vladimir K. Holena, OK1ALV
Public Relations Manager
OK7ULZ VHF GROUP
AMSAT No. A039
Prague, Czechoslovakia
February 10, 1973

LONELY VOICE

I have the OSCAR completely to me and none to share. Though my S-meter peaks 20-15 above S9 on an overhead pass, my QSO's are equally with none. The "Lonely Voice" from VU2-land originates at 12.98 degrees North, 282.33 degrees West (QTH, Bangalore,) and a QSO will bring more points for the "OSCAR 1000" Award. VU2UV looks for stations east of 282 degrees in the mornings, and west at nights (local time). If you work VU2UV, please QSL direct and give your address to receive the QSL by air mail.

73,
V. Subramanian, VU2UV
159/1 Silver Oak Avenue
Eq. TRG. COMM.
Hebbal, Bangalore 560006, India
August 16, 1973

SPECIAL ANNOUNCEMENT - RENAMING OF OSCAR 6

With the reaching of the first birthday of OSCAR 6 and the successful operation of this first satellite of the AMSAT-OSCAR-3 series, the AMSAT Board of Directors is considering redesignating the satellite officially as "OSCAR 6/AMSAT-1", more simply, AMSAT-1. Your comments on the proposed new designation are welcome. If decided upon, the new name would be effective on OSCAR 6's first anniversary, October 15.

Please indicate whether you favor the idea in the space provided at the bottom of the tear-out sheet bound into the center of this newsletter.
**NEWSCOM**

Issued quarterly by the Radio Amateur Satellite Corporation

Price 50c

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<td>Editor:</td>
<td>Membership Renewal Form, Application Form, and</td>
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<td>Thomas H. Mitchell,</td>
<td>AMSAT-OSCAR Information Retrieval Check Sheet...CENTER SECTION</td>
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<td>WA3TBD</td>
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AMSAT
P.O. Box 27
Washington, D.C. 20044

WASHINGTON
D.C.
EDITORIAL -- "Support"

By Tom Mitchell, WAJTBD

With the first anniversary of AMSAT-OSCAR 6 and the planning for AMSAT-OSCAR 7, it is time to reflect on the notice that the amateur satellite program has had within amateur radio.

We believe amateurs in general, even those who have not been able to use OSCAR 6, are justifiably proud of the amateur satellite program as a measure of the fact that amateur radio is still working at the "state of the art." Those who are active with the satellite are perhaps in a better position to consider the future of the amateur satellite program in the years to come.

One way to help provide for the stability of the program in the future is for those American and Canadian members who are using the satellite to report the fact to their Director in the American Radio Relay League.

In this way the representative body of amateur radio will be advised of the relative amount of interest. This will help to assure a broad base of support for the satellite program in years to come.

(Directors' addresses are found on page 8 of each month's QST.)

AMSAT Nets

The following AMSAT nets are now in operation:

North American East Coast 75 Meter AMSAT Net

Mondays 8:00 p.m. EST (0100Z Tues)
3855 KHz LSB
Net Control: W3ZM or W3TMZ

North America West Coast 75 Meter AMSAT Net

Mondays 8:00 p.m. PST (0400Z Tues)
3850 KHz LSB
Net Control: W6DMN or W6BGJ

International 20 Meter AMSAT Net

Sundays 1800Z
14,280 KHz USB
Net Control: W3ZM or others

International 15 Meter AMSAT Net

Sundays 1900Z
21,280 KHz USB
Net Control: W3ZM or others
European 40 Meter OSCAR 6 Net
Sundays 0930Z
7070 KHz LSB

European 80 Meter OSCAR 6 Net
After passes on ON days
3780 KHz LSB

JA Net
Mondays 1300Z
3560 KHz LSB
Net Control: JALANG

Southeast Asia Net
Thursdays 1300Z
14320 KHz USB

ZL OSCAR Net
Mondays, Thursdays & Saturdays, 7 p.m. NZT
3850 KHz LSB
Net Control: ZL1WB

In addition, the frequencies 3855 KHz (LSB) and 14,280 KHz (USB) are
being used as general watch frequencies for satellite information after
passes.

In the Washington area AMSAT traffic is handled via 2 meter FM on
146.85 MHz simplex and through the AMSAT repeater 146.25 to 146.85 MHz.
Those interested in satellites in other parts of the country are urged to
use these same frequency combinations where possible. If a repeater is
already on 25/85, get on it. If not, try to set one up or use 146.85
simplex. In this way we can all communicate more easily with each other
when traveling.

Another source of orbital information is the AMSAT HOTLINE: (703)938-5678.

LETTERS

I would like to congratulate all of you who worked so hard to build, test
and see that OSCAR 6 has worked so well for the past year.

Dave Robinson, K7BBO
Tacoma, Wash.
October 9, 1973

Been very busy here but will be on during OSCAR 6's birthday. Congratulations
on one year as projected.

Bill Hunter, K4TI
Weaverville, N.C.
October 10, 1973
FROM THE PRESIDENT'S DESK

By Perry I. Klein, K3JTE

One Year in Orbit

October 15th marked the first-year birthday of AMSAT-OSCAR 6, amateur radio's newest and longest lifetime satellite in space. The spacecraft continues to operate successfully, having surpassed our lifetime objective of one year.

During its first year, it is estimated that on the order of 100,000 or more contacts have been made through AMSAT-OSCAR 6's two-to-ten meter repeater, and amateurs in at least 74 countries have been participating in this new mode of amateur communications. Experiments have been continuing in order to learn more about radio wave propagation and space communications techniques, and the American Radio Relay League and NASA are now working together to use OSCAR in the schools.

After one full year of operation and over 5,000 orbits in space, the AMSAT-OSCAR 6 spacecraft appears to be in good shape in spite of some battery degradation, and we are hopeful that the satellite will continue to remain useful for some months to come. As the battery becomes weaker, it will be increasingly important that everyone cooperate in using the satellite repeater only during the scheduled ON periods.

AMSAT maintains an OSCAR 6 Users List of stations successfully communicating through the satellite. The list now numbers over 1,800 calls. We are trying to verify as many of these calls as possible, so we are urging all stations who have not yet reported their OSCAR 6 operation to send their reports to AMSAT, particularly an alphabetical listing of the QSL cards you have received for two way OSCAR contacts.

For many of us, the past year of satellite activity has been one of excitement, fulfillment and learning, as well as discouragement at times. The sixth amateur satellite is another step toward the goal of an operational Amateur Satellite Service. As a learning experience, AMSAT-OSCAR 6 has taught us new operating skills, and through its faults (and our own) has shown us how to take the next step -- and how to do a better job next time.

AMSAT-OSCAR 6 has verified our conviction that amateurs are capable of designing, building and operating long-lived communications spacecraft. It is an operational challenge as well as a design achievement to be able to successfully maintain the life of a spacecraft which has a total power budget of only three watts, for this length of time.

We are grateful to the National Aeronautics and Space Administration for making the launch of AMSAT-OSCAR 6 possible, and to the many organizations and individuals who have contributed either hardware, financially, or their personal time. It is only the total effort that has made the AMSAT-OSCAR 6 project a successful one.

LETTERS

Congratulations for such a fine job building and maintaining OSCAR 6! It has been a great service to amateur radio and proved the practicality of satellites for the small user like myself. As for reliability, if the automotive business were run by AMSAT, you'd put the spare parts industry right out of business!

