AMSAT

NEWSLETTER

Issued by the Radio Amateur Satellite Corporation, P. O. Box 27, Washington, D.C. 20044

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Editorial

CONFESSIONS OF AN OPTIMIST

We had hoped to announce in this issue of the Newsletter the good news that all of us have been waiting for—namely, a firm date for the launch of Australis-OSCAR A (A-O-A). Unfortunately, this is not yet possible, because of two reasons. First, NASA has not approved the AMSAT request so far, and second, the Delta vehicle intended for the launch had some recent failures, resulting in the postponement of several scheduled launches till the causes of failure have been determined.

In spite of the disappointment, however, we are optimistic about our chances. The reasons for our optimism are many:

- Precedents exist for the piggyback launch of amateur satellites with other government payloads: all OSCAR's were launched this way.
- AMSAT's request has been under consideration by NASA since March, and obviously has enough merit to justify such extended examination—otherwise it would have been turned down long ago!
- The additional clarification and supplementary information asked by NASA has been duly supplied.
- All tests on A-O-A have progressed satisfactorily, and the chances of A-O-A interfering with the primary mission appear to be vanishingly small.

So we still hope that NASA will approve out request and authorize the A-O-A launch shortly. The actual launch will have to wait till the Delta vehicle has been cleared and the other launches scheduled ahead of us have been performed. We shall keep you informed through the Newsletter, QST, CQ and other media. (Those wishing to have their names included in the joint OSCAR-AMSAT mailing list should contact Project OSCAR, Foothill College, 12345 El Monte Road, Los Altos Hills, California 94022, if they have not done so already.)

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In this issue of the NEWSLETTER we have a report by Jan King, K8VTR, on the tests and current status of A-O-A. He also gives useful hints on what to observe, and how. "Cap" Petry, W3AWN, is setting up an observational network and establishing procedures for the flow of bulletins to and from stations. Considerable amount of additional work will be needed later in reducing and analyzing the data. In keeping with our basic optimism, we are fully confident that all components of this complex mechanism will mesh properly—the square flanges will fit the round shafts, and so on—and that all this will occur well before the big event. Of course, optimism alone is not enough, and a lot of hard work by a lot of dedicated volunteers is needed. And we hope the volunteers will be there: May we count you in?

S. H. Durrani

The highest priority activity in which AMSAT has been involved is directed toward the launch of the Australis-OSCAR A (A-O-A) satellite, to be named Australis-OSCAR 5 when it achieves orbit. Over the past few months, more than two dozen technical persons under the excellent direction of Jan King, K8VTR, have been directly involved in the preparation of A-O-A for a hoped-for launch on a Thor Delta vehicle.

We are occasionally asked why AMSAT is helping arrange to launch a beacon satellite, rather than putting all efforts into building a satellite with a communications repeater. There are several answers to this question. First, it has been nearly four years since the last amateur satellite, OSCAR 4, was launched. There are now many new amateurs who have not yet been exposed to amateur communications via satellite. In a sense, A-O-A will serve as a test and training satellite to help interest amateurs in satellite communication techniques.

Second, A-O-A is carrying significant experiments expected to provide information important for the design of future satellites. These experiments include a ten-meter commandable beacon, a seven channel telemetry system, and a magnetic attitude stabilization system. We also expect that valuable HF and VHF propagation data will be obtained from the satellite's two beacons.

Finally, AMSAT's participation in preparing A-O-A for launch provides an excellent opportunity to obtain invaluable experience in the construction and launch qualification of amateur communication satellites. We expect to call upon this experience during the design, construction and checkout of future amateur satellites.

One can think of A-O-A as the first phase of a three-phase AMSAT program. The first phase is directed toward involving amateurs in communication satellite techniques, and obtaining information on passive stabilization, thermal control, telemetry and command subsystems useful for the design of satellites for phases II and III.

Phase II centers about the development of a long-life, solar powered, multi-channel communications repeater. It is hoped that a satellite with a useful lifetime of a year or more will provide an incentive for large numbers of amateurs to build up the equipment needed to communicate via satellite.

The objective of phase III is to develop a long-life amateur communications repeater for synchronous or synchronous-transfer orbit. We are currently exploring the possibility of providing a long-life satellite repeater subsystem that could be integrated as one of several experiments aboard a synchronous satellite planned by NASA.

This, in brief, is how I anticipate amateur satellites will evolve over the next few years. And in order to enter phases II and III, we must first complete phase I, which we hope to do within the next few months.

