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Our Cover: A circularly polarized log periodic antenna covering 125
MHz to 1 GHz as installed at an ITT antenna test range. The six-foot
long antenna rides on a 65 foot radius arch. Photo taken from the
ground looking skyward. Entire structure including guys is non-
metallic to avoid patten distortions. Range is used to test satellite
communication and general purpose UHF antennas. (Courtesy ITT
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Standards

Perhaps many of us are too close to the action to see it. There's a very important battle going on now within the computer industry. It will have consequences for all of us. Manufacturers, designers, software writers, and users are battling to decide whose computer standard will carry the hearts and pocketbooks of the American public.

Millions are at stake in the computer industry. Advocates on all sides of the issue see the battle as too critical to lose. As the drama unfolds, the hero (or villain, depending on your prejudices) has created a de facto standard in the world of business. IBM has had incredible success in establishing the IBM Personal Computer as the machine of choice for many American businesses. It's starting to become a hot seller overseas as well. Indeed, if an IBM computer is not available, businesses snap up clones, such as the Compaq, Columbia, Corona, or other MS-DOS-compatible machine.

For better or worse, IBM jumped from no share of the market in 1981 to a position of dominance in 1984. By year's end, a PC will be rolling off the assembly line in Boca Raton at the rate of one each seven seconds - all this just three years after the PC was first introduced.

Does this heavy-handed dominance of the computer industry augur well for the computer user? Overall, we think so. Although unanimity on the IBM standard might stifle more creative hardware and software approaches, it does create a solid, sure footing for computer technology. A community that is assured of the long-term integrity of its investment is more apt to invest. What does this have to do with amateur radio and satellites? Our avocation too is seeing exciting times. Silicon chips that fuel the computer revolution also change the way radio amateurs communicate. And it's a very significant change too.

Although cw replaced spark, phone merely supplemented cw. So too has digital communications arrived on our doorstep, not as a replacement for those earlier modes but as a valuable complement. People still enjoy communicating with their voices and that will, we are sure, continue for a long time. And people have also communicated with written language, and amateur facsimile and radio teleprinting have been with us for at least 40 years. But the new kid on the block, still in diapers but growing fast, is a form of digital communications called packet radio. It's a robust child, still wet behind the ears, but full of vigor and promise. It's also a confused child, still groping at its future and uncertain of the direction it will take.

Although reminiscent of radio teletypewriter communications, packet is nevertheless very different and offers a wide range of options for error-free communications, high-speed data transfer, store-and-forward techniques, and computer bulletin-board operation. Where teletype (and it's newest cousin, AMTOR) are mainly used in a people-to-people mode, packet radio finds its real strength in establishing communications between computers. But in amateur radio, just as in the computer industry, standards will play a key role in deciding what the future holds.

In 1982, an AMSAT-sponsored conference resulted in a very important agreement on basic packet radio protocols. That meeting brought us the AX.25 specification for amateur digital packet communication and set the stage for the current boom in interest in the technique. This standardization came just in time, for the newly founded Tucson Amateur Packet Radio (TAPR) group was about to unveil new packet radio equipment into the amateur world — a torrent that has now placed over 1000 sets of hardware in the hands of radio amateurs around the world. But AX.25 defined just two layers of the protocol — the "physical" layer and the "link" layer. The former gives guidelines for the electrical properties of the equipment required for person-to-person packet communicating and the latter specifies the actual commands that link the communicators together in a common, though user-transparent, software bond. The goal of these standards is to establish (by radio) a virtual "wire" connection between individual users.

(Cont. on page 11)
LET'S TALK
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An Innovation Trilogy
Part II

JAS-1:
Japan’s First
Amateur Radio
Satellite

By Shigetake Morimoto, JA1NET
Harry Yoneda, JA1ANG
Haruo Kanawa, JA1JHF
JAMSAT

JAS-1 will be launched from the Tanegashima Space Flight Center in early 1986 aboard NASDA’s H-1 two-stage rocket launcher. Japanese Amateur Satellite (JAS)-1 will recall a famous predecessor and simultaneously preview the unfolding world of digital communications. Similar to AMSAT-OSCAR 8, JAS-1 will carry a Mode J linear transponder. However, like PACSAT, JAS-1 will also carry a digital transponder for store-and-forward digital (packet) communications.

The following project overview provides a glimpse of both the systems and schedule we plan.

JAS-1 is a joint venture involving NASDA,* JARL**, and JAMSAT.*** JAS-1 will provide NASDA an opportunity to carry out a “multi-payload” launch using their new H-1 launcher. NASDA has no experience with multi-payload launches and since JAS-1 will have a telemetry beacon of its own for ranging, this experience can be obtained at very low cost. Amateurs will gain further experience tracking and commanding an amateur satellite not to mention the skills acquired and honed in developing, building and testing the spacecraft itself.

The spacecraft itself will take the form of a 26 faced polyhedron measuring about 40 cm by 40 cm by 50 cm (16” x 16” x 20”) and weigh about 50 kg (110 lbs.). The hardware will have a design life (predicted) of at least 3 years.

*National Space Development Agency of Japan
**Japan Amateur Radio League
***Japan (AMSAT)
The orbit provided JAS-1 by the H-1 launcher will be unique for an OSCAR (Orbiting Satellite Carrying Amateur Radio). Though circular at about 1500 km (931 miles) as was AMSAT-OSCAR 7, the JAS-1 orbit will be neither sun-synchronous nor polar (as was AO-7). Estimated inclination will be 50 degrees compared to AO-7’s 101 degrees. Similar to the current flock of Russian birds (e.g. RS-5), JAS-1 will have an orbital period of 120 minutes. This will provide an average 8 passes per day of about 20 minute duration.

As mentioned above, JAS-1 will carry two separate transponders. One will be a linear, Mode-J transponder. The second will be a digital store-and-forward device mainly for non-real-time communication between stations located in widely separated time zones. A conventional 2 meter fm transmitter will suffice for the rf uplink.

Mode J is the mode of choice for several reasons. Some are well-known; others are more subtle. Man-made electrical noise is becoming increasingly troublesome in the 2 meter band. Listening for weak downlinks at 2 meters is a problem especially in Japan. On the other hand, 435 MHz does not currently suffer the QRM/QRN evident on 2 meters. Moreover, sky noise is lower at 70 cm providing the bonus of a “cooler” backdrop over which to track the signals of JAS-1. Finally, the planners of JAS-1 wish to provide a capable successor to the popular AMSAT-OSCAR 8 Mode J which we helped engineer and for which we provided the Mode J (J for JAMSAT) transponder.

The linear Mode J transponder will have a 100 kHz passband and have a 70 cm output of two watts PEP. Ground Stations will require about 100 watts EIRP. Like Mode B, it will be an inverting transponder, i.e., LSB on the uplink will yield USB on the downlink. A 100 milliwatt beacon will send telemetry in cw and be switchable to PSK when required.

The digital Mode J transponder will have four 145 MHz input channels using PSK/FM modulation for the uplink. Ground stations will require 100 watts EIRP on this transponder too. A single downlink channel at 435 MHz will transmit at 1 watt RMS using PSK. Signaling code will be NRZ-I and the protocol will be the de facto standard amateur radio standard AX.25 which itself is based on the world-wide ISO X.25 recommendation for a High level Data Link Control (HDLC) protocol. We are considering using a terminal node controller (TNC) similar to the TAPR (Tucson Amateur Packet Radio) or VADG (Vancouver Area Digital Group) systems. There will be 1-megabit of on-board memory made up of 256K bit N-MOS and D-RAMs. Error correction techniques will be incorporated to compensate for soft errors. An NSC-800 running at 1.6 MHz will organize data transmission as well as serve as the JAS-1 IHU (Integrated Housekeeping Unit). Any 8 by n bit codes will be transponded, e.g. ASCII.

The telemetry system will compose a 28 channel (or more) frame.

The telecommand system will fully control both transponders.

The milestone chart below shows those key dates in the project leading to a launch of JAS-1 in February, 1986.

![Milestone Chart]
A Satellite Builder's Odyssey:
January 6 to 18, 1984

By Harold Price, NK6K

(Editor's note: Late in 1983, NASA informed satellite researchers at the University of Surrey in Guildford, England that a launch opportunity was available for the second in the UoSAT series of amateur scientific satellites. Due to the need for replacement of an ailing earth resources satellite, the launch date for Landsat 4 was moved up to March 1984. Work commenced at a rapid pace at Surrey to prepare UoSAT-B for its ride into orbit. In perhaps record time, a sophisticated satellite was built. What follows is just a short recitation from a larger story of the dedication, sleepless nights, and sweat that went into the construction of UoSAT-B.)

Now that enough time has passed to put everything in perspective (i.e., I've procrastinated as long as I thought I could), I can report on my whirlwind tour of far away places: Ottawa — the beautiful capital city of Canada, Guildford, England just south of London — home of the University of Surrey, and several stops in between.

Trip Statistics
Total hours: 336
Total hours sleep: 49
Hours spent at Heathrow airport (London): 12
Hours spent at JFK and Laguardia airports (New York City) starting at 3:00 A.M.: 6
Lowest temperature: $-25^\circ F$
Highest temperature: $+50^\circ F$
Average temperature: $-5^\circ F$

Sights Seen
Attic room in Ottawa
Basement workshop in Ottawa
Monastic cubicle (6 by 9 ft.) at the University of Surrey furnished in "Cool Hand Luke" motif with one bed, one chair, one sink, and facilities down the hall.
Satellite laboratory at the University of Surrey

Board in Tucson
The Digital Communications Experiment, or DCE, consists of three boards, 260 by 160 mm, intended to fit in a box 31-mm high. Lyle Johnson designed the CPU board as well as the general memory (GMEM) cards. A group in Ottawa did the memory board, called the RAM UNIT. The CPU and GMEM cards were wire-wrapped...
by Chuck Green. Before they could be tested, both Lyle and Chuck got tied up in the real world, so the wire-wrapped boards were sent to Dallas.

**Dallas Delights**

The wire-wrapped boards were finished and tested by Bill Reed in Dallas. The actual printed-circuit board layout was done by Bill as well as Bob Stricklin, with help from Dave Cheek and Jose Sancho. Late in November, the pc boards were ready to be made. However, with time running out, it was decided that the layouts be sent to Tucson where it was possible to get 24-hour turn-around on complete boards, including drilled holes. I flew to Dallas, stopping off in Tucson to pick up the boards.

Dallas is a town of which 1've only seen one room. I stayed at Bob's place where five of us stuffed, debugged, and tested the CPU and GMEM cards in seven 18-hour days. While the rest of the boards were sent to Ottawa, the Dallas crew stuffed me on a plane to Los Angeles with the test boards.