Bob Crumrine, WB2DNN
Rochester, N. Y.
October 17, 1973
AMSAT-OSCAR 6 Users List Summary

October 15, 1973 (one full year of operation)

Total USA: 737 (40%)
Total Outside USA: 1,079 (60%)
Total Countries: 74 (according to ARRL Countries List)
Total Stations: 1,816

Ranking of AMSAT-OSCAR 6 Users by Country on a Per-Amateur Capita Basis
(As of Oct. 15, 1973)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Total Amateurs</th>
<th>OSCAR 6 Users</th>
<th>Percentage of amateurs using OSCAR 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New Zealand</td>
<td>4,641</td>
<td>70</td>
<td>1.5%</td>
</tr>
<tr>
<td>2</td>
<td>Australia</td>
<td>2,641</td>
<td>85</td>
<td>1.3%</td>
</tr>
<tr>
<td>3</td>
<td>Finland</td>
<td>2,000</td>
<td>23</td>
<td>1.15%</td>
</tr>
<tr>
<td>4</td>
<td>France</td>
<td>7,500</td>
<td>81</td>
<td>1.1%</td>
</tr>
<tr>
<td>5</td>
<td>Sweden</td>
<td>4,400</td>
<td>44</td>
<td>1.0%</td>
</tr>
<tr>
<td>6</td>
<td>Czechoslovakia</td>
<td>2,070</td>
<td>20</td>
<td>0.97%</td>
</tr>
<tr>
<td>7</td>
<td>W. Germany</td>
<td>20,380</td>
<td>168</td>
<td>0.82%</td>
</tr>
<tr>
<td>8</td>
<td>England</td>
<td>16,837</td>
<td>113</td>
<td>0.67%</td>
</tr>
<tr>
<td>9</td>
<td>Japan</td>
<td>14,576</td>
<td>90</td>
<td>0.61%</td>
</tr>
<tr>
<td>10</td>
<td>Canada</td>
<td>12,892</td>
<td>57</td>
<td>0.44%</td>
</tr>
<tr>
<td>11</td>
<td>Italy</td>
<td>6,000</td>
<td>24</td>
<td>0.4%</td>
</tr>
<tr>
<td>12</td>
<td>USA</td>
<td>282,850</td>
<td>737</td>
<td>0.26%</td>
</tr>
<tr>
<td>13</td>
<td>USSR</td>
<td>15,085</td>
<td>30</td>
<td>0.20%</td>
</tr>
<tr>
<td>14</td>
<td>Argentina</td>
<td>17,500</td>
<td>22</td>
<td>0.13%</td>
</tr>
</tbody>
</table>

Total 1564
(86% of all OSCAR Users)

AMSAT-OSCAR 6
User Countries:

ALAND I (OH5) ENGLAND (G) NORTHERN IRELAND (G1)
ALASKA (KL7) ESTONIA (UR2) NEW ZEALAND (ZL)
AMER. SAMOA (KS6) FINLAND (OH) PHILIPPINES (DU)
ANGOLA (CR6) FRANCE (F) POLAND (SP)
ANTARCTICA (VK5) FRANZ JOSEPH LAND (UA1) PORTUGAL (CT1)
ARGENTINA (LU) GERMANY (DL,DM) PRINCE EDWARD IS. (ZS2)
ARMENIA (UG6) GREECE (SV) ROMANIA (Y0)
ASIATIC SSR (WS6) GREENLAND (OX) RHODESIA (2E)
AUSTRALIA (VI) HAWAII (KH6) SCOTLAND (GM)
AUSTRIA (OE) HUNGARY (HG) SPAIN (EA)
AZORES (CT2) ICELAND (TF) SAINT PIERRE I (PF)
BAHRAIN (MP4) INDIA (VU) SOUTH AFRICA (ZS)
BARBADOS (BP6) IRELAND (E1) ST. MARTIN (PJ7)
BELGIUM (ON) ISRAEL (4X) SWEDEN (SM)
BERMUDA (VP9) ITALY (I) SWITZERLAND (HB)
BRAZIL (PY) JAMAICA (5Y5) TAIWAN (U88)
BR VIRGIN I (VP2) JAPAN (JA) THAILAND (HS)
BULGARIA (IL2) JERSEY (GC) TURKS AND CAICOS I. (VP5)
CANADA (VE) LUXEMBOURG (LK) UKRAINE (UB5)
COLOMBIA (HK) MALAYSIA (9M) URUGUAY (CX)
COOK ISLANDS (ZK1) MARSHALL ISLANDS (KX6) U.S.A. (W,K)
CORELICA (PC6) MEXICO (XE) WALES (GW)
CUBACAO (P9) NETHERLANDS (PA) WHITE RUSSIA (UC2)
CZECHOSLOVAKIA (OK) NEW GUINEA (VK9) YUGOSLAVIA (YU)
DENMARK (OZ) NORWAY (LA)

74 Countries Total
MINUTES OF AMATEUR SATELLITE SERVICE COMMITTEE MEETING

September 14, 1973; Reston, Virginia

A meeting of the Amateur Satellite Service Committee was called to order at 9:15 a.m. on September 14, 1973, at the Sheraton Inn, Reston, Virginia. Those present were:

*William Eitel, WATLRU (Chairman)
*Harry Dannals, W2TUK, ARRL
*Richard Daniels, W4DQG, AMSAT
   Charles Compton, WØBUO, ARRL
   John Huntoon, W1RW, ARRL
   William Dunkerley, WA2INB, ARRL
   *Perry Klein, K3JTE, AMSAT
   *V. C. Clark, W4KFC, ARRL
   William Orr, W6SAT, OSCAR
   Don Waters, ARRL
   Richard Baldwin, W1RU, ARRL

(*Members, ASSC)

Minutes of the June 17, 1973, meeting were approved with a correction by Ray Vincent concerning the OSCAR Report and the disposition of funds donated to ARRL by WATLRU and WATLU.

ARRL Report. Harry Dannals announced that the ARRL Board of Directors had approved the establishment of an ARRL Foundation, with its first order of effort oriented toward funding amateur space communications activities. Incorporation papers were momentarily in preparation by the League’s Management & Finance Committee, with expectation of completion before the end of the day. Three members of that committee, Messrs. Larry Shima, Robert York Chapman and Larry Price, constitute an interim Board of Directors for the Foundation; a permanent Board of nine members will be chosen by the ARRL Board at the January annual (ARRL) meeting; five are required to be ARRL directors, and four may come from any field, and need not even be amateurs. Officers will be chosen from the nine directors of the Foundation. The next step is to obtain IRS approval, which normally requires two or more months, but it is expected the matter will be cleared by the January ARRL Board meeting. The Foundation may accept funds from the moment of incorporation, but tax exemption is not assured until IRS approval is received. It was noted that, to fill a possible gap in funding of space activities, contributions can be made tax-free to ARRL, for ultimate transfer to the Foundation, or directly to satellite projects. Bill Eitel expressed the concern of Project OSCAR in the Foundation matter, particularly as to who directors will be. Dannals explained that some details could not be released until the incorporation process was completed, but urged that potential candidates be recommended to ARRL directors prior to the January Board meeting; he cited Herbert Hoover III as an example candidate.