Perry Klein, K3JTE

SECRETARY'S COLUMN

It is with both pleasure and regret that I accepted on June 18 the position as Secretary of AMSAT—pleasure in being able to take an active part in AMSAT affairs and regret that Jim Puglise, W3CBJ, had to resign as your first Secretary in order to return to his home state, Michigan. Jim's guiding hand was most helpful in the first formative months. Since June 18 our membership has doubled and with the many applications came an equal number of inquiries which have required individual attention. The Administrative Staff is composed of volunteers who are all members of AMSAT. In general, there are subdivisions of Newsletter, Article Writing (QST, CQ, OSCAR), Translations, Photography, Printing, Applications and Inquiries, and Mailing. The most active are the Newsletter under Dr. Durrani, Article Writing by George Jacobs, Bill Dunkerley and Bill Orr, and Applications and Inquiries under P. Shome.

Under review is the idea of a distinctive "logo" or identifying symbol for AMSAT. If any readers have ideas, please send them in for consideration.

Since June 18 there has been one meeting of AMSAT. This was on July 22 when members of NASTAR—the moon relay project—came to Washington to discuss their project. That evening turned out to be wettest in history. Many streets were flooded after a drenching rain; as a result attendence was markedly reduced, and only 22 persons attended the meeting.

During September/October at least five AMSAT members including the President and the Secretary were in Geneva, Switzerland for the ITU-CCIR Study Group IV meeting on communication satellites. While there they took the opportunity to attend the International Amateur Radio Club Convention, 12-14 September, and present the AMSAT story.

Charles Dorian, W3JPT

AMSAT ANNUAL MEETING

The first Annual Meeting of AMSAT will be held on Saturday, November 22, 1969 at 8:00 p.m. at NASA-Goddard Space Flight Center, Greenbelt, Md. Attendees are advised to ask the guard at the gate for building and room number.

- ELECTION OF THE BOARD OF DIRECTORS WILL BE HELD AT THIS MEETING. (See Bill Tynan's article for details)
- ALL MEMBERS ARE URGED TO ATTEND OR SEND IN THE PROXY FORM. (See Back Cover)

A Happy Hour and Dinner will be held before the meeting at the Colony 7 Motel on the Baltimore-Washington Parkway at Maryland Route 32. Time: 5:30 p.m.

MEMBERS ARRIVING FROM OUT OF TOWN AND WISHING PICK-UP ASSISTANCE, PLEASE CALL ONE OF THE FOLLOWING:
PERRY KLEIN, K3JTE, PHONE (202) 554-5824
BILL TYNAN, W3KMV, PHONE (301) 384-9138
GERRY HENDRICKSON (FOR FRIENDSHIP AIRPORT), PHONE (301) 766-3653

A-O-A PROGRESS REPORT AND HINTS FOR OBSERVATIONS

BY J.A. King, K8VTR, Project Manager

Australis-OSCAR A (A-O-A) has now undergone nearly all of its testing and modifications, and is being prepared for a launch in the near future. Some test results and current data are described below. In addition, information is presented that will be specifically helpful in observation after the launch.

The Testing Program

The importance of a thorough testing program cannot be over-emphasized. Although the Australian group that built the satellite did an excellent job, some problems were inevitable due to the rigorous nature of space qualification tests. The long delay between construction and testing also caused some problems. Luckily, all the problems detected during the tests have been analyzed and corrected. Based on this experience, future articles will describe how to design and construct amateur satellites that can withstand the severe environments of the launch phase and prolonged life in space.

Test Results and Current Status

All tests have been completed except the magnetic alignment test, which will show how effective the magnetic attitude stabilization system is in damping the rotation of A-O-A. Results of other tests on various subsystems follow.

1. Battery. Frank Briden, W3EPY, has estimated its lifetime by testing identical cells under similar loading conditions. The 2 meter beacon should have sufficient output for 6 weeks. The 10 meter beacon, which is not ON continuously, should last for 8 weeks or more.

2. Beacons. Two transmitters had a few component failures but are now operating satisfactorily under all test conditions. RF power output under ambient conditions and maximum battery voltage are as follows:

HF ("10 m") transmitter: 180 mW @ 29.450 MHz

VHF ("2m") transmitter: 120 mW @ 144.050 MHz

The power output of the 10 m transmitter falls fairly linearly with decreasing battery voltage, but the 2 m transmitter output falls very rapidly, especially under hot conditions (down to 20 mW at 62°C for 17 V at battery). To maintain sufficient 2 m output it will be important to keep the spacecraft temperature low.