Back in Los Angeles, work continued on integrating a boot load program, written by Hugh Pett in Ottawa, onto the actual DCE. I also worked on a set of diagnostic routines to run in the DCE, driven by software running on a Radio Shack Model 100 lap computer. Incidentally, that computer, which is battery powered and totally self-contained, was invaluable since it ran fine in the US, Canada, and England, including the spin vibration measurements. The computer has battery-backed CMOS program space, so cassette or disk storage is not needed.

Meanwhile in Ottawa, work was begun on assembly of a socketed, or non-flight test board set, using the boards, schematics, and jumper lists sent from Dallas. On December 6, the socketed test set was ready to go. I flew to Ottawa with the Model 100 loaded to the gills with test diagnostic software. (In fact, just 412 bytes were left out of 32 kbytes.) I also brought the test boards from Dallas for comparison and backup.

**Ottawa Chill**

The official alarm clock in the Kayser household (and the object radiating the most heat) is a small furry dog name Sham. Sham walks up to a visitor's bed, checks the distance and windage, backs off 10 ft., runs at full speed toward the bed, and leaps into the air, landing on the visitor's chest. Next, a 2-ft. long tongue unfurls and the visitor is treated to a canine good-morning kiss. The only flaw in this wakeup plan is that Sham then falls asleep on your chest, worn out after his morning exertions. The large increase in available heat soon sends the recently awoken visitor back to sleep.

I was permitted to load wood into the fireplace/stove. I enjoyed this task, as it reminded me of the 75°F temperatures that I left behind in Los Angeles.

The Ottawa crew was ready. The socketed set was done, ready to accept the ICs. The flight boards were mechanically ready, meaning they had been milled to fit the standard UoSAT module box, through-the-board (via) holes wired shut, etc. We activated the socketed DCE in stages, using junk chips. Once the board was working, the flight chips were inserted and the boards were run overnight. Most of the flight chips had been previously tested by the Ottawa crew. That done, construction of the actual flight boards began.

The flight boards were also activated in stages. Since it had only been a short time since the socketed set had been made, and each board has a lot of jumpers, we knew we would probably have to debug the flight boards as well. We also knew that the board component density was such that we needed a multilayer board to make it work. That was especially true since, in the time available, we did not have access to a computer to help us with the board layouts. However, we did not want to use a multilayer board. Instead, we ended up with a double-sided board with a third layer of surface wire and epoxy.

The flight boards worked with little trouble. In fact, the only problem developed when we had to stuff the boards in the flight box in time to get to the boards and I to the plane on time. In the hour remaining, we labored to get the boards to fit into the box. In retrospect, all of that was no surprise, since it took two of us 12 hours to get the boards into the box later in Surrey.

Other conditions were also rapidly declining. Everyone had a wife who worked and conditions are such in the Ottawa winter that it is usually feasible to keep only one car running per family. Last Rites had been previously given to the transmission in Larry’s car, so we were out of working vehicles. AMSAT Director John Henry, VE2VQ, saved the day by providing transportation to the airport. In addition, John called Air Canada to get permission to carry the flight module, in its 3-ft. by 2-ft. by 9-in. aluminum shipping box, inside the cabin. With 15 minutes to spare, I got on the plane, and Larry, Stan, Gordon, and Hugh breathed a sigh of relief.

**Interlude in Toronto**

In Toronto, I switched planes for the trip to England. Unfortunately, John’s “in cabin” arrangements hadn’t carried to Toronto. The "Fragile" sticker I had picked up in Ottawa served to get me past all checkpoints except the last. When I got on the plane, an L-1011, I asked the flight attendant at the door where I could put the
box. He glared up at me from his imposing height of 5 ft. 2 in. (I'm 6 ft. 2 in.) and said "under the plane, of course."

It's funny, how your patience can sometimes expire all at once. I was almost the last person on the plane and I had made up my mind that the only way they would take the DCE away from me was if a policeman larger than me came to get it. I figured that at least in jail I could sleep. Now remember, I was on an L-1011, one of the largest things flying, and it wasn't a question of whether or not there was really room on the plane. The short guy was "in charge" and he didn't like the looks of our box, so off it went.

Because I was standing in the airplane's hatch door, they couldn't close it. That disturbance brought a supervisor. I told my story, explained how arrangements had been made, described what was in the box, and offered suggestions as to where it could be safely located for the flight to London. The supervisor said fine and went to find out what the problem was all about. It turned out that the short guy was, in fact, the "service supervisor" or some such title, and had enough authority on the plane to tell the ground supervisor to stuff it...which he did. The supervisor went off in search of a check ticket to accompany my box on its way to the baggage compartment. At that point, I just leaned back against the hatch close mechanism, closed my eyes, and prepared a siege.

At that point, something happened that pointed a way out of my dilemma. A 6-ft. 7-in. angry Canadian walked up to where I was standing and bellowed, "I was promised seat 18A so I could stretch out my legs. I was given 19E, I want justice, eh?" A surreptitious glance at my boarding pass showed that I had 18A. I interrupted the stream of "Sorry sir, but there's nothing we can do" to tell the short guy that I'd gladly give my seat to the big fellow if supervisor would just put my box in the big empty space behind row 16. Since the supervisor had not yet returned with the baggage check ticket, and we were 15 minutes overdue for departure, he capitulated.

**Saturday in Surrey**

Due to a mixup, no one was waiting to pick me up at the airport. I had left Canada two days later than I thought I would, and the UK group hadn't received word that I'd finally gotten on a plane. After an interesting time figuring out how to get change for the pay phone (The United Kingdom has more coin denominations than the rest of western civilization put together.), I arrived at Surrey. My first task was to get five hours sleep. Martin had made arrangements to put me in one of the on-site "guest rooms." After I woke up (I don't remember going to bed that day.) I surveyed my room. I guess "functional" would be the best word to describe it. As stated above, it was the sort of room made famous by Cool Hand Luke, Papillon, Escape from Alcatraz, Stalag 17, etc. It was however, close to the lab.

The disk jockey on the local radio station in the town of Surrey is a chap named Damien Dark. Damien's main claim to fame is that he never speaks. That would normally be a fine way to maximize the music time if it weren't for the people calling to express their joy at having a DJ that never speaks. If Damien gets a chance to spin four disks an hour he's doing well.

I was taken to a pub once. It was actually a trip for a visiting group of NASA brass, but after I leaped into the car and started screaming they had to take me along. The pub had been described as a scenic spot but, unfortunately, all the scenery was outside. The only time I ever left the lab was after dark. Sigh.

The other high point was a 10:00-P.M. trip to get "take away" food at Brent's Burgers. I'd be willing to bet that the street outside Brent's was used as a filming location for the movie "A Clockwork Orange." If you haven't seen it nor read the book, a great deal of the motion picture revolves around a group of English lads who whomp on people with blunt objects. The scene was no better inside, as most of Brent's staff and customers had tiny gold earrings in their ears. Those were the men, I was afraid to look at the women.

My next task was to find a local supply of Coca-Cola, my drink of choice. Coke in England, I think, is made by a chap who had once taken a trip to the United States and had seen an ad on TV for Coke, but had never actually tasted any. To make matters worse, Coke at a restaurant is served warm, with a slice of lemon tossed in. It makes a great mixture for cleaning sidewalks or stripping varnish and leaving a "lemony fresh smell," but little else.

The Surrey crew couldn't have been nicer though, or more helpful. I was given more than enough table space, test equipment, and tools. An altogether dedicated crew of bright folks, they were also on a 16-hour schedule. Indeed, many of them had also taken rooms on campus to cut travel time. Roger, Neville, Ian, and Mac were especially helpful, as was Martin Sweeting. I hid this nice bit in the middle, maybe no one will see it, it could ruin my image.

The DCE flight and pre-flight engineering units were both brought up in short order. The two problems that were isolated during the following three days of intensive testing were fixed in short order. One was a design
error masked by a small difference between the junk chips used for initial checkout and the flight chips, the other was a missing jumper.

The DCE was tested with the command-receiver system, using all the data paths that would be used in flight. That turned up a small timing problem in the ground-based software, due to the delays involved in moving data through the multiple UARTs in the uplink receivers and the command unit. After a small patch to the Model 100 software, the testing was declared a complete success. The boards were then potted in a few places and conformally coated.

With 24 hours left before my return trip to the U.S., I started placing the flight boards into the flight module. Twelve hours later, I was still at it. At 2:00 A.M., Mac stopped by my table on his way out to see what I was doing. The basic problem was this: it simply wouldn’t fit. Due to problems we won’t discuss here (not quite enough time has passed), the bundle of interboard connections was too large to fit in the space allowed. Several hours, holding jigs, vacuum cleaners, covers, shields, burrs, and Kapton tape later, the middle (sigh) board sported an enlarged cutout to allow the wires to pass. It was 5:00 A.M., six hours until I had to leave for the airport. Mac had written off getting to bed. After helping with the major surgery he wanted to see the patient through.

Around 5:30 A.M. it became apparent that the problems were not over. While the boards fit in the x and y plane, z was giving us trouble. Small ferrite beads had been placed on each of 30 or so internal lines coming from the spacecraft interface connectors. The bulk of those beads were just enough to make the top board peek out of the box. The cumulative effective of all the interboard wiring, the surface wiring, the Teflon tubing on the back of the connectors, and the beads could not be overcome. Something had to go, and the beads were the most expendable. Mac and I experimented until we found a way to get the beads (five on each lead) off of the wires without unsoldering all of them, or pinching them. At 9:45 A.M., the boards were finally placed in the box, and nothing came out the top. Success! I put in the screws that held the boards in the box and took some pictures.

I ran the full battery of tests and the DCE functioned perfectly. I screwed the temporary top and bottom covers on the box, ran more tests, and prepared to leave. I powered the system down, cleaned my work area, and fixed the place up. My last task was to leave the DCE running memory tests to continue the burn-in process. Power was applied, the reset switch toggled, the bootload started, and...nothing. Zip, zilch, zero, nought, nada, DOA, belly up, dead, dead, dead.

Since I was already behind schedule, Martin had asked the lab’s fastest driver to take me to the airport. That driver was reputed to never go below 120 km/h, even in parking lots, and to strike terror into the hearts of all who saw the approaching streak in their rear-view mirrors. She was truly disappointed when I told her there would be no trip that day.

I took the covers off, and sadly gazed at the coated boards, safe from my probing test equipment, their secret locked within. I placed a scope probe against the side of the module box, the only “test point” I could reach, and sure enough, two superimposed address signals were on the box. To shorten a long story, two of the interboard wires had been pinched in the spacers holding the boards apart. One was probably conducting to the box all along, the insulation on the other just took longer to move away. Had only the first wire been touching the box, the unit would not have failed until it was mated to the spacecraft, since the box would have been floating until then. During the next twenty-four hours, I got five hours sleep, then repaired the wire with Ian’s help. Mac was wisely hiding out until he got word that I was gone, since his previous “How’s it going?” had netted him 12-hours labor after his regular 18-hour shift.