Perry Klein expressed concern about the funding prospects after February, 1974, in that satellite program planning beyond that date is not certain of financial support; Bill Orr properly termed it a possible "gap." Eitel said his personal efforts, low-key so far, had encountered reluctance to donate directly to ARRL or AMSAT, but an apparent willingness to donate to a Foundation when established. Perry Klein commented on the possibility of a "stretch out" of existing funds to June, but it was pointed out the principal reason for the $38,000 ARRL appropriation was to speed completion by the end of February. It was agreed, however, that AMSAT should prepare and present future budgets, which Klein indicated would be on the order of $82,000 for calendar year 1974. It was indicated unlikely that the ARRL could continue to appropriate additional funds from existing reserves because of the demands of the WARC and other commitments; however, the League would not insist on priority in repayment of the advance from Foundation funds to the exclusion of other uses.

Educational Matters. Bill Dunkerley and Don Waters reported that the Talcott Mountain curriculum had finally been received and should be ready for printing in about a month. ARRL is building a list of interested educators for the first mailing; as to the interim sample curriculum booklet, 1500 copies have been distributed. Bill, Don and Perry Klein will present a briefing to a number of NASA lecturers next week, for their background use in presenting later demonstrations around the country.
WIAW Remote Control. Dunkerley reported that the installation for OSCAR 6 command control was nearly complete at WIAW, awaiting only delivery of components. An application has been filed with FCC for remote control authorization, but an STA may be necessary for earlier action. Perry Klein pointed out the desirability of expediting this project so that assistance can be provided with the AO-6 control program.

OSCAR Report. Bill Orr stated that a spaceframe prototype has been built and tested, and parts for several more are under construction. Approximately $13,000 worth of materials has been donated or financed by OSCAR. An observatory in Oaxaca, Mexico, has been equipped with amateur gear, with some interest evidenced by NASA in this project to tie in satellite communications.

Orr inquired concerning a 1971 Swedish proposal to use part of the 400 MHz band, and the possible effect on amateurs of the forthcoming maritime conference; Dick Baldwin indicated that these appear to offer no threat to amateur allocations, but the matter is being watched; G2BVN will attend the conference as an IARU observer.

OSCAR 6 Report. Perry Klein remarked that September 15 will complete 11 months of OSCAR 6. Batteries are degrading somewhat, and the operating schedule reduced accordingly in order to extend useful life. Aeronautical, land and maritime mobile communications have been accomplished through the satellite, and even radio control of model craft. Over 1,500 different users have been recorded so far -- 650 in the U.S., and 850 outside. On a per capita basis, leaders in order of use are ZL, VK, F, SM, DL, JA, G, VE, W, UA. W3TMZ, K4TI and W9OII have all made WAS.

OSCAR 7 Progress. Klein reported that AOB has NASA approval, and a March launch is still an objective, with progress on schedule. There is a parallel development of a production-type 2-to-10 meter repeater; VE3QB has a breadboard of the 435-MHz beacon ready and there is cooperation from most everyone involved including the Goddard center and RCA. FCC has expressed the view that call letters should be assigned rather than the traditional "HI," and this is currently under discussion.

Bill Eitel commented on the large amount of support coming from industry and the importance of keeping the program going, with a need for continuity paramout. Discussion indicated the desirability of Don Waters undertaking an article or similar promotional material telling the story and pointing out need for funding. Dick Daniels suggested a cassette program on the subject.

Harry Dannals announced that effective immediately he was turning his duties on ASSC over to ARRL First Vice President Charles Compton, W0BUO, because of heavy pressure of other League responsibilities. The committee expressed deep appreciation for W2TUK's contributions to ASSC progress.

The Committee adjourned at 1:55 p.m.

V. C. Clark, W4KFC

BOARD OF DIRECTORS MEETING
September 16, 1973

The meeting was called to order by President Klein at 11:25 a.m., at the Sheraton International Conference Center, Reston, Virginia.

In attendance were:

P. Klein, K3JFE
R. Solfer, K2QBW
W. Hook, W3QBC
C. Dorian, W3JPT
W. Tynan, W3KMW
J. King, W3GKY
W. Dunkerley, WA2INB
W. Eitel, W6UF/WA7LRU
L. Eitel, WB6MRW/WA7LUN
L. Kayser, VE3QB
J. Kasser, G3ZCZ/W3
J. Gregory, W3ATE
President Klein announced that the tellers had completed the vote count and that from the ten nominations the following four members were elected to serve as Directors for the next two years: P. Klein, C. Dorian, W. Tynan and J. King. K. Heinzer, DJ4ZC and R. Carpenter, W3OTC were elected first and second alternate Director, respectively.

There was a short discussion of officers for the coming year. The present officers agreed to continue to serve in the existing jobs. In addition, the Board unanimously agreed to appoint Larry Lazar, WA2AAD as Manager, Emergency Communications Planning.

After discussion, it was agreed that the existing bylaws were up-to-date and were not in need of amendment.

It was agreed that subject to the availability of the necessary designated funds, President Klein would continue to serve as full-time President. The required extension of an employment agreement was signed by the Directors present. It was also agreed that the President would continue to serve on the Board of Directors, as elected.

It was agreed that the ready availability of the Directors for meetings rendered the need for an Executive Committee as moot. The issue will be considered again whenever Directors are elected who live a considerable distance apart.

Approval was given to reimburse the following for travel expenses in support of AMSAT:

J. King - Central States VHF Society Meeting
J. Fox and R. Dunbar - Technical Symposium & AMSAT Coordination
L. Kayser - Technical Symposium & AMSAT Coordination

After some discussion it was agreed to request NASA to identify our present satellite as AMSAT-OSCAR 6 in their "Satellite Situation Report."

Approval was given to the designation of Bill Eitel, WA7LRU as a back-up West Coast command station.

The meeting adjourned at 1:00 p.m.

Charles Dorian, W3JPT

BOARD OF DIRECTORS MEETING
October 15, 1973

The meeting was called to order at 7:45 p.m., by President Klein, K3JTE. Present were:

P. Klein, K3JTE
W. Dunkerley, WA2INB
J. King, W3JEF
W. Hook, W3QBC
C. Dorian, W3JPT

Discussion was given to the question of life membership. W. Hook reported that 30 responses were received indicating support for such a membership. After a review of the possibilities, it was agreed to establish a life membership for a donation of $50 or more for a member and $100 or more for a member society.

The 1974 budget was submitted by President Klein and discussed. A budget of $85,130 was approved and the specific allocation among the various budget items was decided upon.
The follow-on program to A-O-B was discussed. It was agreed that the proposal made originally for a Syncart repeater, which was to be included on the ATS-G satellite, would be updated and developed as one of the possible follow-on repeaters. The Project Manager, Jan King, spoke of the efforts underway by the Australians and the Germans, AMSAT Deutschland. Additional information on the Australian project is desired and President Klein is to explore its status. At the AMSAT technical meeting in February there was an understanding reached whereby these two organizations would be partially supported in their endeavors by AMSAT.

Bill Dunkerley reported on the status of the Satellite Educational Program and the forthcoming attendance at the New York State Educators Meeting. ARRL will be represented by Bill Dunkerley, Dave Sumner, and Don Waters. Additional copies of the educational booklet have been prepared for this affair. Fred Merry, W2GN will establish a satellite transmitting and receive station for demonstrations with OSCAR 6.

Jan King reported on the status of A-O-B. It is anticipated that integration of the satellite will be completed by November or early December with a test program to immediately follow, and that it is expected to have the spacecraft fully ready for launch by early March.

The meeting adjourned at 10:30 p.m.

