

## NASTAR SPACE NOTES

### 1968 NASTAR ANNUAL REPORT

by N.K. Marshall, W6OLO/2  
President, NASTAR

All in all, 1968 was an excellent year for NASTAR. The overall goals and accomplishments materialized mostly as planned. Significant events were:

1. Additional new members: Henry Meyer WA2BGD  
Ed McGinley --  
and honorary members: Jean P. Shepherd K2ORS  
Grace Weidmann --  
Dick Nebel W2DBQ  
Bea Dietz WA2GPT
2. Continued progress on Project MOONRAY Proposal and system design.
3. Acquisition of a Club license (WA2UVP)
4. Acquisition of a Special Events license (K2SS) for MOONRAY activities.
5. FCC approval to use the special call "SS" for the MOONRAY lunar transponder.
6. Publication of several MOONRAY articles:  
"Project MOONRAY" by H.A. Stover, WØTKR in CQ (Sept.)  
"Project MOONRAY" 73 Magazine (April)  
"Students MOONRAY to go with Apollo" EDN (April)  
"Project OSCAR and Beyond" by Thomas Tate, W1GTA in MIT's Tech Engineering News (February)  
"Project MOONRAY" Veron VHF Bulletin, Holland  
"Thermoelectric Power Supply" Ham Radio (Sept.)  
NASTAR published an Amateur Space Bibliography which appeared in the August 1968 issue of Ham Radio (W6OLO/2, Grace and Richard Weidmann).
7. Affiliation of NASTAR with the Nassau College Association (W2DHN).
8. ARRL affiliation started by NASTAR membership.
9. Acquisition of a new rotator, coax lines, 2 Meter antenna (WA2IZU); 3 K.W. power supply (W2OQI) and a Variac (WB2JOU).
10. Appointment of Henk Ripet of the Veron VHF Bulletin as The European Representative for Project MOONRAY. (by NASTAR vote)
11. Redesign, rework and placing into operation of 2 Meter setup - Johnson 6N2 crystal controlled converters, power supplies and modulator, antenna switching system, new wiring and installation (WA2SVG, W6OLO/2, WA2QMC and WB2MNG).
12. Setup for APT ground station started (WA2QMC, WA2HQF and WA2GFH).
13. Rewriting and formal adoption of the new NASTAR Constitution (NASTAR Executive Board).

14. Acquisition of a teletypewriter from ITT and the formal presentation to NASTAR by Mr. Butterworth (V.P. of ITT World Comm.) and attended by Dr. Chambers, Pres. of Nassau College; Dean Johnston, also of NCC; and several NASTAR members (WB2MNG).
15. Installation and setup of RTTY facility at NASTAR (WA2QMC).
16. NASTAR building improvements plan submitted and approved by membership (WA2BGD and WB2UCX)
17. Completion of new HF Operations Room (WA2BGD, WB2UCX and WA2GFH).
18. Completion of VHF Operating Center (WA2SVG, W6OLO/2, WB2UCX, WA2BGD and WA2QMC).
19. Enclosure of large porch and storage room (WA2GFH, WB2UCX, WA2BGD and WA2SVG).
20. First 432 MHz signals received and 432 to 2 Meter crossband operation at NASTAR Headquarters (WA2SVG, WA2QMC and W6OLO/2).
21. Continued development and first on-the-air tests of 432 MHz K.W. (W2DMB and WA2SVG).
22. Lectures given on Projects OSCAR and MOONRAY by W6OLO/2:  
Rochester East Coast VHF Conference (May)  
VHF International Convention - New Jersey (May)  
Hamden County Radio Association - Mass. (Dec.)
23. Construction and tests of new 432 MHz backfire array antenna (WA2QMC).
24. Setup and first tests on new Antenna Test Range (WA2QMC, WA2SVG and W2IDL).
25. Maintenance, cleanup, painting of pedestal and repairs on 584 Radar Trailer continued (WA2BGD, WB2UCX and Ed McGinley).
26. Several Laser experiments conducted and demonstrations made (WA2EMX and W6OLO/2).
27. MOONRAY signal simulation demonstrated (WA2QMC).
28. Participation and exhibit in International VHF Conference in New Jersey (W6OLO/2, Grace Weidmann, WA2QMC, WA2TQQ and WA2VBO).
29. Appointment of additional MOONRAY Technical Advisors (W6OLO/2).
30. Initiated regular RTTY Broadcasts from NASTAR Headquarters of MOONRAY Progress Reports.
31. Visits to and consultations with Dr. Kenneth Franklin of the Hayden Planetarium on potential MOONRAY experiments.
32. Joint meeting at NASTAR Headquarters with LIMARC (full house).
33. Initiated new NASTAR Membership Bulletins (W2IDL doing the printing)
34. Talks given at NASTAR Headquarters by Bill Schiffirin, WA2IZU (July), Nick Marshall, W6OLO/2 (August) and Ken Doyle, WA2QMC (Oct.).