Later that day I left Surrey as I had arrived, awake for close to 24 hours, with eyes that were sensitive to sunlight. I checked all my baggage, got on the plane, closed my eyes, and went to sleep. I awoke somewhat when the plane started its takeoff roll, but then phased out again. Suddenly, Bang! It felt like we dropped into a 10-ft. hole. Luggage racks broke open, some oxygen masks came down, and someone on the other side of the plane (a 747) said “Smoke!” It seems that one of our engines had exploded (or was “lost” as the pilot said) during the takeoff run shortly before the point of no return.

The next part of the story is mostly a blur. It wasn’t easy trying to sleep in the waiting lounge while trying not to miss the announcement of when Pan Am thought we might get off the ground. Eleven hours and a new plane later, we did. I won’t go into detail about our 3:00 A.M. arrival at JFK airport New York City, a taxicab ride through a blizzard to Laguardia airport, sleeping on the floor with other refugees of Flight 001, the trip on US Air to Pittsburgh, or the flight on a Rinky-Dink Airlines 12-seater to Morgantown (“Welcome to Rinky-Dink, when we arrive in Morgantown the big hand will be on the 10...”).

After a successful meeting and PACSAT talk at West Virginia University I left for Los Angeles, got home, checked to see if I was still married (I was), and slept for the next two days.

Epilogue

The DCE is still running, having survived shake, rattle, and roll up to 20 g. Congratulations to all involved in designing, building, testing, and delivering a flight-ready 3-board computer. The unit contains a 2-MHz CMOS Z80 microprocessor, 126 kbytes of memory including 16 kbytes of 12-bit wide EDAC, two serial ports, and 24 parallel lines. Everything is fully buffered and fits into a 214 by 160 by 31-mm box. Total current draw is less than 120 mA at 5 V. I don’t have a complete list of calls of those involved, and some folks weren’t even
hams, but thanks go to Lyle, Chuck, Bill, Bob, Dave, Jose, Larry, Stan, Hugh, as well as Gordon, the guy who built the great harness simulators in Ottawa. Thanks also to those I've missed plus the whole gang at Surrey as well as all the wives involved in Tucson, Dallas, Ottawa, and in Los Angeles. Meals at odd hours and clearing the Coke bottles away contributed as much to the success of the project as anything else.

**Postscript Thoughts**

I've kidded everyone about the living accommodations, but the pit style sofa in Larry's attic studio is the most comfortable thing I've slept on this side of a water bed. The Surrey room did its job — maximize the work time available. All sites involved cut down on distractions that would have endangered completion of the job. There's time to socialize after the launch.

As many of you know, Larry Kayser, whose group of VITA volunteers worked on the batteries for UoSAT-B and on the DCE, was severely burned a few weeks before the final construction campaign began. Fortunately, the third-degree burns were limited to his legs, but he has been through a lot of pain and will be for months to come.

His burns added a complication to efforts to communicate with Larry. When he was in a good and receptive mood there was no sense in talking with him. He was doped up then with pain killers and would agree to anything, but remember nothing. When he was in an evil and foul mood, ready to disagree to such statements as "Sun's up!", he was off the pills but in lots of pain. In spite of his travails, Larry struggled to come up with the right mix of pain and chemical pleasure and did a good job. The first day I arrived was the first day he had the bandages off of his legs. For 50 cents he would show you his legs, for 5 dollars he wouldn't.

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**Call For Nominations**

This Fall we will hold elections for three Directors on the AMSAT Board. Those interested in filling these positions may be nominated by a letter of nomination signed by at least 5 current AMSAT members or by a Member Society. All letters of nomination must be received by the office no later than July 31st. Candidates will be expected to supply background and biographical information. Send nominations to: AMSAT, 850 Sligo Ave., #601 Silver Spring, MD 20910.

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**Editorial** (Continued from page 3)

The next challenge facing packet designers is Layer 3, the networking layer. At that level, instructions determine how packetees connect to each other over long-distance paths — from town-to-town, state-to-state, and country-to-country. The problems of linking just two radio amateurs together are formidable. The task of joining them over trans- and inter-continental distances can be staggering.

The linch pin of any linking system is a common agreement on the basics, such as frequencies, data format, and other intricacies that make one packet radio receiver recognize the data from another. Just how the East Coast of the U.S. will talk with the West Coast, the Midwest, or with Europe is a key element of a packet radio network and without a common understanding on the procedures, communication will not take place.

When agreements are written, codified, published and then actually used by someone they become standards — clear, unambiguous instructions for creating a system that will work the first time with similarly configured systems elsewhere in the world. Many recognize the need to join together under a common banner. Deciding banner color is another story. Reaching a common agreement is not simple. Most have opinions; many are not compatible.

Amateur radio operators are a fortunate lot since those who have taken a lead in developing tomorrow's packet radio systems are often well schooled in the need for standard practices and procedures. Meetings, such as those held recently in Trenton, New Jersey under the aegis of the ARRL (and well represented by AMSAT), bring differing viewpoints under a common roof and meld expertise into a strong, cohesive plan for the future. Although such conferences are costly, the dollars and energy spent will serve amateur radio well in the future. And AMSAT will continue to help sponsor and organize these meetings to insure that amateur satellite communications are at the forefront of technology.

AMSAT is helping to extend the radio horizon well into space, first with such high-orbit satellites as OSCAR 10 and soon with a dedicated packet satellite, called PACSAT. Gateway stations into the satellites from local area networks will abound in the near future and getting a printed message from W7 to PA8 via the satellites will seem trivial. Standards will play an important part in securing a viable and reliable system and, much as in the computer industry, will bring users together in a common hardware and software bond.
A Survey of OSCAR Station Equipment  Part II

By Harold Winard, KB2M, and Roger Soderman, KW2U

The first part of this article appeared in ORBIT issue Number 16. It detailed some of the accessories you can acquire to improve the performance of your OSCAR station. Here is a look at some of the transceivers, converters, and amplifiers that generate, receive, and boost your space-bound signal.

Although the art of homebrewing is still widely practiced in amateur radio community, many, if not most hams prefer to buy the major pieces of their OSCAR satellite station. Included are such items as transceivers, transmitters, receivers, converters as well as power amplifiers. Most will concede that some homebrew equipment can outperform even the finest piece of factory-built gear. However, the complexity of some pieces of equipment, such as a fully synthesized and microprocessor-driven transceiver, makes construction from scratch a difficult and time-consuming chore.

The economics of the electronics industry require a significant market for a piece of equipment before a manufacturer can commit an assembly line to its construction. Because satellite users still are few in number compared to the rest of the amateur radio community, it is not surprising that few dedicated satellite rigs have been available. The first, set up for use with Mode A (144/28-MHz) transponders, was marketed in the U.S. several years ago by KLM. The second, the FT-726R (Fig. 1) from Yaesu Electronics (Paramount, CA), has proved more successful, reflecting an increased interest in amateur satellite communications, especially since the launch of the first successful Phase III spacecraft — AMSAT-OSCAR 10.

The FT-726R is a multimode vhf/uhf tribander but comes from the factory equipped only for 144-MHz operation. However, optional plug-in modules for 50 and 432 MHz extend the capability of the rig, as does an i-f unit that gives the transceiver full-duplex and cross-band
capability for satellite operation. With that unit installed, tuning and mode selection on each band are independent of each other.

As with most new rigs, the Yaesu transceiver includes such features as i-f shift and width control, provision for a cw filter, memory channels with battery backup, VOX, tone control, and an all-mode squelch. Standard are a built-in ac power supply, selectable agc, continuously variable transmitter power, and a noise blanker. The rig operates from either the ac power line or from a 13.8-V dc supply capable of at least 4.5 A. The power output is 30 W pk-pk on 2-meters and 70-cm. For 6-meter fans, the rig will deliver 20 W pk-pk.

Because most amateur satellites operate in popular bands, much of the equipment designed for terrestrial operation are suitable for use with either Modes A and B. The multimode transceiver, such as the TS-780 from Trio-Kenwood Communications (Compton, CA), gives owners equal access to local contacts, ground-based DXing, or exciting transoceanic satellite contacts on the vhf and uhf bands. The TS-780 operates at 2-meters or 70-cm in either USB, LSB, cw, or FM modes. Memory scanning is useful for keeping track of popular passband net frequencies and can be set up for both bands simultaneously.

Multimode performers from ICOM America (Bellevue, WA) include two base-station transceivers, the IC-271A for 2-meters (Fig. 2) and the IC-471A for operation at transceiver with a matching power supply and 10-W linear amplifier. Basically a portable unit, the rig generates 2.5 W from internal C-sized batteries. Two VFOs allow rapid change from the satellite portion of the band to the FM subband. The frequencies are displayed on an LCD readout. A matching unit, the FT-790R, operates from 430 to 440 MHz. Like the 2-meter model, the 70-cm transceiver runs on internal batteries or an external power supply. Its power output is 1 W.

If greater transmitting punch is desired, Yaesu offers larger rigs: the FT-480R for 2-meters and the FT-780R for 70-cm. Both feature bright fluorescent displays, 10-Hz step tuning, and priority-channel selection. A blanker eliminates pulse-type noise, such as that from an ignition system. The FT-480R produces 20 W pk-pk; the FT-780R, 30 W pk-pk. A station console complements the rigs and provides such operating niceties as an LCD clock, fingertip up/down scanning control, and a built-in power supply.

Kenwood too has complementary vhf and uhf mobile rigs: the TR-9130 for 144-MHz and the TR-9500 for 430 MHz. The former delivers 25 W of rf on all modes and tunes in steps of 100 Hz, 1 kHz, 5 kHz, or 10 kHz. Six memories store popular operating frequencies that are retained by a user-supplied 9-V rechargeable battery. The rigs feature a conventional S/RF meter, a helpful aid for accurately pointing an antenna at a distant satellite. A noise blanker and a receiver incremental tuning (RIT) control also make satellite reception easier.