Charles Dorian, W3JPT

September 15, 1973

SUMMARY OF AMSAT-OSCAR-B SPACECRAFT SYSTEM

AMSAT-OSCAR-B SPACECRAFT

A-O-B (to be known as OSCAR 7 after launch) is an international effort now involving four nations. The A-O-B systems developed in each country are as follows:

Germany:
AMSAT Deutschland Repeater, Spacecraft Structure, Battery Charge Regulator, 28V Power Regulator, Antenna System - DJ45C, DJ5KQ.

Australia:
Two Redundant Command Decoders, Teletype Telemetry Encoder - VK3ZPI.

Canada:
435.1 MHz Beacon Transmitter - VE3QB, VE2AO, and VE3FUA.

United States:
2M/10M Repeater, Morse Code Telemetry Encoder, Experiment Control Logic, Instrumentation Switching Regulator, Solar Panels, Battery - K3JTE, W3GEY, WA4DGT, W3DTN, Marie Marr. Codestore - W5CAY.
S-Band Beacon Transmitter - K6HIJ.
1. **AMSAT Deutschland Repeater (designed by Karl Meinzer, DJ4ZC)**
   - Input freq. passband between 432.125 and 432.175 MHz.
   - Output freq. passband between 145.975 and 145.925 MHz.
   - Power output (high power mode) is 14W PEP.
   - Satellite uplink and downlink antennas are circularly polarized.
   - Downlink passband is inverted from uplink passband.
   - Repeater is 45% efficient using envelope elimination and restoration technique.
   - Linear Operation -- SSB and CW are preferred modes.
   - Repeater is commandable to either 3.75 or 14W PEP output.
   - Telemetry beacon at 145.980 MHz (200 mW).
   - Uplink power required - 300-400 W. EIRP.

2. **AMSAT Two-to-Ten Meter Repeater (designed by Perry Klein, K3JTE)**
   - Input freq. passband between 145.85 and 145.95 MHz.
   - Output freq. passband between 29.40 and 29.50 MHz.
   - Power output is 2W PEP.
   - Satellite uplink antenna is circularly polarized.
   - Downlink passband is not inverted from uplink passband.
   - Linear Operation -- SSB and CW are preferred modes.
   - Telemetry beacon at 29.50 MHz (not same as OSCAR 6).
   - Uplink power required - 80-100 W. EIRP.

3. **Morse Code Telemetry Encoder (designed by John Goode, W5CAY)**
   - 24 analog input channels.
   - Converts each analog value into a two-digit Morse code number or "word."
   - A third digit precedes the telemetry value and gives the line number in which the word is located.
   - Format is arranged four words per line, six lines per telemetry frame.
   - Morse code rate is commandable to 10 w.p.m. or 20 w.p.m.

3. **Teletype Telemetry Encoder (developed by Peter Hammer, VK3ZPI and Edwin Schoell, VK3BDS)**
   - 60 analog input channels.
   - Converts each analog channel to a three-digit number transmitted in Baudot code.
Each three-digit value is preceded by its channel number, making a five-digit telemetry word.

The data is arranged 10 words per line by six lines per telemetry frame.

Two lines of status information follow the analog matrix and give the spacecraft time (i.e., time in "counts" from launch, 1 count = 96 minutes).

Output keys 435.1 MHz beacon in FSK: 850-Hz shift; 45.5 Baud: (inverted from U.S. standard). Also keys 145.98 and 29.50 MHz beacons as AFSK, on command.

5. 435.1 MHz Beacon Transmitter (developed by Larry Kayser, VE3QB and Bob Pepper, VE2AO)
   . Beacon output freq. is 435.10 MHz.
   . Power output is 0.4W at an efficiency of 45%.
   . Beacon is FSK modulated 850-Hz shift.

6. 2304.1 MHz Small Beacon Transmitter (developed by San Bernardino Microwave Society)
   . 0.1W at 2304.1 MHz.
   . Turned on by command only for 30-min. periods.
   . CW keyed -- HI followed by 30-sec. carrier. Also FSK keyed with Morse code telemetry on command.

7. Codestore -- Message store-and-forward system (built by John Goode, W5CAY)
   . 896 bit memory capacity using COS-MOS shift register memory.
   . Loaded via command link.
   . Output code speed is 13 w.p.m.

8. Experiment Control Logic (designed by Jan King, W3GEY)
   . Selects the spacecraft operating modes.
   . Protects satellite against excessive battery drain by reducing repeater output power or by shutting it off completely.

9. Input Solar Power / Battery Charge Regulator (developed by Karl Meinzer, DJ4ZC and Werner Haas, DJ5KQ)
   . Converts 6.4V at arrays to 14V to charge battery or to supply the spacecraft experiments.
   . Senses overcharge of battery and reduces charging current.
   . Senses failure of either of the two redundant regulators and switches to the opposite regulator automatically.
AMSAT-OSCAR 7 AND ITS CAPABILITIES*
(What it is, and how to use it.)

By Joe Kasser, G3ZCZ/W3 and
Jan A. King, W3GEY

Introduction

This paper briefly describes the AMSAT-OSCAR 7 radio amateur satellite, its modes of operation, its orbit and tracking information, and also specifies the type of ground equipment needed to work through or receive signals from the spacecraft.

The Spacecraft

AMSAT-OSCAR 7 is the second in the AMSAT-OSCAR-B series of long-life amateur spacecraft. It is built in an octahedral (8-sided solid) configuration, allowing sufficient surface area for enough solar cells to provide a positive power budget system. This means that unlike OSCAR 6, this spacecraft should not have to be commanded into recharge modes periodically.

Physically, the experiments and individual modules are built in a "plug-in module" construction. This allows the same spacecraft configuration to contain a number of different experiments and modules. The main difference between this spacecraft and OSCAR 6 is that OSCAR 7 contains two repeaters and two auxiliary beacons, and both Morse code and teletype telemetry encoders.

The OSCAR 7 two-to-ten meter repeater has an output power of 2 watts PEP. This will make received signals somewhat stronger at the ground than those coming from OSCAR 6. The second repeater is the AMSAT Deutschland repeater which relays signals from 432 MHz to 145.9 MHz with an internal beacon on 145.98 MHz. The unit was designed and built by Dr. Karl Meinzer, DJ4EC and Werner Haas, DJ5KQ. The two beacons consist of a Canadian-built 435.1 MHz beacon similar to the one flown on OSCAR 6, and a second auxiliary beacon at 2304.1 MHz developed by members of the San Bernardino Microwave Society.

Ground control of the spacecraft is achieved by means of command receivers in each repeater, redundant command decoders and an Experiment Control Logic subsystem.

Downlinked telemetry and stored message data are generated by the Morse code telemetry encoder, or the Codestore unit, these two systems being identical to those flown on OSCAR 6, and a new teletype telemetry encoder designed and built by Dr. Peter Hammer, VK3ZPI and Edwin Schoell, VK3BDS.

The Codestore, Morse code telemetry and teletype telemetry signals can be routed to any of the four beacons in the spacecraft.** The four beacons include two in the repeaters and two auxiliary transmitters in a similar manner to OSCAR 6. It is thus possible, for example, to receive Morse code telemetry on the 29.50 MHz beacon and teletype telemetry on the 435.1 MHz beacon at the same time (on two receivers).