3. Command Receiver. At this time the receiver is considered to be marginal. Thermal vacuum tests show that the sensitivity varies greatly with changes in temperature and pressure. Another problem is that the 2 m transmitter signal is being received and detected by the receiver. This signal is extremely undesirable because of its interference with the command signal. A series tuned filter to ground has been installed to remove the undesired signal. The filter is effective under ambient (room temperature) conditions but not at other temperatures.

4. Telemetry. The telemetry system has operated most satisfactorily during all phases of testing. Calibration data has been repeatable during various thermal vacuum tests. The following points should be noted regarding the published calibration curves:

a) The temperature curves may be used to +60°C by a linear extrapolation. The actual curve is slightly higher, being 2.5°C above the linear estimate at 60°C.

b) The current calibration has been altered from the published value, because the resistor used for current measurement had to be replaced by one of higher value. The new curve has the same slope but is displaced upward by 9 mA; the new curve has the equation.

$$I(mA) = f(Hz)/9 - 53.5.$$

The current read by the horizon sensors when looking into space (i.e. "dark current") gives a telemetry reading of 510 Hz at 10°C and 640 Hz at 60°C.

Hints for Observations

While tracking a satellite is an important and interesting amateur activity*, it is far from being the main objective of A-O-A. This is a telemetry satellite and reports information about itself as well as its environment; the former is useful to designers of future satellites and the latter gives data for ionospheric propagation and space research. Project Australis-OSCAR and AMSAT need this information from every amateur listening to the satellite. Some suggestions for observations are given below:

1. Acquiring the Satellite. Generally listen for the 2m beacon before trying the 10m beacon which may be ON intermittently or only during weekends. Observe telemetry channel #1 to see if the 10m beacon is on; a current of 50 to 60mA (during the first month of operation) indicates the beacon is ON, while 25 to 30 mA shows it is OFF.

2. Temperature Record. Keep an accurate record of the temperature (channels #5 and #7) during each part of a pass. Overhead passes will occur at your location around 1500 local time every day. Data for these and other passes is of interest for the thermal designer of future satellites. Of great interest is the temperature during the North-South pass at 0300 local time daily, when the satellite will be going through a dark (colder) period. Another useful measurement is the difference in temperature between the skin and inside of the spacecraft.

3. Horizon Sensor. This experiment is a first for amateur radio. Three horizon sensors are mounted on the satellite with the following alignment:

x axis sensor - parallel with the 2m antennas
y axis sensor - perpendicular to all antennas
z axis sensor - parallel with the 10m antennas

*For tracking information see "Australis-OSCAR 5: Where it's At", by W. Danielson and Sheldon Glick, WA1IUO/WB2 OHH; QST, p. 54, October, 1969.

When a sensor is not viewing the earth, the telemetry channel emits a tone between 510 and 640 Hz; when it views a portion of the earth, the tone will be higher, probably around 1000 to 1200 Hz. Measure these values for each axis and add them to your telemetry report.

A word of caution. If the satellite spin rate is high about a given axis, one or two sensors may have an ON time shorter than the duration of the sampling period. In this case, be careful not to confuse the ON-OFF transition with a telemetry channel change. Probably the spin rate around the z axis will be slow (about 4 rpm) but confusion may sometimes arise even at this slow rate.

Occasionally a short transition may occur on one of the sensors as it sweeps across the sun or the moon. Note the time, particular sensor, and tone frequency when this happens. Also note if the signal is in a null or a peak at the time. You may like to compute the exact attitude of the spacecraft and to correlate it with the signal strength and polarization of the two beacons.

The x-axis sensor data can be used to assess the effect of the magnetic attitude stabilization system: the x-axis spin rate should gradually decrease during several days as the axis comes into alignment with the geomagnetic field.

4. The Propagation Experiment. The 10m beacon operating at 29.450 MHz is potentially A-O-A's most important source for scientific information. It also requires greater sophistication on the part of the amateur.

To fully participate it will be necessary to track both beacons simultaneously and preferably to record them on magnetic tape or paper charts.

Estimate the time when you expect to acquire the satellite and start listening several minutes beforehand. Note the time difference between acquisition of the two signals (2m and 10m). Similarly, note the time difference between loss of signals. Note any anomalies.

Using the 2m signal as a reference, try to time correlate the 10m signal to it. Make corrections for any pointing errors with either antenna. Discount the fairly regular nulls in signals caused by satellite spin.

An interesting number to be reported would be S_{10}/S_2 i.e. the ratio of signal strengths at 10m and 2m, measured in linear units or in dB. Compute this ratio for as many points during a pass as possible. Compare it with similar passes on other days. Does it stay particularly large or small during certain periods? Check for other amateur activity at 10m affecting the observed signal.