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# Apogee View

## The Beginning

by Bill Tynan, W3XO

I have always considered it important for everyone to know something about the history of their society. We should all be familiar with the history of our nation as well as our particular ethnic and religious origin. Similarly, a doctor or lawyer should know something of the trials and tribulations their professions went through in evolving to their current states. Radio amateurs should be acquainted with the early days of wireless and how amateur radio became established as a defined and accepted radio service. There was a time when there was a question as to whether or not such a thing as "amateur radio" would exist at all.

Since our specific interest is amateur satellites, we should be familiar with how they got started and of the contributions various people made to them through the years. By such knowledge, we can better appreciate what we have today. Such knowledge will also be invaluable in helping us plan what we want to have available tomorrow.

Although AMSAT is celebrating its 25th birthday this year, the beginning of the amateur space program actually goes back more than 30 years with the successes of Project OSCAR. Not only did these pioneers provide inspiration for what came later, but they showed that amateur satellites could be built on a "shoestring" and, once built, that launches could actually be found for them.

The actual beginning of AMSAT can be traced to early in 1969. The inspiration for the organization was provided by George Jacobs W3ASK, who still writes the propagation column for CQ Magazine. On January 9, of that year, George was the guest speaker at the COMSAT Amateur Radio Club. In his talk he recounted the accomplishments of Project OSCAR and said that there was no reason why a similar effort could not be mounted on the East Coast. He noted the space and technical expertise that had been assembled in the Washington, DC area alone.

George's talk was particularly inspiring to a young Ph.D. who worked at COMSAT and was an active member of the Club - one Perry I. Klein K3JTE (now W3PK). Perry vowed to accept George's challenge and immediately set to work on the project.

I first became aware of these activities one evening in late January when my phone rang. It was Jim Puglise W3CBJ (now K9CQ), then a co-worker of mine at the Johns Hopkins Applied Physics Laboratory. Jim asked me if I was acquainted with "Oscar East". My immediate response was: "Who's he?" He said, "no, it's not a person but some kind of amateur satellite organization that's getting started". He told me that there was to be a meeting that evening about it, and suggested that we go see what it was all about. We found the location, a modern apartment building in the newly rebuilt Southwest section of Washington. Upon entering and introducing ourselves, we were seated with perhaps a dozen people, all associated with amateur radio clubs at various research labs and other technical organizations around the DC area. I do not recall all of those present, but I will attempt to name a few. Of course, there was Perry, whose apartment it was. Also in the group, were two people from Goddard Space Flight Center. One was Harry Helfrich W3DWF (later W3ZM, a call which AMSAT still holds as a memorial to his very significant contributions to the fledgling organization). The other was newly arrived from the University of Michigan - a not yet 22 year old young man named Jan King K8VTR (now W3GEY). I do not recall whether or not Dick Daniels WA4DGU (now W4PUJ) was present at that particular meeting, but he was in on the early formative days of AMSAT.

Perry opened the meeting by outlining his concept for an organization to carry on in the work of Project OSCAR, and recounted what George Jacobs had said at the COMSAT Club a few weeks earlier. He

announced his intention to form an organization built around people from the amateur radio clubs associated with various technical organizations. The group would exist to build amateur radio satellites and find launches for them.

All in attendance were inspired, largely due to the infectious enthusiasm radiated by Perry Klein and the excitement of doing something in space that would benefit Amateur Radio. However, all could readily see that we were committing ourselves to something that would represent years of hard work - work that promised to consume a large percentage of our lives and prevent us from pursuing other interesting activities. That premonition has certainly been born out for many of those original founders and numerous others who have stepped up in later years and volunteered their services to the amateur space program.

Following the first meeting at Perry's apartment, there were many others at various locations around Washington, mostly at COMSAT Headquarters. In addition to the task of defining the organization's structure, framing By-Laws and establishing a charter, we began to talk about technical projects we might undertake. As a part of this, we established study assignments. Among these were the feasibility of using gravity gradient stabilization, potential launch vehicles and how we might interface to them, suit-

able antenna and transponder designs, choice of frequencies, appropriate orbits and various power systems. Included in that item, in addition to solar arrays, was the possible use of nuclear isotope power supplies. Since JHU/APL, where I worked, had done early work in both gravity gradient stabilization and nuclear isotope power systems for space applications, I drew the assignment to collect information on these two technologies. It is interesting to note that the subject of spacecraft and ground support computers was not even on the list. Computers had not yet reached the stage where any of us had even considered putting one in an amateur satellite!