The primary power source of the spacecraft consists of eight solar cell arrays supplying 2.2 Amps at 6.4 volts when illuminated by the sun. A Battery Charge Regulator converts the raw solar cell array output to a +14 volt supply bus. This supply line charges the battery and supplies the spacecraft loads if the solar cell current is not sufficient to run the spacecraft (for example when the satellite is on the dark side of the earth). During these periods, the Nicad battery supplies the extra power. Two other redundant switching regulators supply the remaining voltages needed by the spacecraft modules.

---

*Presented at the ARRL Technical Symposium, Reston, Virginia, Sept. 14, 1971

**There is one exception; the 2304.1 MHz beacon cannot be keyed with Codestore or teletype telemetry.
Modes of Operation

OSCAR 7 has four automatic modes of operation defined as follows:

Mode A: AMSAT two-to-ten meter repeater.
Mode B: AMSAT Deutschland 432-to-146 MHz repeater in high-power mode.
Mode C: AMSAT Deutschland 432-to-146 MHz repeater in low-power mode.
Mode D: Recharge mode.

Each of these modes of operation may be overridden by ground command. In Mode D either the 435.1 MHz or the 2304.1 MHz beacon can be operational upon ground command, while none of the repeaters will be operating. It is also possible to have the 435.1 MHz auxiliary beacon operational by ground command while the spacecraft is operating in Mode A. The 2304.1 MHz beacon can be operated in any of the Modes A through D.

The spacecraft will normally alternate between Modes A and B. An internal timer in the spacecraft generates a pulse every 24 hours which causes the satellite to switch between these two modes. The 24-hour timer will be set by ground command so that the mode change can be kept at approximately the same time each day. Thus, each repeater will be operational on alternate days.

The spacecraft contains automatic power supply monitoring circuitry, such that if the battery charge drops 60% below the full-charge value, the spacecraft will automatically switch to Mode C and reset the timer so as to stay in that mode for 24 hours. In Mode C, the AMSAT Deutschland repeater output power is reduced to 2.5 watts PEP, and the battery drain should be reduced sufficiently to permit the battery to be recharged by the solar cell arrays.

The switch to Mode C takes place under low battery charge conditions when the spacecraft is operating in either Mode A or Mode B. If the battery charge recovers, the spacecraft will switch to Mode B at the next 24-hour pulse, and then continue normal operation.

If the battery power does not recover, but deteriorates even further so that the battery charge drops 70% below the full-charge value, the spacecraft will automatically switch to Mode D and reset the 24-hour timer. Both repeaters will then be switched off, but the 435.1 or 2304.1 MHz beacons can be switched on by ground command to allow telemetry to be received.

Modes C and D are actually expected to serve as backup operating modes for use if the spacecraft available power reserves are low. Normally, operation in these modes will not be required.

Each of the modes can be changed by ground command so as to turn any repeater or beacon on or off as required. This is done so that any failure of the automatic control circuits can be overcome by ground command.

Initial Launch Operation

The spacecraft contains an initial condition reset circuit so that the antennas will deploy after separation from the launch vehicle and the spacecraft will power up in Mode D with the 435.1 MHz beacon on. No repeaters will be operational for at least the first day, so everyone should forget about working through OSCAR and settle down and copy telemetry. It is expected that the repeaters will not be turned on until the spacecraft has stabilized electrically and thermally, as indicated from telemetry data.
Orbit and Tracking Data

The expected orbit for OSCAR 7 is very similar to OSCAR 6. The orbit is expected to be sun-synchronous with an almost identical period and inclination. Thus, the same tracking procedures used for OSCAR 6 will be suitable for use with OSCAR 7.

OSCAR 7 is expected to be placed into orbit so that it is half an orbit ahead of or behind OSCAR 6. Currently, OSCAR 6 comes over daily at a time about 5 minutes earlier every 48 hours. If all goes well, OSCAR 7 is to be launched so that it will come over about 2 1/2 minutes earlier than OSCAR 6 did the day before, and similarly, OSCAR 6 will come over about 2 1/2 minutes earlier than OSCAR 7 did the day before. It is thus possible to expect that instead of three usable spacecraft passes about two hours apart each evening, there will be five or six passes (assuming OSCAR 6 is in operation) about sixty minutes apart.

The reference orbit data for OSCAR 7 will also be published in the same format as the OSCAR 6 data has been up to now, so as to enable each individual to plot his own orbital information.

Ground Equipment Requirements

In considering the ground equipment needed for OSCAR 7, each repeater or beacon will be discussed separately in terms of the ground equipment needed to operate with it.

1. AMSAT Two-to-Ten Meter Repeater

The two-to-ten meter repeater operates in a linear mode similar to the unit flown on OSCAR 6. As such, SSB and CW are the preferred operating modes. The repeater receives signals between 145.85 and 145.95 MHz and re-radiates them between 29.4 and 29.5 MHz. There is also a telemetry beacon on 29.50 MHz.

Note that these frequencies are different from those employed with OSCAR 6. They reflect comments received on the operational experience obtained with OSCAR 6. The repeater has an output power of 2 watts PEP, so received ground signals should be stronger - but don't throw those preamplifiers away yet!

The same equipment used to work through OSCAR 6 will be suitable for working through this repeater, namely a sensitive receiver, and preamplifier if possible, as well as a suitable ten-meter antenna. Since the spacecraft will again be using a linearly polarized ten-meter antenna, the ground station antenna should preferably be circularly polarized. Linearly polarized ten-meter receiving antennas can also be used, but at the sacrifice of some fading.

The transmitting equipment should be capable of putting out no more than 80-100 watts of effective radiated power from the antenna. It is operationally preferable to use a transmitter with an output power of the order of 80-100 watts and a simple ground plane or turnstile antenna than to use a lower powered transmitter and more directional antenna. Communicating through OSCAR 7 in a low orbit is a challenge for the single operator. Besides tuning the transmitter and receiver, it is necessary to keep both antennas tracking the spacecraft - and then work someone in between. Surely there must be advantages in minimizing the duties to be performed during each pass so as to be able to concentrate on the important business of making contacts through the satellite. This can be partly achieved by using the low-gain antennas and the 80-100 watts indicated.

2. AMSAT Deutschland 432-to-145.9 MHz Repeater

The AMSAT Deutschland repeater is also a linear device. Again, CW and SSB (or controlled-carrier AM) are the preferred operating modes. The repeater has an input frequency passband between 432.125 MHz and 432.175 MHz, and an output frequency passband between 145.975 MHz and 145.925 MHz. The output passband is inverted. That is, upper-sideband signals transmitted to the spacecraft would be received on lower sideband.
The relationship between input and output frequencies is such that a received signal on 432.125 MHz would be relayed on 145.975 MHz, and similarly, a received signal on 432.175 MHz would be relayed on 145.925 MHz, i.e., tune up the band at 432 MHz and down the band at 146 MHz. This repeater also has a telemetry beacon on 145.980 MHz.

Any receiver with a good two-meter converter should be able to receive signals from this repeater, even with a simple antenna. Since the spacecraft antennas associated with this repeater are circularly polarized, linearly polarized antennas will be suitable for ground use. If linearly polarized, the receiving antenna for this repeater can be the same one used to work through the two-to-ten meter repeater.

On the transmitting side, the recommended effective radiated power output is of the order of 300-400 watts. Thus, a 30-watt transmitter will require an antenna with a gain of the order of 10-12 dB, but it would be preferable to obtain or even build a 300-watt amplifier and use an omnidirectional antenna to reduce the antenna pointing accuracy requirements.