Going Out For a Spin

Mobile rigs are often the answer for hams looking for the best of both worlds: base-station performance and portable convenience. Although they require the addition of a 13.8-V power supply, the transceivers are often so compact that a complete satellite station, plus power supply, can be tucked into one corner of the operating bench or desktop. Fig. 3 shows the Yaesu FT-290 2-meter multimode

![Figure 3](image-url)

70-cm. Both are nearly identical in appearance and features. For example, the rigs offer 32 full-function memory channels that store both a frequency and mode. And both tune in increments as small as 10 Hz. For the traditionalist, a large front-panel knob tunes the transceiver over its range. For the speedy operator, two pushbuttons change frequencies in 1-MHz steps. Both rigs measure 11-1/4, by 4-1/4, by 10-1/4 in. and operate from ac power or a separate 13.8-V dc supply. The IC-271A generates 10 W pk-pk and the IC-471A produces 10 W pk-pk at 70-cm.
A popular feature of many modern rigs — the sideband squelch control — is also part of the IC-290A mobile 2-meter transceiver (Fig. 4) from ICOM. Five memories, priority-channel scan, two VFOs, and a built-in noise blanker are some of the features of that compact mobile unit. It measures 6-11/16 by 2-1/2 by 8-7/8 in. and delivers 10 W pk-pk to the antenna. The IC-290A's 70-cm mate is the IC-490A, which also produces an output of 10 W pk-pk. An optional battery backup system is available for both rigs. Designated the IC-BU-1, it will sustain internal memory settings for up to 10 hours after the 13.8-V dc operating supply is removed.

**Satellite Station in a Box**

Not all hams have vhf and uhf equipment but many have receivers that can tune the 10-meter band. If you're one of those, Ten-Tec (Sevierville, TN) has a fast and easy way for you to enjoy OSCAR-10 quickly. The Model 2510 (Fig. 5) is a complete Phase III station in a box, and requires just a 10-meter receiver. The attractive unit contains a 435-MHz single sideband and cw transmitter plus a 2-meter-to-10-meter receive converter.

In addition to its small size, other features of the Model 2510 include a typical dynamic range of 85 dB and a 10-W output. Because it is compact, the satellite box makes a welcome traveling companion for the vacationing ham who wants to bring satellite capability to a summer home. With the right antenna, its 10-W output should be sufficient for many satellite contacts.

An external power amplifier can be used to boost station performance if required. Tube types remain popular projects for the homebrewer but solid-state amplifiers hold sway in the commercial market. A favorite of many is the D1010 (Fig. 6) from Mirage Communications Equipment (Morgan Hill, CA). For an input of just 10 W, the D1010 will reward its owner with 100 or more watts of output. A linear amplifier, the unit operates in any mode — FM, ssb, or cw. A built-in and adjustable time delay prevents relay chattering on sideband contacts.

The D1010 draws a hefty 20 A from a 13.8-V dc supply and will accept an input from 430 to 450 MHz with as little as 300 mW to a maximum of 15 W. A smaller amplifier, the D24, operates over the same frequency range and boosts a 2-W input to 40 W of output. For Mode A enthusiasts, Mirage offers a range of 2-meter power amplifiers, including the 80-W output B108, the B1016, a 160-W linear amplifier that requires 30 W of drive. To boost the output of a small exciter, Mirage offers the B23, a 2-W input, 30-W output amplifier.

A new name in amateur radio is TE Systems (Los Angeles, CA). That company's linear rf amplifiers deliver outputs of up to 160 W and can be ordered with a built-
in GaAs FET preamplifier. The Model 4410G (Fig. 7) covers 420 to 450 MHz and can produce 100 W for a 10-W input. A built-in GaAs FET preamplifier boasts a 0.8-dB noise figure, 10-dB gain, and a third-order intercept point of +18 dBm. In addition to an array of front-panel switches and LED status indicators, the unit includes a thermostatic switch that shuts the amplifier off if extended transmission at full power produces internal temperatures in excess of +65°C. Other features include a remote control unit and a one-year warranty on the transistors. TE Systems also manufactures amplifiers for 2 meters. All measure 2.8 by 5.8 by 10.5 in.

Compact, trim, and with a dash of styling is the HL-45U, a 430-to-450-MHz linear amplifier manufactured by Tokyo Hy-Power Labs and available in the U.S. from Encomm, Inc. (Plano, TX). The booster, shown in Fig. 8, includes front-panel switches to select either FM or sideband operation, to throw a preamplifier on line, and to turn the unit on or off. Status LEDs indicate amplifier operation.

For an input from 2 to 15 W, the HL-45U provides from 10 to 45 W. At the maximum power output, the unit draws 7 A from a 13.8-V dc source. The HL-45U joins an existing line of uhf amplifiers that include the 25-W output HL-20U and the HL-90U, an 80-W amplifier.

Very far removed from Tokyo is Liverpool, the English city that brought us the Beatles and a versatile line of Microwave Modules products, including the MML.432 series of linear amplifiers. Models are available to deliver from 30 to 100 W of output. Two of the units have an integral preamplifier. Microwave Modules equipment is offered in North America and elsewhere by distributors, such as Spectrum International (Concord, MA).

Tubes Do the Job

There are some jobs in amateur radio that tubes do very well, for example generating power in the microwave region. A venerable tube, the 2C39, also known as a 7289, is a compact tube with a long history of service in the shack. Angle Linear (Lomita, CA) puts it to work in its Model LCA amplifier, an open-frame style unit designed for those with some technical skill.

Required for operation of the LCA are a separate high-voltage power supply, a tube, a blower, and a meter (all available from the manufacturer). With 1 W of drive, the amplifier will deliver 40 to 50 W of stable output power from 1240 to 1300 MHz. If a more capable exciter is available, the amplifier puts out 250 W, however a water cooling system, such as that supplied by Angle Linear, is a must.

Also using the 7289 tube are the USD 285, a dual-tube 23-cm amplifier, and the USD 200, its single-tube counterpart. Both are manufactured by the Swedish firm Parabolic (Kungsbacka, Sweden) and available in North America from the VHF Shop (Mountaintop, PA). Another European-manufactured unit is the PA 2310 linear power amplifier from SSB Electronic (Iserlohn, West Germany). A transistored unit, the 2310 turns 500 mW into 10-W output from 1250 to 1300 MHz.

Low-cost Add-ons

Because many hams already have the basic equipment necessary for a satellite station, a careful choice of converters or transverters will have the radio amateur up and running on the birds quickly and with minimum expense. Indeed, it is often possible to select an inexpensive second-hand hf rig, equip it with the necessary converters, and enjoy satellite communications without making a significant dent in the yearly ham radio budget.

For the person who can wield a soldering iron well, the least expensive route is the build-it-yourself converter, such as those from Hamtronics. Those kits come with a choice of input and output combinations, for example the 435-MHz satellite band can be downconverted to 10-, 6-, or 2-meter bands to breathe new life into an unused rig. The same versatility is provided by the 2-meter receiv-

(Cont. on page 16)
ing converter. Both types can be ordered in assembled form.

The kit-builder can also consider receive converters from Lunar Electronics (Fig. 9). Both vhf and uhf models are offered and come with double-sided pc boards, a gold anodized box, and provision for netting the circuit’s crystal onto frequency.

The RXXVDA series of receive converters from Advanced Receiver Research also have provision for crystal netting. The compact units include such other features as an input filter/matching network, a zener diode for temperature stabilization, and low-noise transistors in the rf amplifier stage. The R435VD is specifically designed for reception from 435 to 437 MHz, however the R432/435VD has an additional crystal that allows coverage from 432 to 434 MHz as well. The converters are housed in a rugged aluminum enclosure that lends itself to remote installation.

Microwave Modules also lists receive converters, including two models that translate 70-cm signals to either 10- or 2-m.

But how can you talk through OSCAR-10 with your existing 2-meter rig? Simply connect the rig to a transmit converter that ups the input signal to the satellite band of interest. For example, if you’re a Mode L fan, the Microwave Modules MMZ1268/144 may be just the thing. It will connect to a 2-meter exciter and deliver 2 W at the appropriate 1269-MHz uplink frequency for the high-flying elliptical-orbit satellite.

SSB Electronics also produces equipment for the amateur 1-band frequency assignment. The UFA-2 is a crystal-controlled oscillator chain that develops 10 mW over a 1-to-1.3-GHz range when driven by an appropriate 2-meter exciter. An amplifier, of course, would be required. The USM-2 is an upconverting transmit mixer that requires 6 mW from an external local oscillator plus from 5 to 200 mW of drive from a 2-meter exciter. With the proper selection of oscillator frequencies, drivers operating on other bands can be used.

Designed expressly for OSCAR-10 use, the XV4 transmit converter from Hamtronics comes equipped with the crystal needed for operation from 435 to 437 MHz. The linear converter, which uses a double-balanced mixer for low spurious performance, comes either as a kit or an assembled unit. As little as 1 mW will drive the unit to 3/4-W output on single sideband or 1 W on CW.

Mindful of the needs of satellite users, as well as those interested in terrestrial microwave communications KLM Electronics (Morgan Hill, CA) has introduced a dual-frequency transverter, that is, a receive and transmit converter in a single enclosure. The Model 1200DF converts the 1269-to-1271-MHz band to 2 meters and generates an output at those microwave frequencies with suitable 144-MHz drive. The output power, 5 W, is suitable for driving a 2C39-type tube amplifier. Similar capability is included for the 1295-to-1297-MHz span.

In addition to the KLM transverter, similar units from other companies can give suitable service in the satellite band as well as in local usage. Transverters from Lunar Electronics and Microwave Modules also can be used for either their receive or transmit functions.

Postscript

Since the first part of this two-part article was written, a new antenna has been introduced to the North American market by the West German company Sommer GmbH through its distributor Eurotechnik (Plainville, CT). Designed expressly for the satellite enthusiast, the Type HXP 70-14 helical antenna is just the thing for the Mode B uplink. Standing out from a solid aluminum-alloy reflector are 14 spiral turns that are supported by ultraviolet-resistant polycarbonate-nylon tubes. The boom length is slightly more than 6.5 ft. and the antenna weight just 12 lbs. Windloading is 2.6 ft/lb. The antenna’s manufacturer claims a gain of 16 dBi and a beamwidth of 38°. The feedpoint impedance is 50 ohms.

Manufacturers Directory

For more information on products mentioned in this two-part article, contact the manufacturer or distributor directly at the address or telephone number shown below. Also check Orbit and other amateur radio magazines for information on other manufacturers and on new products designed for the satellite enthusiast. Please mention Orbit in your inquiry.

Advanced Receiver Research
P.O. Box 1242
Burlington, CT 06013
(203) 582-9409

(Cont. on page 27)
Occasional readers of this column may not be aware of my penchant for arranging complex technical and sociological matters into basic categories. A recent example dealt with amateur satellite program participants who were neatly sorted out and summarily tossed into one of three bins containing engineers, operators, or managers, respectively. Simply stated, some of us build satellites, and some of us use satellites, while the remainder attend meetings. Feedback has revealed that not everyone is comfortable with being forced into those concise little slots. I recognize we have many exceptional contributors within our ranks and that some have inclinations and talents that cut across the different categories. Therefore, my apologies to those who don’t really fit the molds.