When we convened to report our findings on these fascinating subjects, George Jacobs was on hand once again - this time to nudge the organization he had inspired back on track. He noted that our studies were all well and good but didn't we think that it would be better to start with something relatively simple - something with which we could build confidence in ourselves and establish a reputation as a group that can actually get things done - not merely produce reports (a syndrome all too common in our Nation's Capital). He reminded us that there was an amateur satellite already built. It had been constructed by students at the University of Melbourne in Australia and sent, several years earlier, to

Project OSCAR in hopes of an eventual launch. He suggested that obtaining a launch for this satellite and preparing it for its ride into space, might be a good first project for our new organization, which by then had been named the Radio Amateur Satellite Corporation, or AMSAT for short, with Perry Klein as its first President.

The wisdom of George's recommendation was apparent to all of us, who by then numbered about fifty, and we immediately began work. We contacted Project OSCAR and the Australians who had built the spacecraft, later to be known as Australis OSCAR 5, or AO-5. All were eager for us to try our hand on getting it launched; and it was soon shipped to us. Even though it required a lot of work to get the satellite ready for launch and extensive negotiations with NASA to obtain a launch, AO-5 was successfully put into orbit January 23, 1970, just a year from that first meeting at Perry Klein's apartment.

While some of us were concentrating on securing a launch and putting Australis through the necessary environmental tests, activities for which Harry Helfrich was invaluable, others were working on letting the amateur community know what we were trying to accomplish. As part of this effort, Perry and I co-wrote an article for QST announcing the formation of AMSAT and outlining its goals. This article appeared in the June 1969 issue. It might be interesting to quote from the first few paragraphs, as I believe you will agree that the fantasy that Perry and I conjured up, 25 years ago, has largely come to pass.

"It's a chilly winter evening and darkness has fallen. The last remnants of 20 meter signals are just going out as you bid 73 to your friend Joe across the country. You have been keeping weekly skeds with Joe since he left the area, two years ago. It's sure nice to be able to keep in touch with him. "Twenty is about out", you say to yourself as you switch the receiver down to 40. Mostly foreign broadcast stations, a few amateur signals sandwiched in between; no clear spots and no CQ's can be heard. What's going on down on 75? A quick listen reveals the usual gang on 3999. Everything is pretty jammed up there too. You start to pull the big switch and go in and



Foreground, AUSTRALIS - OSCAR 5.  
Standing L to R, Jim Puglise W3CBJ, George Kinal K2MBU, Cap Petry W3AWN, Charles Dorian W3JPT, Bill Tynan W3KMY, Jan King K8VTR, Perry Klein K3JTE

watch TV with the XYL when you remember. A few flicks of switches later you're tuning 2 meters. There are a number of weak but readable signals. That accent sounds like a VK! You wait for him to sign. Sure enough, he's working a JA. The JA comes back on the same frequency. He's not as strong as the VK but he's readable nevertheless. You tune around some more. There's a VE8 calling CQ. Imagine, 2 meter activity in such a location. His signal is not very strong but good and steady, not fluttery like stations from that area usually are on the HF bands."

The article goes on to say that this "fantasy" will become a reality if the new AMSAT group has anything to say about it. I think current AMSAT members will agree that turning on a 2 meter receiver and hearing hams from all over the world is not fantasy these days. That AMSAT group, and its brethren in many nations, have had a lot to say about it.

For those who would like to delve more into the history of the amateur space program, the aforementioned article and various other QST articles, dating from the early

1960s, provide an excellent chronicle. See also the other historical articles in this issue of the Journal and in other Journals throughout the remainder of this silver anniversary year. In addition, the Satellite Experimenter's Handbook by Martin Davidoff K2UBC, published by ARRL and available through the AMSAT office, contains a lot of information on the early days of both Project OSCAR and AMSAT. Of course, this book also includes a wealth of technical information on amateur satellites and their use.