Though the spacecraft will have circularly polarized antennas for this repeater so that linear antennas at ground stations will work fine, it is important not to forget that circularly polarized ground station antennas can be expected to provide as much as 3 dB more signal, and this might be the difference between making or missing a contact. All circularly polarized antennas used with this repeater should be right-hand circularly polarized (RHCP) in the Northern Hemisphere and left-hand circularly polarized (LHCP) in the Southern Hemisphere.

The easiest way of generating RF for the 432 MHz uplink is probably to convert a surplus 450 MHz FM transmitter strip for CW operation on 432 MHz. This should not be too difficult, even for inexperienced VHFPers. Other techniques are to triple 144 MHz signals to 432 MHz or double 220 MHz to 440 MHz and use a different crystal to transmit on 432 MHz. The best method is to build a transverter from say 50 MHz to 432 MHz. This would allow both SSB and CW operation with full VFO control.

3. 435.1 MHz Auxiliary Beacon

The Canadian 435.1 MHz beacon will usually be operating when the spacecraft is in Modes A or D. It will not operate while the spacecraft is in Modes B or C because of interference effects with the 432 MHz uplink of the AMSAT Deutschland repeater.

Extremely good signal levels were copied from the OSCAR 6 435.1 MHz beacon during the early months that it was operating. For receiving the signals, a receiver with any good converter and antenna will be suitable. Again, a circularly polarized antenna would be preferable.* The converter should be fitted with a new crystal so as to cover 435.1 MHz instead of the more conventional 432 MHz.

Doppler shifts of the order of ±10 kHz can be expected on the signals, so be prepared to keep retuning during the pass.

4. 2304.1 MHz S-Band Beacon

The 2304.1 MHz beacon, built by members of the San Bernardino Microwave Society in California, will transmit a "HI" in Morse code followed by thirty seconds of continuous carrier for tracking purposes. The beacon contains an internal thirty-minute timer to ensure positive control which will shut down the beacon 30 minutes after it is commanded on. The 2304.1 MHz beacon can also be keyed with Morse code telemetry on ground command.

*In this case, LHCP should be used in the Northern Hemisphere and RHCP in the Southern Hemisphere.
Link calculations have been done for the spacecraft-to-ground communications link to determine the sort of equipment needed. Consider a typical ground station using a four-foot dish and a converter with a 6 dB noise figure. The link calculations are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacecraft output power (100 mW)</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>Path loss to ground for 2000 miles</td>
<td>-170 dB</td>
</tr>
<tr>
<td>Thus, signal level at antenna</td>
<td>-150 dB</td>
</tr>
<tr>
<td>Gain of four-foot dish</td>
<td>+27 dB</td>
</tr>
<tr>
<td>Polarization and line losses</td>
<td>-6 dB</td>
</tr>
<tr>
<td>Signal power at converter input</td>
<td>-129 dB</td>
</tr>
<tr>
<td>Noise power in a 500 Hz bandwidth, 6 dB noise figure receiver</td>
<td>-141 dB</td>
</tr>
<tr>
<td>Thus, received signal-to-noise ratio is</td>
<td>+12 dB</td>
</tr>
</tbody>
</table>

This was calculated for a four-foot dish and a receiver with a bandwidth of 500 Hz. The Doppler shift for an overhead pass at this frequency has been calculated to be ±55 kHz. The 3 dB beamwidth of the four-foot dish is only 7.5°. Anybody trying to track the S-band beacon is going to have a lot of fun.*

Copying Telemetry

OSCAR 7 contains two separate telemetry encoders: a Morse code unit identical to that flown on OSCAR 6 and an 850-Hz shift teletype encoder designed and built in Australia.

Morse Code Telemetry -

The Morse code telemetry format is identical to that of OSCAR 6. The format is arranged in six lines of four words. The first digit of each three-figure "word" is the line identifier. Each telemetry frame is separated from the next by the "HI" identifier. The code speed, like OSCAR 6, is commandable between 10 and 20 WPM.

Teletype Telemetry -

Sixty channels of data are monitored and encoded by the WIA-Project Australis teletype telemetry encoder. The data is formatted as ten words per line in six lines of data. Each data word contains five digits. The first two digits indicate the channel number, and the last three represent the encoded sensor data digits.

Between each data frame are two lines of digital data which provide information on the spacecraft clock and command register status.

The encoder has two operating modes. There is a stepping mode in which each channel is sampled in turn, and a single-channel "dwell" mode in which one channel is sampled continuously. Each line of data is followed by a carriage return, line feed and figures signal, so as to keep the printer in upper case.

*For anyone who wants to build a converter, Ham Radio contains a fairly simple design in the March 1972 issue. Another 2304 MHz converter is described in January 1974 QST.
The teletype data is transmitted from the spacecraft in Baudot code using 850-Hz shift. Signals will be frequency-shift keyed on 435.1 MHz and audio-frequency shift keyed on 145.98 and 29.500 MHz. It may be necessary to be able to reverse the mark and space tones in the ground station terminal unit to receive the AFSK telemetry.

Doppler on the 435.1 MHz beacon will be of the order of ±10 kHz for a pass directly overhead. Tests were conducted from WA3EWJ transmitting FSK RTTY through the two-to-ten meter repeater in OSCAR 6 during January 1973. It was found that the 5 kHz Doppler shift encountered there did not cause any appreciable errors. It was just necessary to keep retuning the receiver every few minutes. Thus, the tuning rate will just have to be increased to cope with the extra Doppler shift.

A better idea is to use a special IF with a 25 kHz bandwidth and a phase-lock loop teletype terminal unit using one of the phase-lock integrated circuits now available at low cost.

Summary

This paper has briefly described OSCAR 7, its projected orbit and the type of equipment needed to operate with it. A summary table of the frequencies of interest is presented below.

Beacons

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.50 MHz</td>
<td>Mode A</td>
<td>Associated with the two-to-ten meter repeater.</td>
</tr>
<tr>
<td>145.98 MHz</td>
<td>Mode B, C</td>
<td>Associated with the 432-to-146 MHz repeater.</td>
</tr>
<tr>
<td>435.10 MHz</td>
<td>Mode A, D</td>
<td>Teletype, Morse code or Codestore keying.</td>
</tr>
<tr>
<td>2304.1 MHz</td>
<td>Mode A, B, C, D</td>
<td>CW tracking beacon and Morse code telemetry.</td>
</tr>
</tbody>
</table>

Repeaters

<table>
<thead>
<tr>
<th>Mode</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>145.85 MHz to 145.95 MHz input</td>
</tr>
<tr>
<td></td>
<td>29.40 MHz to 29.50 MHz output (non-inverting passband)</td>
</tr>
<tr>
<td>B, C</td>
<td>432.125 MHz to 432.175 MHz input</td>
</tr>
<tr>
<td></td>
<td>145.975 MHz to 145.925 MHz output (inverted passband)</td>
</tr>
</tbody>
</table>

It is hoped that those reading this article will want to try their hand in participating with OSCAR 7, certainly the most advanced satellite yet developed for the amateur service.

LETTERS

My congratulations to AMSAT for a highly successful year of amateur satellite communication.

Richard J. Cotton, W8BDX
Detroit, Mich.
October 19, 1973
FCC NOTICE OF INQUIRY ON THE AMATEUR-SATELLITE SERVICE

In order to develop the recently established Amateur-Satellite Service in an orderly fashion and in a spirit of cooperation with other amateur radio activities sharing the same frequencies, the U.S. Federal Communications Commission has issued a Notice of Inquiry requesting comments and suggestions for specific rules to be adopted for the new service.