Nevertheless, it can be stimulating to think in terms of controversial categories. For instance, there have been three distinctly identifiable eras of amateur radio. The first included the years from the discovery of wireless to the start of the Second World War. It encompassed a period when it was necessary for most amateur communicators to construct their own transmitters and receivers. To do so, they first had to build many of the essential parts.

We entered a second era following World War II. Discrete electronic components of all kinds became available in abundance. Homebrewing remained in vogue. Hams assembled their own transmitters, which in many cases were superior performance-wise to the more expensive commercial equipment offerings.

We moved into the third era when, about 1970, it became technically and economically advantageous to acquire and use commercial transceivers. That change, of course, coincided with the advent of solid-state electronic miniaturization.

To recap, we have progressed through the Construction Age and the Assembly Age, and are now well established in the Appliance Age. Amateurs from the first two eras seem to have settled comfortably into today’s manufactured world. On the other hand, many younger hams find the term “Appliance Operator” offensive. Perhaps our senior members, who cut their teeth in a more primitive environment, perceive they are enjoying the fruits of their earlier struggles. At the same time the clever young ones may harbor an unfulfilled need to face tougher challenges.

The subject came up at a recent amateur radio luncheon held at the Disneyland Hotel in Anaheim, California. The main objective of the meeting was the premiere showing of the American Radio Relay League’s “Ham in Space” video tape featuring Owen Garriott, W5FL. That excellent production was appropriately created by a group of talented hams. Its one flaw is that it doesn’t clearly designate Owen’s starting era. It may be significant that he used a homebrew antenna.

All three eras were well represented within the receptive audience. One of several from the Construction Age was Walt Henry, W6ZN. While still in his teens, Walt was making his own components at home in Butler, Missouri. In 1927, he and his brother Bob, W8ARA, overcame a personal difficulty by founding Henry Radio. (Brother Ted, W6UOU and sister Mary, W6VWL hadn’t yet appeared on the scene.) To build electrolytic rectifiers, Walt and Bob had to purchase quantities of aluminum in excess of their own needs and financial resources. They solved the problem by sharing small amounts of raw material with other hams through ads in QST. Walt has adapted well to the successive eras. Today, he is a distinguished AMSAT supporter who has operated with considerable dexterity on the various OSCARS, using assorted domestic and imported appliances.

Physical appearance notwithstanding, I qualify as a spokesman for the Assembly rather than the Construction Age. My first station was put together from readily available discrete components, including an oscillator crystal, a vacuum tube rectifier, and a real 807 final. Along with most of my peers, I have for some years resided contentedly in Appliance land.

Several modern era hams attended the Anaheim meeting. Their representation included Harold Price, NK6K. Many of you will recognize Harold as the Program Manager for PACSAT. He spoke very authoritatively of future digital amateur communication satellites. He also articulated impressively in the philosophical arena. Harold seriously believes we are presently in what he calls the Systems Engineering Age. We don’t just plug in appliances; we take manufactured subsystems and arrange them into unique, functional, tailored, operating, communications stations. That assertion came as a shock because it conflicts with my own carefully thought out categories. But then, Harold is a bright lad who deserves our attention.

Obviously, some friendly reconciliation of our differing views is needed. Perhaps there are subtle sub-eras of the three main Ages. It is true there were Assemblers who built from kits, others who relied only on handbook schematics, and still others who were clever enough to come up with their own designs. Correspondingly, there may be Appliance types who require assistance in connecting their rigs, others who can do it by themselves, and a third group who can actually think up new ways to combine boxes. The obvious beauty of this expanded view of our modern world is that it re-opens the door for individual technological progress!

In my own case, I have retained the ability to connect cables unsisted but I haven’t functioned as a creative ham for many years. This fresh line of thought presents a stimulating challenge! Excuse me while I explore potential improvements to my old 1976-model OSCAR terminal. Who knows...maybe I can qualify to become a bona fide Appliance Age, Systems Engineer.

Move over, Harold!
Since our last column was written, we now have 'UoSAT-B' in orbit as UoSAT-OSCAR 11, following a totally successful launch and early initiation. Excellent signals from the 145.825 MHz telemetry beacon were heard at some +8 dB on OSCAR 11 following separation and the University of Surrey "on" command, all readings were nominal. A later command to continue transmission was fully effective, and the new satellite was functioning perfectly as it went out of range, or LOS in Britain. It was still going strong when monitored by Miki, JR1SWB, but was found to be silent when it should have been acquired at AOS by Bud, W6CG. It is not totally clear at this time as to what the problem is, i.e., a command error, a software problem, or a beacon failure. But the most likely cause is thought to be a problem that manifested itself just prior to launch, when the two meter beacon, due to current limitation, went into white noise. The limiter was reset prior to launch, but it seems possible, if not probable, that the drop in temperature as OSCAR 11 went through eclipse re-manifested the condition, which is thus de-sensing the command receiver and not permitting commands to be heard.

Martin Sweeting, G3YJO, at Surrey believes that commands sent on 1.2 GHz might overcome the problem, as it would be unlikely that the wideband noise spectrum would extend that far. Accordingly, a command encoder was sent to Chip Angle, N6CA, who will try to access the system. Signals are being heard on 145.825 MHz by those with good front-ends and superior antenna systems and they are likely from the beacon driver stage. VK1DS has the use of a 26-meter dish (29 dB gain) and is hearing OSCAR 11 at -120 to -135 dBm. Several 2-meter EME stations have reported signals over the noise at TCA.

Plans are now being made with the European Space Agency (ESA) by the Marburg AMSAT group to try for a launch on the Ariane 4 rocket commencing in the 1986-1987 period. Two amateur and two commercial satellites are planned (see diagram). The launch, from Kourou, French Guiana, would place into orbit a new METEOSAT weather satellite, 'ATHOS', a French communications satellite, the AMSAT Phase IIIC satellite, and the French amateur-radio ARSENE satellite.

AMSAT-DL are planning for a new Mode 'L' transponder concept, plus a 2.4 GHz (S-band) beacon by DC9RK using a helical antenna. To achieve the 57° inclination desired, some 40 liters of ordinary water will be used as the propellant, as already proposed by Karl Mezner, DJ4ZC. It surely must be the world's safest fuel prior to electrolytic decomposition and/or heating. More details in a later issue on the plans.

F9QW reports that the AMSAT-F ARSENE project is making steady progress, with over 100 meetings having already been held by the project group under the guidance of F8YY. Until now, no funding has been necessary, since time and materials have been freely donated. But as they approach the launch possibility, it will be imperative to find patrons for financing and sponsors are urgently being sought. If you feel that you can help, please contact F6FHE, or, if you feel that you would like to assist in the actual work, please let F3HKT know of your expertise. So far, the UHF receiver and local oscillator are partly completed, with the layout and components complying with the required specification. The 145 MHz rf amplifiers have been virtually completed by the Bordeaux group, while F5EN (Paris) and F3VF (Rennes) continue to make progress on the 2.4 GHz chain. The telemetry transmitter is already complete, and a printed layout will be functioning by September. F2MM has proved the system in its experimental stage to the practical. A complete test of the entire transponder system is imminent. The project group consists of some twenty specialists, of whom half have been in from the start of the operation. Numerous meetings have been held with those in the space industry to do research into the function and availability of components, leading to details of the actual

The Ariane IV rocket planned for 1986/1987 launch with the positions of the satellites shown. (1) Meteosat, another weather satellite, (2) ARSENE, the French Amateur Radio Satellite, (3) AMSAT-Phase IIIC, and (4) ATHOS, a French communications satellite.
structure, motor, stabilization system, etc.

To get to the operational side, no signals have been heard from either OSCAR 7 or 8, and the beacons of RS-3 and 4 remain silent. RS-2 (or is it RS-1?) continues to chirp away with his '5's, while RS-5 to 8 are still going strong until the next eclipse period, with the 'ROBOT's' being activated regularly. A new contest activity period is being planned for the 'RS' series in June, and though intended for the USSR, overseas participation will be welcome. UA3CM went to Tiksi Bay with Vassily, UA3DTD earlier this year, to set up EK0BDT, Asia, and Zone 19. Operation was on 145.920 and 145.970 MHz uplink in preparation for a further trip to 4K1 Antarctica destined for January or February 1985.

No news is in hand yet regarding new 'ISKRA' launches from SAL.YUT-7, but the Cosmonauts can be heard regularly on 142.420-142.430 MHz FM, with their voice link just below our two meter band for those who can tune their receivers that low.

The bulk of activity is on AMSAT-OSCAR 10, with new stations and countries appearing weekly. It is believed that some 92 DXCC countries are now operational on AO-10, and many stations are fast approaching the total possible. Nikki, K5ADQ and Peter, ON7HP, are running neck-and-neck with 83 countries worked each. New and welcome arrivals include OH0AM, G3E6FB/A, W9PW/VP2V, ZD8LM, HB9POM/P, and LZ2US, the latter being the first to arrive of several keen and coming stations in Bulgaria.

With the satellite fast approaching its inclination i.e. the apogee at the 26° North point, "long path" has become possible. OH7AZL has worked several W6's, K5ADQ has worked Victor, UL7DD, both to the West and to the East, and KH6 has been worked both ways from G land. With a little re- -angulation by E (or even F layer despite the low sunspot number) it may just be possible to establish antipodal QSOs. Times and possibilities are being finely studied for the first UK to ZL potential contact.

Werner, PY1BJL, writes from Rio to confirm that to his regret there is very little activity from South America. He believes that a main cause of this is the economic problem caused by escalating inflation and the devaluation of the dollar, which means that very few amateurs can afford to purchase the necessary equipment. He has worked out a fine program for satellite tracking in BASCOM on his Radio Shack model III compatible computer. It runs in a quarter of the time that it takes in BASIC.

Ralf, CE6EZ confirms the low activity in South America, as he worked all of the active SA satellite stations in a few weeks! He is delighted to have OSCAR 10 up and active to extend his horizons and opportunity to give many more QSOs. Ralf is trying to furnish a satellite station complete for every radio-club in his country this year. He hopes to stimulate interest and activity and encourage operators to get their own stations active. Also from South America, a good tip comes from Carlos, LU4ENQ,
A watertight housing holds the 70-cm transverter, the Mirage D-101 and B-108 amplifiers and the 30-A power supply in the CE6EZ radio shack.

for TR3000 users. Disconnecting C138 in the agc circuit gives a major improvement when the rig is used for AO-10.

Werner, DJ5KQ, one of the prime sources of our new satellite, has kindly corrected my belief that the first OSCAR 10 QSO was between PA8SB, Jan, and Karl, DJ4ZC. That was in fact the first QSO after regular operation had begun. The very first QSO on first placing the transponder on was between Karl and Werner, DJ5KQ.