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# The Formation and Early Days of AMSAT

by Perry Klein, W3PK

(Life Member No. 1)

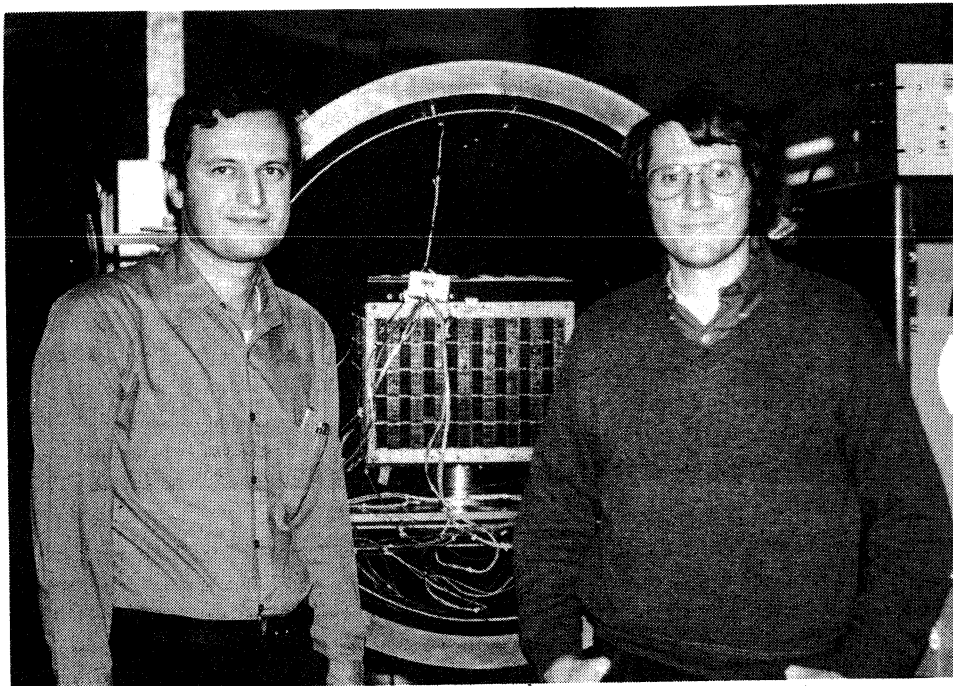
One evening, back in early 1969, George Jacobs, W3ASK addressed the Communications Satellite Corporation (COMSAT) Amateur Radio Club in Washington, D.C., on the subject of amateur radio communications in space. George described the early history of the original OSCAR satellite program, beginning with OSCAR 1, launched in 1961, and continuing up to OSCAR 4, launched in 1965. He urged the COMSAT club to pick up where the original OSCAR group had left off, pointing out that with all the radio amateurs working in aerospace in the Washington area, the knowhow existed to continue the outstanding work of the California-based Project OSCAR Association.

George pointed out that two OSCAR packages were still in California, having never found a ride into space. One was a complete satellite built by the Project Australis group in Melbourne, Australia. The other was an in-band two-meter repeater developed by a group in Germany led by Karl Meinzer, DJ4ZC. A good start for a new "OSCAR-East" group would be to find rides into space for these two amateur satellite experiments.

We took George's suggestions seriously, and managed to assemble a group of Washington area hams, including Jan King, W3GEY and Harry Helfrich, W3ZM at the NASA Goddard Space Flight Center, Bill Tynan, W3XO and Jim Puglise, W3CBJ at the Johns Hopkins Applied Physics Laboratory, Cap Petry, W3AWN at Aeronautical Radio, Inc., and George Kinal, K2MBU at Computer Sciences Corp. Incidentally, Jan King was only 21 years old at the time; (I was 26.)

After several organizational meetings, the group incorporated as a non-profit organization in the District of Columbia on March 3, 1969 and AMSAT, the Radio Amateur Satellite Corporation was officially born. Dues were set at five dollars, and we all rushed to get our money in to get the first membership numbers. I remember that Jan didn't have any money with him, and had to settle with Member No. 6 when I lent him \$5! Bill Tynan was a little upset, not getting a single-digit number. His was No. 10!

The group's first project was to repre-



Perry Klein and Jan King W3GEY preparing OSCAR 8 for thermal vacuum testing, 1978

sent the Project Australis group in securing a launch for their Australis-OSCAR satellite, which had been sitting in Lance Ginner's, K6GSJ's garage in California. When we received the spacecraft from Project OSCAR, I recall that we found spider webs inside among the hardware! We were able to obtain a donation of a new set of batteries for Australis-OSCAR (which had no solar cells), but one of the biggest challenges was to get NASA to agree to launch the payload, and at no cost to us. This was a precedent for NASA. True, OSCAR's 1, 2, 3 and 4 had been piggybacked on U.S. launches before, but these were military rockets, and we had to convince the decision-makers at NASA that this was a project in the public interest deserving support. Not only did we have to justify the project on the basis of its experimental merits, but we also had to demonstrate that the Australis payload would not jeopardize the safety of the main mission, a Delta-launched weather satellite. We also had to show that adding Australis-OSCAR to the mission would not impact the cost of launch.