To assist the F.C.C. in formulating rules for the Amateur-Satellite Service, knowledgeable parties are invited to submit comments and suggestions on the following:

a. What specific types of stations and/or functions should be provided for in the Amateur-satellite Service, in addition to space stations? Earth stations? Telecommand stations? Others?

b. What should be the station license requirements and privileges for the above stations? What representations should be made for these stations in applications for licensing?

c. What classes of amateur radio operator licenses should be a prerequisite for the above station licenses? What should be the operating privileges at these stations? What material should be added to the examinations for these operator classes?

d. What technical standards should be adopted? What should the telecommand and telemetry requirements be? What emissions should be authorized?

e. What should the rules provide for in the way of operating requirements and procedures? Station identification requirements? Station log requirements? Should distinctive call signs be assigned?

f. What other provisions should be included in the rules?

If you have any comments and thoughts on this matter, please communicate them to AMSAT. Comments to the Commission must be filed by January 7, 1974.

AMSAT gratefully acknowledges recent donations of $25.00 or more (or equivalent) from the following:

The American Radio Relay League
Central States VHF Society
Alan M. Chedester - WA3PIC
Richard J. Cotton - W8DX
Harold D. DeVoe - KL7MF
Stephen J. Hay - K5RZU
Hewlett - Packard
International Amateur Radio Union - Region 1
Fred J. Merry - W2GN
Jay Mahoney - W6YDF
W. M. Gettmeier - W4BYY
Project OSCAR, Inc.
Radio Corporation of America
Jack H. Ross - K4NVD
Bruce Rowlings - ZL1WB

We also thank the many others who made financial contributions to the AMSAT-OSCAR projects.
AN OSCAR ANGLE NOMOGRAM

By Roy E. Gould - WSPAG

To make full use of a high gain antenna array, the azimuth and elevation angles to the satellite must be known so that it can be tracked by the antennas during the pass. In search of a method for determining the proper antenna angles, I have developed the nomogram described here.

The nomogram is based on these equations:

\[
D = \arccos \left( \frac{R}{R + h} \cos \gamma \right) - \gamma
\]

\[
\sin B = \sin A \cos D + \cos A \sin D \cos C
\]

\[
\sin L = \frac{\sin C \sin D}{\cos B}
\]

Where:
- \(D\) = distance along path in degrees
- \(R\) = radius of the earth
- \(h\) = height of the satellite above the earth's surface
- \(\gamma\) = elevation angle in degrees
- \(B\) = latitude of the satellite
- \(A\) = latitude of the receiving point
- \(C\) = heading to the satellite from north
- \(L\) = longitude difference between receiver and satellite.

The last two equations were derived from the heading and distance equations found in the ARRL Antenna Book.

The nomogram shown in Figure 1 was drawn with the aid of a Hewlett-Packard HP-9820 calculator with plotter. It could also have been drawn by first calculating the points and then plotting the curves by hand. Note that only points from 0 to 180 degrees heading need be calculated because one side of the figure is a mirror image of the other.

Even if directional antennas are not used, the information available from the nomogram is still useful and interesting. One piece of information all stations need is the time-of-acquisition and the time at loss-of-signal. If only this information is desired, only the outside ring need be plotted. It is obtained using an elevation angle of zero (\(\gamma=0\)) in the equations. This simple nomogram will also give the time of closest approach and will give some idea of how close the satellite will pass.

To use the nomogram, the orbital path of the satellite as a function of time must be known. The orbital information for OSCAR 6 given in the December 1972 Newsletter was used to plot the two orbit path plots shown in Figures 2 and 3. I plotted these on a piece of flexible plastic so that the nomogram could be easily read through the overlay. Instead of breaking the path into two sections, they can be plotted as one continuous plot. This would be desirable for those living far enough north to be within range of the OSCAR when it is at its most northerly position.

The distorted circles are "iso-elevation" angle lines and the spirals are "iso-heading" lines. To determine the elevation angle and the heading as a function of time, the orbital path overlay is first positioned on the nomogram with the equator line of the overlay aligned with the equator line on the
Figure 1. OSCAR-6 Nomogram Centered On El Paso, Texas
Figure 2. Ascending Node (Evening) Orbital Path
Figure 3. Descending Node (Morning) Orbital Path
nomogram. The equator crossing point on the overlay is positioned at the point on the equator line of the nomogram corresponding to the equator crossing point of the particular orbit being considered. The ascending node overlay is positioned at the equator crossing point given in the tables in the Newsletter or in the W1AW broadcasts. However, when the satellite is in the descending node, the north-to-south crossing point must be determined and the descending node overlay equator crossing point positioned at this point. For OSCAR 6 the descending node crossing point can be easily determined by subtracting 165.6 degrees from the ascending node crossing point.

Once the overlay is positioned, the antenna heading and elevation angles can be easily read as a function of time. The time read on the overlays is the time from equator crossing, and the actual time is found by adding the time read to the equator crossing time for the particular orbit in question.

This nomogram provides a fast and easy method for determining antenna angles during a pass. About five minutes preparation are normally required to prepare a table showing where to point the antennas during the pass. The information in the tables can then be used to position the antenna during the pass.

Perry Klein, K3JTE (holding trophy) awards the first AMSAT-OSCAR Worked All States trophy to Jack Colson, W3TMZ at the AMSAT Annual Meeting. Also in the picture is Bill Hunter, K4TI (seated at the right) who completed the second OSCAR WAS.

Standing at the right is Larry Kayser, VE3QB who gave an interesting presentation on his automated AMSAT-OSCAR 6 command station at the ARRL Technical Symposium.
To date, observations of AMSAT-OSCAR 6 have been made on two orbits. Its brightness variations are very large and it is probably spinning fairly fast.

The first optical sighting, to my knowledge, was made by Ray Newell, a member of the Rochester Moonwatch Team, on 26 September, orbit 4325 at about 0155Z. As OSCAR entered his field of view, it flashed to about 5th magnitude (just visible to the naked eye), then quickly faded to below his threshold (10th magnitude) when he lost it. He was using a 5 inch apogee refracting telescope with a 2 1/2 degree diameter field of view.

Both Ray and I saw it on orbit 4375, 30 Sept. at 0144Z, using larger telescopes this time. Again, it brightened rapidly, only to 8th magnitude though, then faded to below our threshold, 12th magnitude. It was visible for a total of about 5 seconds. Both instruments were homemade 8 inch reflecting telescopes with a one degree field of view.

AMSAT-OSCAR 6 was located using information from a detailed computer printout of circumstances for optical observations donated by ZIPSAT. Its position for a particular time was plotted on Webb's Atlas of the Stars. Then the position was located by noting the surrounding star patterns, and I just waited until it came into view.

During future observations, I would like to try to follow OSCAR from one peak to the next to see what kind of difference there is in peak brightness. This way I hope to determine spin rate and possibly the axis of rotation. To do this, I have converted a 6 inch telescope to a 3 degree field of view.

In conclusion, I would like to recognize the considerable computer work done by Ed Steeble, K31XD, and Jim Welch, WB2DEI. They both have been working on programs to pinpoint OSCAR, and after a few more bugs are worked out, they will be off and running. I would also like to thank Mr. Norton Goodwin, Director, ZIPSAT Information Services, for donating some of his ZIPSAT orbital data in the meantime.*

*Further information on how to optically track OSCAR 6 and other satellites may be obtained by writing Mr. Norton Goodwin, Director, ZIPSAT Information Services, 824 Connecticut Avenue, N.W., Washington, D.C. 20006.