The S_{10}/S_2 observations assist in the analysis of ionospheric effects at the two wavelengths. In addition try to observe antipodal reception by listening for the 10m signal when the satellite is on the exact opposite side of the earth from you. Such observations should be well documented and reported to AMSAT.

5. Other Experiments. The above list is not comprehensive. Imaginative amateurs will certainly think up many new experiments. If you have ideas or suggestions, please send them in. Remember, your participation is essential to the continuation of an amateur satellite program.

Report from "Down-Under"

THE PEOPLE BEHIND A-O-A

by Richard Tonkin, Chairman, Project Australis

The "hard core" of people who built the AUSTRALIS OSCAR A (A-O-A) satellite numbered about eight people, with another dozen or so giving assistance at different stages of the project.

Most of this hard core were students at the University of Melbourne when the satellite was being constructed. They included:

David Bellair, VK3QO (ex VK3ZFB): David built the A-O-A command decoder. He is now doing his Ph.D. in electronics at Melbourne University.

John Monro, VK3ZGY: John built the satellite's telemetry system. He is studying for his Communications Engineering diploma at the Royal Melbourne Institude of Technology.

Peter Hammer, VK3ZPI: Peter built the HF and VHF transmitters and the HI keyer for the satellite. Peter is interested in solid state transmitters, receivers and command systems. Like David Bellair, he is studying for a Ph.D. in electronics at Melbourne University.

Paul Dunn, VK3ZPD: Paul built the satellite casing and integrated the various systems into it. Paul is doing an M.Sc. in computation at Melbourne University. He has a pilot's license and recently flew a light plane to New Zealand.

Stephen Howard: Stephen designed and built the magnetic attitude stabalization system for A-O-A. He completed his B.Eng. last year and is teaching for a year at Ravenshoe, in "outback" Queensland. We figure that, if that stabalization system doesn't work properly, he had better stay there!

Les Jenkins, VK3ZBJ: Les built the command receiver for the satellite. He is a technical officer with CSIRO, the Commonwealth Scientific and Industrial Research Organization, which is a little like NASA, ESSA and the Ford Foundation, all rolled into one. Les is recognized as one of Australia's leading radio amateurs in the development of VHF and UHF equipment.

Owen Mace: Owen was the technical co-ordinator for the A-O-A satellite and he also did a lot of work on the design and integration of the power supply. He is studying for his M.Sc. in electronics at Melbourne University. This work involves frequent trips to Mildura, about 350 miles north of Melbourne, where he flies balloons (his wife insisted they be unmanned).

Richard Tonkin: Richard was responsible for the administration of the project; which probably explains why nobody ever gets any letters from Australia! He is a technical officer with the Weather Bureau in Melbourne and is studying for a Law degree at Melbourne University.

AMSAT'S OTHER TECHNICAL PROGRAMS

by George Kinal, K2MBU, Vice President, Engineering

Although a great portion of the available time of AMSAT members in the Washington area has been devoted to preparing the Australis-Oscar package, many members have also been looking ahead to future repeater satellite concepts. Several such endeavors are under way.

Our Australian colleagues are continuing research into a channelized repeater design. It has been suggested therefore that the next AMSAT payload be a repeater satellite with the electronics built by the Australian group, and the rest of the package construction and launch integration performed by an appropriate group of U.S. members.

Separately, we would like to invite interested members and member clubs to investigate the design and construction details of amateur repeater spacecraft. A repeater study group has already been formed, and interested members are urged to contact either Mr. Thomas Thompson of the Applied Physics Lab or the writer.

Probably the primary question to be answered pertains to frequency band(s) of operation. There are distinct advantages, for example, in using 2 meters for the up link and 432 MHz for the down link. Some members have also advocated use of the 1296 MHz band. Eventually the study group will turn its attention to hardware design considerations, and AMSAT members with professional or ham experience in solid state VHF design can be of great help.

Dr. Durrani and the writer are also working on the ATS-G experiment proposal. We are proposing to NASA that, as one of the experiments to be carried on the synchronous ATS-G satellite (with its 30 foot dish), amateur radio repeaters for television and for 20 channels of SSB be provided by AMSAT. The television experiment would demonstrate AM-type TV broadcast to simple receivers, a feat not before attempted. The channelized repeater would also be something essentially new in space communications. Members not previously contacted who think they can be of assistance are urged to contact Sajjad Durrani (TV) or George Kinal (channelized voice repeater) as soon as possible.

LETTERS TO THE EDITOR

I suggest SATELLITE for the name of the Newsletter. What could be more appropriate for our news bulletin!