Suggestions have come from numerous sources that an "Alligator of the Month Award" be given to those who outperform all others in pushing the alc in OSCAR 10 to the maximum, and who successfully totally attenuate all other QSOs on the satellite. Anyone stronger than the beacon is eligible on the proviso that the QRO is regular and consistent. Bonus points would be offered to those who have already been told by three or more users to QRP. Any proper user may nominate candidates who qualify. The eventual score for the winner would be calculated from points made up from the number of times told multiplied by the dB over the beacon multiplied by the number of stations that submitted nominations. The overall winner at the end of a year will receive a certificate or replica depicting a large alligator, with a very small brain and a very thick skin. Already we have twelve call signs on the list, six of them many times over, with prefixes of LX, I, JW, OE, DL, HB, F, PC and W being dominant.

From New Zealand, Murray, ZL3TIB, is active with a 14-element RHCP Yagi and VK stations. Ross, ZL3ADT, has a 0.6 dB N.F. GaAsFET pre-amp fed from an 8 element vertical Yagi. The transmitter delivers 30 W to an 8/8 skeleton slotted beam. He has worked 30 countries to date. His list shows ZS5JJ, ZS6US, OH5LK, JY9CF, U17GBD, UB5MGW, FK1RF, 9M2CR, P29FZS, H44PT, KL7NO, VE3XQ, WB5LBJ/D6U, UA8LIF, CE3BFZ, YO6AT, VS6HH, LUTLA, YV5Z, FRIAC, KG6DX, T2NA, XE1TU, HL3UJ, with many JA's, W's, and VK's. Ross would very much like to make a sked with LA, SM and OY, since he feels that they could QSO in the short, infrequent window. He would appreciate a line to Ross Johnson, 189 Queensbury Street, Christchurch, New Zealand.

‘RS’ is still the most popular satellite series in ZL, as most of the time, with the perigee in the Southern Hemisphere, OSCAR 10 is off. But that is expected to change when full-time operation reoccurs and as the satellite goes toward the equator again with its apogee point.

Peter, ZS5JJ, has moved QTH, leaving Dudley, Z22JR, to represent Zimbabwe on OSCAR 10. He hopes to be on and active again on both AO-10 and EME as soon as he has settled in. The new QTS is W.S. Carey, ZS6CDD, Salbu, P.O. Box 40505, Arcadia 0007, Pretoria, T.V.I., South Africa.

Heinz, DL1CF, is celebrating his 300th satellite QSO, which includes 55
Minutes of the 1983 AMSAT Board of Directors Meeting

Opening

The meeting was convened at 9:38 AM EST on November 18, 1983, at the Columbus Inn, Columbus, Maryland, with the following present: John Browning, W6SP*; John Champa, K8OCL; Tom Clark, W3WI*; Pat Gowen, G3IOR*; Phil Karn, KA9Q; Jan King, W3GEY*; Bill Lazzaro, N2CF; Doug Loughmiller, KO5I; Bob Myers, W1XT; Harold Price, N6K; John Pronto, W6XN*; Vern Riportella, WA2LQQ; Martha Saragovitz; Roger Soderman, KW2U; Ray Soifer, W2RS.

Each attendee individually read the previous meeting's minutes and suggested minor correction.

Pat Gowen brought up the issue of AMSAT's apparent involvement with the US military agencies, discussed at the previous board meeting, and agreed to "let sleeping dogs lie."

Commendations

John Browning gave commendations for the previous weekend's Annual General Meeting; a lot of credit is due to the organizers. A discussion followed regarding the format of the meeting and whether parallel presentations should have been held. Pat Gowen expressed frustration at having to miss half the sessions, and suggested that a common Q&A session be added to the meeting. Jan King expressed a need for a more formal opportunity for the members to "respond" to the annual report. Pat Gowen moved the following:

That at the next Annual General Meeting, a two day period should be utilized, if feasible, in which:

1) A non-lecture time slot should be allotted in so that those committed to demonstrations are able to fulfill these obligations and also attend those events of major interest.

2) That a published period of up to two hours should be allotted in the program advertised as a "Q&A" session between the officers and Board of Directors and the membership, giving a needed two-way dialogue and essential feedback on activities and progress, this meeting to be held at the time of anticipated peak attendance.

Jan King seconded this motion, and it was passed 5-0.

The previous minutes were amended to add Martha Saragovitz to the nominating committee listed on page 8, and to mark Roy Rosner, K4YV, as chairman. Pat Gowen moved and Tom Clark seconded a motion to approve the minutes, which was approved 5-0.

Pat Gowen expressed a sentiment that the selection of the AMSAT General Manager was done undemocratically and that the full board of AMSAT directors, e.g., both overseas directors were not involved in the approval process. It was explained that the chairman of the selection committee had not contacted Pat because he had already contacted enough board members to form a majority in favor. A discussion followed on the proper procedure to follow when taking board votes when the board is not in formal session. The board prepared a comprehensive list of members to be commended for their significant contributions to AMSAT activities in the past year:

W3OZ and W3XO for their support of the Annual General Meeting; G4GPQ and JRJ5SB for their information dissemination activities in Europe and Japan, respectively, during the launch of AMSAT-OSCAR 10; GM4HHJ for tracking software contributions; the entire Phase IIIb design and construction crew: W3GEY, ZS1FE, DJ4ZC, The University of Budapest, W2FPY, W4PJJ, WD4FAB, K4YV for past service as treasurer and chairman of the search/selection committee; the AMSAT-OSCAR 10 telecommand support team: JRJ5SB, W8PN, W1HDX, VE1SAT, DJ4ZC, KA9Q, ZL1A0X, W3WI; the AMSAT Launch Information Network team: WH6AMX, G3AAJ, W6RPK, WA2LQQ; the contributors to and organizers of the AMSAT Software Exchange: N5AH, N5BF, W6RPK, N8AN, N3AR, K0RZ. Jan King remarked on being very gratified that the whole tracking software area seemed to have "taken on a life of its own."

John Browning moved that AMSAT recognize, by means of certificate and publicity, the outstanding achievements of these members assisting the radio amateur satellite activities. Seconded by John Pronko, passed 5-0.

Internal Communications

Orbit Magazine

Pat Gowen expressed concern that no proof copies of Orbit articles are sent to authors prior to publication. Others replied that doing so would overburden an already expensive publication process and delay excessively the printing schedule. Tom Clark suggested that editorial review be tightened for policy and technical content. A discussion followed on the proper content of Orbit, and how much should be controlled by Board direction, e.g., what the balance should be between technical and introductory articles.

Jan King maintained that Orbit is not a vehicle for highly detailed papers from the technical team, and that it could not be used to "sell" industry professionals on AMSAT. Alternative proposals for an outlet for technical reports via a vis Orbit followed. Jan pointed out that AMSAT-DL's 300 Orbit subscribers had voted to cancel their subscriptions. Regarding duplication of ASR items in Orbit, it was felt that certain "must print" articles, followed by lower priority items of lasting importance, should be printed in Orbit.

Tom Clark strongly supported the concept of a separate "technical report series", with abstracts to be published in Orbit. Each technical author would prepare his/her own material for publication. Jan King proposed, seconded by Pat Gowen, that a committee of Jan King, Tom Clark and Harold Price be formed to create an AMSAT technical publica-

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tion medium, under the following conditions:
  a) Finances are self-sustaining
  b) Coordinated with the existing publications staff
  c) That it is not parasitic upon Orbit Magazine

This motion passed, 5-0.

ASR

Concern was expressed over the growing size of the AMSAT-paid distribution list for ASR. Tom Clark moved that the VP Operations be responsible for reviewing the complimentary distribution list for ASR with the intent of reducing expenses to the organization. This was seconded by Pat Gowen and passed 5-0.

Telemail

Pat Gowen expressed a concern that Telemail had created an “in” crowd within AMSAT, along with a parochiality towards those not having access. Others strongly disagreed, pointing to the essential role Telemail played at launch time both as an internal pipeline between command stations and as a backbone network for dissemination of information to the members via publications and on-air nets.

A long discussion followed regarding the proper role and cost recovery for Telemail; Tom Clark commented that the “Telemail Experiment” itself had been a great success, but that the fiscal arrangements were not satisfactory. He proposed wider access to Telemail, possibly to include functions now served with NSAHD’s bulletin board system, but with automatic charging and usage control. The board voted 4-0, with 1 abstention, to continue use of an electronic mail service (not necessarily Telemail).

Reasons cited included the absolutely vital role Telemail played in the launch and initial operations of OSCAR 10, the manner in which it connects “centers of excellence” within separate AMSAT organizations, and the noticeable improvement in dispersion of information to the general membership. The primary concern was to develop proper financial controls and procedures.

John Pronko moved that a committee consisting of Tom Clark, Phil Karn, Harold Price, Bill Lazzaro and Bob Diesing be formed to examine the electronic mail alternatives, give recommendations to the board, and establish appropriate billing and control procedures. Passed, 5-0.

Pat Gowen suggested the need for intra-user nets, with less one-way broadcasting of information. Problems cited with this approach include propagation on the 15 and 20 meter net frequencies. Pat also moved for institution of additional net(s) on HF and AMSAT-OSCAR 10 at times selected for optimum propagation and participation to involve membership in 2-way dialogue. This motion was seconded by John Pronko, and passed 3-1 with 1 abstention (John Browning opposed, Tom Clark abstaining).

Financial Report

Bill Lazzaro presented a financial statement and new member reports. The number of members was approximately 4,356, half of which are life members. Trends the months since the launch of AMSAT-OSCAR 10 showed an increase of approximately 3% per month, or 6% per month over “paying” (non-life) members.

Bill reported that sales of tracking software have been very successful as an AMSAT money-maker, with gross sales of $16,000 to date. Many people have been writing in for “freebies”, with much interest generated by the upcoming STS-9/WSLFL operation. Opportunities exist for future products. Solutions to the rapid growth in demand were discussed, with the possibility of setting up a separate project group for handling the development and distribution of software.

In the “trinkets” category, AMSAT T-shirts have yet to be profitable while belt buckles have been making money.

Exploratory talks with TRW on an educational program are underway, with the possibility of a $5,000 grant.

Discussion followed on the funding possibilities from aerospace companies for educational programs and their possible impact on the ability of the technical groups to get donations in kind from these same corporations.

Ray Soifer is resigning as Chairman of the Management and Finance Committee. Ray was thanked for his past service to the organization.


Bill Lazzaro suggested that university connections be pursued for funding opportunities. The primary advantage is the increased size of each funding award, but a major disadvantage is the overhead taken from each grant by the university. The strong need for volunteers to manage tasks, including fundraising, was expressed. There also appears to be a need for coordination on satellite-related fundraising between AMSAT and VITA, now that they are cooperating on a satellite project.