AMSAT-OSCAR 6 OPERATING SCHEDULE

The current operating schedule of the AMSAT-OSCAR 6 satellite is as follows:

Thursdays, Saturdays, Mondays (GMT days) --

Satellite repeater ON for communications during south-to-north passes only. These ascending node passes are within range of your location during the late afternoon and evenings.

Tuesdays, Fridays, Sundays (GMT days) -- Beginning on December 2, the repeater will be ON during north-to-south (local morning) passes, primarily for use in educational demonstrations. All users are urged to arrange demonstrations for your local schools and other community groups, and to let AMSAT and ARRL know about them.

Telemetry data is taken on the reference orbits, i.e., about 5-15 minutes after the first equatorial crossing of each Greenwich day. AMSAT is in need of more telemetry collection stations. Please help us by sending us any data received on the 29.450 MHz beacon (including any old data on past orbits that you may not have sent us). Data is constantly needed if we are to successfully achieve additional months of operation with OSCAR 6 beyond its first birthday.
AMSAT-OSCAR 6 COMMUNICATOR ENDORSEMENTS NOW AVAILABLE

Special AMSAT-OSCAR 6 endorsement stickers are now available for attachment at the bottom of your AMSAT membership certificate. These "AMSAT-OSCAR 6 COMMUNICATOR" endorsements are available to AMSAT members upon receipt of an up-to-date list (in call-letter order) of all the QSL cards you have received for two-way contacts through the satellite.

To receive your endorsement, send a completed "AMSAT/OSCAR CHECK-SHEET FOR CONFIRMED TWO-WAY CONTACTS" and a self-addressed envelope to:

AMSAT-OSCAR 6 Endorsement Dept.
P. O. Box 27
Washington, D.C. 20044

Please include your AMSAT membership number as it appears on your membership certificate.

RUBBER STAMP OF AMSAT-OSCAR 6 NOW AVAILABLE

Rubber stamps similar to the one shown on this page are now available.

The stamps show AMSAT-OSCAR 6 and the Earth surrounded by a 1.75 inch diameter circular border.

These are available, post-paid within the U.S. and Canada, for $3.50 from:

Al Simpson, WA5TJB
1005 East "I" Street
Russellville, Arkansas 72801

For shipment to other countries please include an additional 50¢ for air mail postage. A smaller version without the border is available for use in limited space. This would be ideal for the backs of QSL cards. The price is $2.50 PPD, U.S. and Canada.
The following data for AMSAT-OSCAR 6 are supplied by AMSAT. The times are in GMT and the longitudes are in degrees west of Greenwich.

**Period = 114,99455 Minutes**

**Longitude Increment = 28.748° per orbit.**

Note that orbits repeat on a 263-orbit cycle every three weeks (i.e., every 21 days), but 3.6 minutes later and 0.9 degrees further west.

<table>
<thead>
<tr>
<th>DEY</th>
<th>DATE</th>
<th>TIME / LONG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5151 DEC</td>
<td>11 04:29:7</td>
<td>03:0</td>
</tr>
<tr>
<td>5464 DEC</td>
<td>2 01:46:6</td>
<td>03:0</td>
</tr>
<tr>
<td>5175 DEC</td>
<td>1 05:47:3</td>
<td>03:0</td>
</tr>
<tr>
<td>5185 DEC</td>
<td>1 06:30:4</td>
<td>03:0</td>
</tr>
<tr>
<td>5191 DEC</td>
<td>0 05:44:4</td>
<td>03:0</td>
</tr>
<tr>
<td>5214 DEC</td>
<td>0 03:13:0</td>
<td>03:0</td>
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<tr>
<td>5227 DEC</td>
<td>1 01:12:6</td>
<td>03:0</td>
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<td>5235 DEC</td>
<td>1 03:01:6</td>
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<tr>
<td>5251 DEC</td>
<td>0 00:10:6</td>
<td>03:0</td>
</tr>
<tr>
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| 5602 JAN | 6 01:09:7 | 03:0 |
| 5614 JAN | 7 00:14:1 | 03:0 |
| 5627 JAN | 8 01:04:0 | 03:0 |
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| 5652 JAN | 10 00:46:3 | 03:0 |
| 5665 JAN | 11 01:53:8 | 03:0 |
| 5677 JAN | 12 00:53:7 | 03:0 |
| 5690 JAN | 13 01:47:8 | 03:0 |
| 5702 JAN | 14 00:42:5 | 03:0 |
| 5715 JAN | 15 01:35:4 | 03:0 |

...
"AMSAT-Deutschland e. V." founded

This summer a number of amateurs of the Federal Republic of Germany founded the association "AMSAT-Deutschland e. V.," abbreviated AMSAT-DL, with the address:

D - 3550 Marbach, Fuchsweig 10, W. Germany.

AMSAT-DL is a non-profit association working towards the construction and operation of radio amateur satellites as a public service.

As the name suggests, AMSAT-DL works closely together with AMSAT, Inc., Washington. OSCAR 7 will contain a number of subsystems built by AMSAT-DL, particularly the DJ4ZC 70 cm-to-2m linear repeater. Also AMSAT-DL is contributing the main power regulators, satellite structure and parts of the 70cm/2m antenna system.

The Board of Directors is composed of Karl Meinzer, DJ4ZC, Werner Haas, DJ5KQ, and Hans Koch, DK8FJ. The information service of AMSAT-DL is handled by Alexander Schoening, DC7AS, Maximiliankorso 52, 1 Berlin 28, W. Germany, who will be happy to supply all information regarding AMSAT-DL and their projects.

LETTERS

I believe that the unprecedented achievement by OSCAR 6 of a one-year active lifetime represents without a doubt the greatest single advance in the history of amateur radio since the discovery of the world below 200 meters. Everyone connected with OSCAR 6 should be congratulated in the strongest possible terms for your respective roles in making this first long-lived, easily-accessed amateur radio communications satellite a reality.

Raphael Soifer, K2QBW
Glen Rock, N.J.
October 15, 1973

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HAPPY BIRTHDAY AMSAT-OSCAR 6

Congratulations to the Radio Amateur Satellite Corporation on the occasion of completing one year's operation in space with your AMSAT-OSCAR 6 communications satellite. Achievements by the radio amateur community with this satellite have been quite remarkable. NASA wishes you even greater success with OSCAR 7.

James C. Fletcher
Administrator
National Aeronautics and Space Administration
October 19, 1973

Happy birthday to OSCAR. My congratulations to all who contributed for this tremendous achievement.

BFRA VHF Section
Sofia, Bulgaria
October 19, 1973

Cheers and 73 to one year old OSCAR.

OH2RX
Helsinki, Finland
October 15, 1973

The past year has been one of great achievement of which you can all be real proud. I am grateful for the privilege of taking part in it. Sincere thanks and good wishes to all -- and long live OSCAR 6!

Bruce Rowlings, ZL1WB
Whangarei, Northland, New Zealand
Oct. 19, 1973

Congratulations on first year OSCAR 6. Significant milestone for amateur radio.

WIA- Project Australis
Melbourne, Australia
October 16, 1973

Happy first birthday for OSCAR 6!

Eugenio C. Pottana, LU9MA
Mendoza, Argentina
Oct. 20, 1973

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