I suggest that SATELLITE carry hard news of prospective launchings, with enough updating to give members advance notice to prepare for participation.

I would like to see AMSAT carry all possible amateur satellite information, including updated NASTAR and OSCAR information.

I would be pleased to act as a bulletin station from my excellent location near Zion Park, S.W. Utah. I run a legal limit station on 10 thru 160. I am retired and prepared to bulletin information on CW and SSB on the common bands out here.

I suggest that AMSAT carry on a program to select sked stations to cover the USA. I note that none are listed in the West, yet there is tremendous interest in satellite programs in the West — through the effors of OSCAR.

I will do all I can — just pass this letter on to the proper person.

A. David Middleton, W7ZC/W5CA

(Mr. Middleton's offer of help is highly welcome. His points about the bulletin station and sked stations were passed on to Cap Petry, W3AWN. The proposed name will be placed before the Board of Directors.)

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I suggest the name SIGNAL TO NOISE or SIGNAL/NOISE.

The name taken from the term "signal to noise ratio" was chosen for the following reasons:

1. It implies a guiding signal or beacon out of all the present randomness (you are trying to undo the chaos by the formation of AMSAT).

2. It implies individualism.

3. It implies leadership.

4. It implies coordination and teamwork.

Robert C. Garnier, WA9CQV

(Mr. Garnier has also sent four sample sketches showing an oscillating wave-train with the words SIGNAL and NOISE arranged in various positions, separated by the wave or by a line. The sketches and the name suggested by him will be placed before the Board of Directors.)

A Reminder

THE FORTHCOMING AMSAT ELECTION

by W. A. Tynan, W3KMV

This second Newsletter finds AMSAT about ready to complete one era and enter a second, which will be hopefully even more exciting and interesting than the first.

The first era has seen the founding of the organization, completion of agreement with Project Australis and Project OSCAR, and preparation of the satellite Australis-OSCAR A for launch. Thus, AMSAT's first era was one of preparation on both the administrative and technical fronts.

The second era, it is hoped, will be known as one of accomplishment. An early launch of Australis-OSCAR A is expected. Collecting and reducing the vast amount of ensuing data will indeed be an accomplishment. Other things are on the horizon, including a proposal to NASA for amateur experiments on a future Applications Technology Satellite (ATS). If accepted by NASA, the construction and data reduction from these experiments will be a major accomplishment indeed.

In order to have a chance to enter this new era of accomplishment, however, AMSAT has to pass through a very vital process, namely, AMSAT's first election. This election process must be completed with as many members participating as possible; its failure could bring about the demise of AMSAT and resulting abandonment of all of its objectives.

The first step in the AMSAT election process, as specified in the bylaws, is nominations for members of the Board of Directors. This is done by Member Clubs. Each club may make two nominations for board members. The Member Club is a very important constituent of AMSAT. If your club has not yet joined, get a Member Club application form from the Secretary right away. Hold your meeting and convince the members to vote to join AMSAT. Make your club's two nominations for the Board of Directors and send them along with the completed application form and the $10.00 annual club dues to the Secretary as soon as possible. Note that Nominees need not be members of the nominating club.

The elections will be held during the first annual meeting of AMSAT which is scheduled for November 22, 1969. (See announcement on page 4). All members who possibly can attend the meeting are urged to do so. This is very important because the bylaws require that 11% of the membership be represented for the election to be valid.

At the first annual meeting the general membership will elect all seven members of the Board of Directors. The Directors will meet later to elect the Officers who will serve for the first full year of AMSAT's history. This then will mark the beginning of the second era from the administrative standpoint of elected board members and officers. Without its successful initiation the era of accomplishment in the technical area may never occur.

ATTENTION MEMBERS!

FIRST ANNUAL MEETING - NOVEMBER 22, 1969

Please complete and return the following, whether or not you are coming to the meeting. Mail to:

AMSAT
P.O.Box 27
Washington, D.C. 20044

NAME _____

CALL LETTER _____
and
ADDRESS _____

Check X to indicate "yes" :

( ) I will attend the annual meeting

( ) I expect to attend the happy hour and dinner

( ) I expect to require transportation from _____

_____
(Airport, Bus or Railroad Terminal)

to ( ) happy hour/dinner

( ) meeting

( ) I will not attend the annual meeting

( ) I may be able to attend, but am not sure

* * *

PROXY FORM

(Print name and call letter)
If I, _____
cannot attend the AMSAT Annual meeting, then I authorize the following individual to vote in my place:

( ) Charles Dorian, W3JPT, AMSAT Secretary

( ) Other(name, call letter)_____

Signature_____