Just before dinner, a series of possible fundraising ideas (some rather wild, but all plausible) were circulated, including:
  a) Salvage rights to defunct OSCARS in orbit and under the oceans
  b) Daily sponsorship of satellite operations
  c) Daily sponsorship of earth gravity
  d) Sales of spacecraft reject parts

Officers

After dinner, the Board discussed the duties of the various officers, particularly the proper roles for the President and the General Manager. Bill Lazzaro, the General Manager, has been acting treasurer since the resignation of Roy Rosner. Changes in the AMSAT bylaws were discussed, but action was deferred to the next day. The results of the recent Board of Directors election were presented. A total of 1,213 votes were cast, 30% of the membership:

- Jan King, W3GEY - 1,131 (elected);
- John Browning, W6SP - 987 (elected);
- John Pronko, W6NX - 790 (elected);
- John Henry, VE2VQ - 720 (elected);
- Jack Colson, W30Z - 679 (1st alternate);
- John Montague, WØRUE - 458; Wray Dudley, W8GOW - 370.

A list of suggestions to the Board by Jack Somers, WA6VGS, was discussed. Several of these suggestions regarded the dissemination of financial information, and it was the consensus of the Board that it accommodate these desires while at the same time saving the members’ money. The action on each issue was as follows:

1. Require that the bylaws be published every other year for general review by the membership.
2. Declined; AMSAT Bylaws are already available on request. The estimated cost of publishing the Bylaws in Orbit would be $1,000/year.
3. Require a budget or balance sheet be published for review by the membership once a year.

The Board reaffirms its policy that a balance sheet be printed once a year, announced in AMSAT publications, and be made available to the members. This motion was made by Tom Clark, seconded by Jan King, and passed 5-0 with one abstention.

3. Require that platform statements and background reviews be published and accompany ballots mailed to the membership.

Estimated cost would be $600. Declin-
ed to take specific action, delegating same to the administrative staff.

4. Require the formation of a "New Projects" Committee who should poll the membership to determine the projects of greatest interest to the members and review new projects and submit recommendations to the Board of Directors.

Delayed until Saturday session.

5. Update Senior Vice-President duties and responsibilities as well as those of the General Manager.

Board declined; no specific action, although the Bylaws were later amended to define the duties of the General Manager.

6. Publish an established organization chart showing the chain of command and responsibilities. Suggest that both the President and General Manager report to the Board of Directors.

No formal action, but the information is to be made available.

7. Appoint a comptroller to approve fund expenditures, etc. (control expenditures).

No formal action.

8. Limit the President to $500 expenditures without Board approval. No formal action.

9. Require the Board of Directors to review the performance of paid employees on a quarterly basis.

John Pronko moved that the Board shall conduct a yearly performance review of the General Manager. Seconded by Pat Gowen and passed 6-0.

The first day of the meeting was adjourned at 11 PM.

Day Two

The meeting was reconvened at 9:18 AM Saturday, November 19, with the following present: Ian Ashley, ZL1AOX (arrived 10:45 AM); Bill Brown, K9LF (arrived 11:10 AM); John Browning, W6SP***; John Champa, K8OCL; Tom Clark, W31W*; Dick Daniels, W4PU; James French, World Space Foundation (arrived 9:49 AM); Pat Gowen, G3IOR*; John Henry, VE2VQ*; Phil Karn, KA9Q; Jan King, W3GEY* (arrived 9:45 AM); Bill Lazzaro, N2CF; Doug Loughmiller, K0S$; Bob Myers, W1XT; Harold Price, N6OK; Terry Price, N6HBB; John Pronko, W6XX*; Vern Ripportella, WA2LQ; Martha Saragovitz; John Shew, N4QQ; Roger Soderman, KW2U; Ray Soifer, W2RS; Bill Tynan, W3XO (arrived 12:23 PM); Harry Yoned, JA1ANG* (left at 5:30 PM); Rich Zwirko, K1HTV.

The minutes of the previous day were reviewed.

Membership Services

A number of membership and operating award incentives were proposed by Vern Ripportella. Ray Soifer described a 3-tier award concept:

a) Operating awards with eye toward controlling the negative aspects of competition.

b) Technical, research, public service and education to be encouraged.

c) Mode L: perhaps recognize more conventional operating awards in order to create Mode L ground hardware.

d) To encourage enlistment of AMSAT membership.

Videotapes, slides, etc., were discussed, as were ways to involve clubs. Computer clubs, especially, are an untapped resource especially with respect to packet radio.

Project Review

Jan King reviewed AMSAT-OSCAR 10. It is generally considered a success. All strategies were proven: a single multitasking computer, software control, active attitude control, and the Mode B transponder. Problems encountered included the wiring error in the kick motor control circuitry, the helium tank leak, and Mode L performance. An uplink on Mode L of +44 dBW (25 kW) EIRP, along with a 16 dbi gain receive antenna and a 1 dB NF preamp are needed to obtain a peak signal-to-noise ratio of 10 dB. The sensitivity problem is suspected to be the failure of a switching regulator in the bias supply of the final amplifier modulator. There is a very strong European interest in Mode L, despite its disappointing performance.

Because of the non-nominal final orbit, a little less power margin will be available with peak sun angles. Various options exist for handling difficult operational conditions that will exist in the future during peak sun angles and eclipse seasons.

On Mode B, the average signal-to-noise ratio seen on voice peaks with a good receiving station is 16 dB.

A need exists for a routine engineering operations plan for AMSAT-OSCAR 10. Alternatives include the "rotating hot seat". There is a need for continued funding to support telecommand activities.

For Phase IIC, an opportunity may exist for a launch on an Ariane 4 test mission. ESA would accept a "modification to proposal" to include the spacecraft. A marked positive shift in ESA's attitude with respect to AMSAT has taken place in the recent months. The only problems are associated with the real costs and complexity involved in the launch campaign.

The possibility of Karl's earlier proposed "asteroid encounter" mission is small, and he cannot make a dedicated commitment.

User feedback on Phase III must include money if the program is to continue!

Bill Tynan reviewed the status of W51FL's planned operation on STS-9. Amateurs are credited with discovering an EMI problem in the shuttle ground test equipment during a test of the 2 meter radio. The project is popular with NASA Public Affairs and Headquarters, but unpopular with the science project people.

John Champa introduced Dr. James French from the World Space Foundation, who gave a lunchtime presentation of a proposal for joint development and flight of a solar sail project. After the presentation, Tom Clark introduced a resolution thanking Dr. French for his interesting presentation, saying that we see interesting future possibilities for future cooperation between our two organizations. Seconded by Pat Gowen and passed 6-0.

Harold Price reviewed PACSAT. A $15,000 grant from VITA has been received and spent so far on development and design activities; a design document is available and had been delivered to VITA.

The project is on the same order of complexity as two Phase III satellites, including propulsion, CPUs and attitude control. Target date for launch is 1986; the American and Canadian groups will do the PACSAT experiment proper (8 CPUs), while the University of Surrey constructs the spacecraft frame, IHU and bus. Harold is the full-time PACSAT project manager, with his salary being paid by $30,000 from VITA which also covers some expenses for the engineering development payload on LoSUSAT-B.

As it is hoped to launch PACSAT from the Space Shuttle, the progress of other small groups also planning on deploying small payloads from a Getaway Special (GAS) canister was reviewed. Gil Moore of Thiokol Corporation is sponsoring a small FAA radar calibration spacecraft that is planned for deployment from a lidless GAS can on STS-17 in August 1984. Unfortunately, a whole new set of Pandora's boxes have opened with launches on the Shuttle, primarily due to the extremely stringent safety requirements associated with flying on a very expensive manned vehicle.

The current project leaders involved with PACSAT are: Harold Price, N6OK, project manager and software manager; Lyle Johnson, W7GKX, hardware design; Phil Karn, KA9Q, modulation, coding, data modem design; Larry (Cont. on page 27)
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Both the 2M-14C and 435-18C sport virtually unbreakable 3/16” rod parasitic elements anchored thru the boom, folded dipole driven elements produce excellent physical and electrical symmetry for years of constant performance.

Specifications: (2M-14C)

<table>
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<tr>
<th>Bandwidth:</th>
<th>144-150 MHz</th>
<th>Boom Length:</th>
<th>12' 9&quot;</th>
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<td>Gain:</td>
<td>11 dBd</td>
<td>VSWR:</td>
<td>1.2:1</td>
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<td>Beamwidth:</td>
<td>48°</td>
<td>Wind:</td>
<td>1.25 sq. ft.</td>
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<tr>
<td>Feed Imp:</td>
<td>50 ohm unbal.</td>
<td>WT:</td>
<td>7.5</td>
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<tr>
<td>Balun:</td>
<td>4.12 kW</td>
<td>Elasticity:</td>
<td>3 dB Max.</td>
</tr>
<tr>
<td>Circularity Switcher:</td>
<td>Included</td>
<td></td>
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</tr>
</tbody>
</table>

The 435-18C is a star performer, an optional CS-2 circularity switcher puts left, and right-hand circular control in your shack, and doubles as a two port divider/impedance transformer for single feed line convenience.

Specifications: (435-18C)

<table>
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<th>420-450 MHz</th>
<th>Gain:</th>
<th>12 dBd</th>
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<td>VSWR:</td>
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<tr>
<td>Feed Imp:</td>
<td>50 ohm unbal.</td>
<td>WT:</td>
<td>1.25</td>
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<tr>
<td>Balun:</td>
<td>CS-2</td>
<td>Elasticity:</td>
<td>3dB Max.</td>
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<tr>
<td>Circularity Switcher:</td>
<td>Optional (CS-2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Orbit Predictions
By KA9Q

Satellite: oscar-9
Catalog number: 12888
Epoch time: 84148.4833630
Sun May 27 09:40:51.21 1984 UTC
Element set: 644
Inclination: 97.5983 deg
RA of node: 122.6521 deg
Eccentricity: 0.0085984
Arg of perigee: 145.0202 deg
Mean anomaly: 211.1146 deg
Mean motion: 15.2576086 rev/day
Decay rate: 5.097e-05 rev/day*2
Epoch rev: 14637
Semi major axis: 6663.607 km
Anom period: 94.379151 min
Apogee: 493.146 km
Perigee: 468.912 km
Beacon: 145.9250 mhz

Satellite: oscar-10
Catalog number: 14129
Epoch time: 84148.8636908
Fri May 25 21:12:30.867 1984 UTC
Element set: 103
Inclination: 25.6282 deg
RA of node: 197.5898 deg
Eccentricity: 0.6809713
Arg of perigee: 274.5131 deg
Mean anomaly: 22.7147 deg
Mean motion: 2.05844694 rev/day
Decay rate: 1.21e-06 rev/day*2
Epoch rev: 75
Semi major axis: 26106.549 km
Anom period: 699.55631 min
Apogee: 35630.517 km
Perigee: 3834.739 km
Beacon: 145.8100 mhz