The Australis satellite was launched on January 23, 1970 as Australis-OSCAR 5 (AO-5), and the satellite transmitted beacon

signals on two and ten meters for 52 days until its batteries expired. We had known from the start that the Australis-OSCAR mission would be a short one since the satellite had no solar panels. But we felt the mission worthwhile nonetheless, because we were able to establish the precedent for piggyback launch by NASA, thermal-vacuum, vibration and other test procedures, methods of integrating the payload with the launch vehicle, telecommand and data collection methods, and the myriad of other details involved with satellite construction, test, integration, launch, licensing and operations.

Later in 1969, we met with Karl Meinzer, DJ4ZC to discuss arranging to fly his two-meter to two-meter inband repeater, but Karl indicated his preference to develop a newer repeater of improved design with an input on 432 MHz and output on 146 MHz. We began to make plans to fly this repeater on one of our future satellites.

Our next satellite, AMSAT-OSCAR 6 (AO-6), launched on October 15, 1972, continued to operate for 4 1/2 years. It contained several important experiments. One was a two-to-ten meter repeater built by Dick Daniels, W4PUJ. Since it was the first



of our long-lived transponders, we decided to designate this frequency combination "Mode A". AO-6 also carried an ingenious Morse code telemetry encoder developed by John Goode, W5CAY. Both the two-to-ten meter repeater and Morse code telemetry system were new projects designed to make possible participation by as many hams and students as possible.

AMSAT-OSCAR 6 was followed by AMSAT-OSCAR 7 (AO-7), launched by NASA on November 15, 1974. Like AO-6, AO-7 included a two-to-ten meter Mode A repeater, and it also included the 70 cm-to-two meter repeater built by Karl Meinzer's group in Germany. Being the second frequency combination, it became known as "Mode B". This transponder delivered very strong signals and became very popular. The AO-7 satellite was very successful, and operated for 6 1/2 years.

AMSAT-OSCAR 8 (AO-8) was launched by NASA on March 5, 1978. Although constructed by AMSAT groups, this satellite was sponsored by ARRL to replace the Mode A capability of AO-6, which was no longer in operation. This enabled continua-

tion of educational activities which ARRL had initiated. AO-8 provided service for over 5 years.

The growth of AMSAT and the affiliated family of AMSAT organizations since that time has been simply amazing. A sign of a successful organization is its ability to perpetuate itself and grow. In the United States, AMSAT-NA has had only five presidents over the past 25 years. AMSAT-Deutschland has had but one, Karl Meinzer, DJ4ZC!

But perhaps the most impressive evidence of success of the international AMSAT organization has been the ability to disseminate not only satellite operating information worldwide, but also satellite construction expertise, with satellite contributions from a number of countries. And the list is growing, with the more recent satellite projects in Mexico, Israel and Chile. Who would have dreamed that some day astronauts circling the globe would be communicating using amateur radio, or that small amateur satellites would be computer controlled and be capable of sending pictures back from space.

It is extremely important that all satellite design and construction work be fully documented if it is to be duplicated by others. In the past, the satellite hardware developers have been so busy designing, building and testing their hardware, that often they have not had time to fully document their contributions in such a way that others could build upon their designs. The development and documentation of software has been another serious problem, sometimes delaying the full operating potential of the OSCAR communications hardware in space.

In summary, for many of us, our personal participation in the amateur satellite program has touched our lives and affected us in a very positive way. The excitement of launch of a satellite one has personally helped build is almost beyond description. It can be likened to the birth of a baby, although I am not sure that my wife Suzie would agree. Certainly, some of the world's most worthwhile contributions come from the work of volunteers, motivated only by personal satisfaction. AMSAT is living proof.

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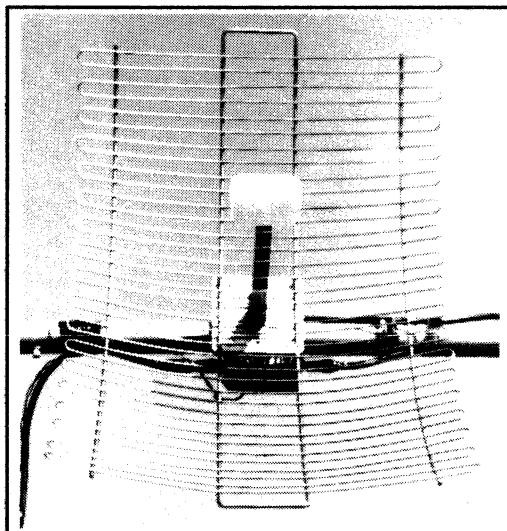
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