Satellite: oscar-11
Catalog number: 14781
Epoch time: 84148.10356205
Sun May 27 02:29:07.761 1984 UTC
Element set: 29
Inclination: 98.2481 deg
RA of node: 210.5649 deg
Eccentricity: 0.0041702
Arg of perigee: 358.1468 deg
Mean anomaly: 1.9676 deg
Mean motion: 14.6666721 rev/day
Decay rate: 2.56e-06 rev/day*2
Epoch rev: 1262
Semi major axis: 7862.336 km
Anom period: 98.54418 min
Apogee: 694.181 km
Perigee: 674.305 km
Beacon: 145.9250 mhz

oscar-9:
Wed Jun 6 01:03:01.281 1984 UTC: Ascending node at 137.9 west
Nodal period: 94.43341 min
Longitude increment: 23.68556 deg w/orbit
Element set 644, epoch: Sun May 27 09:40:51.21 1984 UTC

oscar-11:
Wed Jun 6 00:40:39.654 1984 UTC: Ascending node at 44.5 west
Nodal period: 98.55213 min
Longitude increment: 24.635684 deg w/orbit
Element set 29, epoch: Sun May 27 02:29:07.761 1984 UTC

oscar-10:
Wed Jun 6 00:39:17.68 1984 UTC: Ascending node at 123.2 west
Nodal period: 118.71513 min
Longitude increment: 29.803589 deg w/orbit

oscar-5:
Wed Jun 6 01:56:08.700 1984 UTC: Ascending node at 134.5 west
Nodal period: 119.55415 min
Longitude increment: 70.015552 deg w/orbit

rs-6:
Wed Jun 6 01:03:01.281 1984 UTC: Ascending node at 137.9 west
Nodal period: 94.43341 min
Longitude increment: 23.68556 deg w/orbit
Element set 644, epoch: Sun May 27 09:40:51.21 1984 UTC

rs-7:
Wed Jun 6 00:33:48.787 1984 UTC: Ascending node at 117.2 west
Nodal period: 115.19447 min
Longitude increment: 29.925512 deg w/orbit
Element set 156, epoch: Sat May 19 11:24:26.127 1984 UTC

rs-8:
Wed Jun 6 01:56:24.178 1984 UTC: Ascending node at 132.5 west
Nodal period: 119.76282 min
Longitude increment: 30.86701 deg w/orbit
Element set 274, epoch: Thu May 24 08:32:55.695 1984 UTC
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- more LISTENING articles
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In fact, since January of 1982, satellite-related articles have averaged 25% of the total number of articles published per issue of 73. The most recent of those covered such topics as:

- OSCAR Tracking Antennas
- PHASE III
- OSCAR By The Numbers

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Allow 6-8 weeks for delivery.
Kayser, WA3ZIA/VE3QB, bulk solid state memory; Bill Reed, WB0ETZ, ground station design; Martin Sweeting, G3YJO, spacecraft bus.

The Board moved to commend VITA for their cooperative approach to the PACSAT project and the technical group headed by Harold Price for their technical contributions. Passed 7-0.

Jan next brought up the condition and future of the AMSAT lab at the Goddard Visitors Center, provided for by Goddard at no cost to AMSAT. He asked that someone else's name be placed on the NASA contract due to his impending relocation to Colorado, and asked if there was still a continuing need for the laboratory. Considerable concern was expressed regarding the condition of the lab and the need to keep it in condition suitable for public display. Bill Lazzaro volunteered to take appropriate action with respect to the lab.

John Champa reported on the Independent Space Research Group (ISRG), an organization primarily occupied with an amateur space telescope project. They are looking for an amateur ground tracking network, but are a long way away (several years) from a Letter of Intent, and major problems remain.

Harry Vonesh reported on the status of JAS-1. JAMSAT members did the necessary contacts on behalf of JARL. The JAS-1 concept has been reviewed and an early 1986 launch, the first multipayload mission for NASA, is expected.

Changes to AMSAT Bylaws

A series of changes was voted upon. Article V of the Bylaws is amended by deleting Paragraph A thereof, renumbering Paragraphs B through F as Paragraphs C through G and inserting new paragraphs A and B as follows:

"A. A General Manager may be appointed by the Board of Directors at its discretion who shall hold office for a term and upon such compensation as the Board and he may agree. The General Manager shall manage the affairs of AMSAT under the direction of the Board of Directors. He shall serve as an ex officio member of the Board, without vote. He shall authorize and approve all expenditures and shall furnish to the Board of Directors from time to time such statements as may be required. He shall prepare and submit to each meeting of the Board of Directors a comprehensive report of the progress and status of the affairs of AMSAT. He shall perform such other duties as may be assigned to him by the Board of Directors."

"B. The President shall preside over all meetings of the members of the Corporation. He shall, subject to instruction from the Board of Directors, and with the assistance of the General Manager, repre-

sent AMSAT in its relationships with the public and the various governments, governmental agencies, and officials with which AMSAT may be concerned and shall be the official spokesman of the Board of Directors in regard to all matters of AMSAT policy. The President may appoint committees for a period of up to one year. Standing Committees shall require the approval of the Board of Directors."

Other Resolutions

"Resolved, that authorized signers on corporate accounts shall be any two of the General Manager, President, Treasurer and Corporate Secretary, and the Corporate Secretary may certify form resolutions to such effect."

Jan King introduced the following motion:

"A separate fund raising effort shall be initiated and conducted by the General Manager in support of the approved satellite projects of the Corporation. Funds so raised shall be set aside for the use of said projects and shall not be available for other uses of the Corporation. The General Manager will establish appropriate accounting procedures for assuring the proper use of these funds, and the Project Manager will have signatory authority."

Pat Gowen moved to approve the proposed 1984 Budget as submitted; John Pronko seconded and the motion was passed 6-0 with Jan King abstaining.

Pat Gowen proposed that the Board meeting be temporarily closed to non-Board members for the election of senior officers; this motion was seconded by Jan King and passed 4-1 with two abstentions.

In closed session, the Board voted to elect the following officers:

President: Tom Clark, W3IW1
Exec. VP: Vern Riponiella, WA2LQQ
VP: John King, W3GEY
VP Operations: Doug Loughmiller, KO51
Senior VP: John Champa, K8OCL
VP Special Projects: Bill Brown, K9LF
Corporate Secretary: Martha Saragovitz
Treasurer: Jack Colson, W3OZ
Board Chairman: John Browning, W6SP

Back in open session, the following officers were elected by a vote of 6-0:

Asst. VP Operations, User Services: Ralph Walito, W0RPK
Asst. VP Operations, Spacecraft ops: Rick Dittmer, WH6AMX
Asst. VP Engineering, Systems: Phil Karm, K9AQ
Asst. VP Engineering/PACSAT Project Mgr.: Harold Price, NK6K
Asst. VP Engineering/R&D: Steve Robinson, W2FFY

Thankfully no action was taken to re-elect K9AQ as Secretary to the Board. Tom Clark and Jan King expressed a desire to decrease their personal level of involvement in day-to-day AMSAT activities. Jan will continue to act as a technical mentor and consultant, while Tom will be out of the country on business for long periods and will try to contribute much of his remaining time to technical topics.

Pat Gowen moved to approve the contract between AMSAT and Bill Lazzaro pursuant to which he will serve as General Manager of AMSAT for two years. The General Manager is authorized to commit up to $2,500 on any unbudgeted project and following full consultation with all of the Board of Directors and with the approval of not less than a majority of four, up to $10,000 on any such project. The motion passed 6-0.

Jan King moved to adopt a standing Long Range Planning Committee, consisting of the President, VP Engineering, VP Operations and others as appointed by the President with the objective of creating and maintaining a 5-year operating plan, establishing fund raising goals for supporting technical projects, and identifying resource requirements in order to realize these projects. This motion was seconded by John Henry and was carried 6-0.

The meeting was adjourned at 10:33 PM. — Phil Karm, K9AQ, Secretary

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countries on the 'RS' series alone, and 150 QSOs over OSCAR 8 Mode J. He is do-
ing well on OSCAR 10, when the alligators are absent (list enclosed for the
award), and regrets that he is unable to hear the bulletins when they are on. His
AO-10 list contains ZS3B, ZR3AL, ZS6UF, ZS6AXT, ZS6BMS, ZS5AAK,
FR1AC, EA8CS, EA8AAE, TU2IF (QSL via DL4BAM), TU2GA (QSL via
F6CBC), JY7CF, A71AD, 4X41X,

VS6HH, 9M2CR, YB0AQG, HZ1AB
(QSL via K8PYD), four KH6's, FK1BG,
FK8CR, VK's, 9H1BT, and a whole lot
more. Heinz warns those sending to the
ARRL for Satellite WAC that he sent the
six QSLs plus $4, but received the cards
(not the $4) back after six weeks saying
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Powered by an 8-bit Central Processing Unit, the ten-channel memory of the FT-726R stores both frequency and mode, with pushbutton transfer capability to either of two VFO registers. The synthesized VFO tunes in 20 Hz steps on SSB/CW, with selectable steps on FM. Scanning of the band or memories is provided.

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The optional SU-726 module provides a second, parallel IF strip, thereby allowing full duplex crossband satellite work. Either the transmit or receive frequency may be varied during transmission, for quick zero-beat on another station or for tracking Doppler shift.

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Borrowing heavily from Yaesu’s HF transceiver experience, the FT-726R comes equipped with a speech processor, variable receiver bandwidth, IF shift, all-mode squelch, receiver audio tone control, and an IF noise blanker. When the optional XF-455MC CW filter is installed, CW Wide/Narrow selection is provided. Convenient rear panel connections allow quick interface to your station audio, linear amplifier, and control lines.

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- Memory scan.
- Internal battery memory back-up, using 9 V Ni-Cd battery, (not KENWOOD supplied). Memories are retained approx. 24 hours, adequate for the typical move from base to mobile. External back-up terminal on the rear.
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- 10 memories include band and frequency data, backed up by internal batteries (not supplied). Battery life exceeds one year. Memories 9 and 10 for priority instant recall.
- Band scan, with selectable 0.5, 1, 3, 5, and 10-MHz scan bandwidth.
- Memory scan selectable for all memories, or 2-m or 70-cm only.
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- FM center-tune meter.
- Noise blanker for SSB, CW.
- TS-780 accessories:
  - TU-4C programmable two-frequency CTCSS encoder.
  - MC-425 500 Ω UP/DOWN hand microphone.
  - MC-48 16-button Autopatch UP/DOWN microphone.
  - MC-60A deluxe desk top microphone.
  - MC-80 desk top UP/DOWN microphone.
  - TR-1 AC adaptor for memory back-up.