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American made RF Amplifiers and Watt/SWR Meters of exceptional value and performance.

- 5 year warranty • prompt U.S. service and assistance

**RF AMPLIFIERS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Power Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>B23</td>
<td>2W in = 30W out</td>
<td>$89.95</td>
<td>(useable in: 100 mW-5W)</td>
</tr>
<tr>
<td>B108</td>
<td>10W in = 80W out</td>
<td>$179.95</td>
<td>(1W = 15W, 2W = 30W) RX preamp</td>
</tr>
<tr>
<td>B1016</td>
<td>10W in = 160W out</td>
<td>$279.95</td>
<td>(1W = 35W, 2W = 90W) RX preamp</td>
</tr>
<tr>
<td>B3016</td>
<td>30W in = 160W out</td>
<td>$239.95</td>
<td>(useable in: 15-45W) RX preamp (10W = 100W)</td>
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</table>

**220 MHz ALL MODE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Power Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>C106</td>
<td>10W in = 60W out</td>
<td>$199.95</td>
<td>(1W = 15W, 2W = 30W) RX preamp</td>
</tr>
<tr>
<td>C1012</td>
<td>10W in = 120W out</td>
<td>$289.95</td>
<td>(2W = 45W, 5W = 90W) RX preamp</td>
</tr>
<tr>
<td>C22</td>
<td>2W in = 20W out</td>
<td>$89.95</td>
<td>(useable in: 200mW-5W)</td>
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**430-450 MHz ALL MODE**

<table>
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<tr>
<th>Model</th>
<th>Type</th>
<th>Power Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>D24</td>
<td>2W in = 40W out</td>
<td>$199.95</td>
<td>(1W = 25W)</td>
</tr>
<tr>
<td>D1010</td>
<td>10W in = 100W out</td>
<td>$319.95</td>
<td>(1W = 25W, 2W = 50W)</td>
</tr>
</tbody>
</table>

**WATT/SWR METERS**

- peak or average reading
- direct SWR reading

**MP-1 (HF) 1.8-30 MHz**

<table>
<thead>
<tr>
<th>Model</th>
<th>Power Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP-1</td>
<td></td>
<td>$119.95</td>
</tr>
</tbody>
</table>

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Specifications:  (2M-14C)
- BANDWIDTH: 144-150 MHz
- GAIN: 11 dBi
- BEAMWIDTH: 48°
- FEED IMP: 50 ohm unbal.
- BOOM LENGTH: 12' 9"
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- WINDLOAD: 1.25 sq. ft.
- WT. (LBS): 7.5
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- 4/1.2KW CIRCULARITY SWITCHER: INCLUDED

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.

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- BEAMWIDTH: 44°
- WT. (LBS): 4.5
- FEED IMP: 50 ohm unbal.
- MAST DIA: Cen- Rear: 1/4"
- ELLIPTICITY: 3 dB MAX.
- CIRCULARITY SWITCHER: (CS-2) OPTIONAL

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A durable symbol of the Phase II era has gone silent, but even in its death, Radio Amateurs have gained great insight into how a satellite works.

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Our Cover: Yoshi, JA4BLC, sports this fine looking piece of hardware. It’s a 20-foot diameter dish used for 432-MHz moonbounce. For OSCAR work, JA4BLC uses a pair of seven-element Yagis for the uplink and several seven-element Yagis for the downlink. Yoshi is mentioned in this month’s Worldwide Satellite Activity by G3IOR beginning on page 19.

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NOW is the time to get ready for OSCAR with Cushcraft's all new high performance 416TB 16 element 435 MHz BOOMER, featuring our new insulated elements, T-matched driven elements, built-in balun, special phasing harness, rear boom mount, and stainless steel hardware. This amazing antenna has true circular polarization right or left, and 12.5 dBi gain to give an extra margin of radiated power to the satellite.

The two-meter antennas have been proven in many thousands of ham satellite stations. They feature excellent performance plus ease of assembly and installation.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>10 Element</th>
<th>20 Element</th>
<th>16 Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency, MHz</td>
<td>145.9</td>
<td>145.9</td>
<td>435</td>
</tr>
<tr>
<td>2:1 SWR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandwidth, MHz</td>
<td>&gt;2</td>
<td>&gt;1.5</td>
<td>&gt;3</td>
</tr>
<tr>
<td>Forward Gain, dBi</td>
<td>10.5</td>
<td>12.2</td>
<td>12.5</td>
</tr>
<tr>
<td>3-dB Beamwidth, deg</td>
<td>52</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>F/B Ratio, dB</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Boom Length, in (m)</td>
<td>70 (1.8)</td>
<td>130 (3.3)</td>
<td>80 (2.03)</td>
</tr>
<tr>
<td>Longest in</td>
<td>40</td>
<td>40</td>
<td>13.3</td>
</tr>
<tr>
<td>Element, (m)</td>
<td>1.0</td>
<td>1.0</td>
<td>34</td>
</tr>
<tr>
<td>Wind Area, ft² (m²)</td>
<td>.74 (.07)</td>
<td>1.42 (.13)</td>
<td>.5 (.046)</td>
</tr>
<tr>
<td>Weight, lb (kg)</td>
<td>3.5 (1.6)</td>
<td>6.6 (3.0)</td>
<td>4.9 (2.2)</td>
</tr>
<tr>
<td>Max Mast OD (in/cm)</td>
<td>1.50 (3.8)</td>
<td>1.50 (3.8)</td>
<td>2.0 (5.0)</td>
</tr>
</tbody>
</table>

OSCAR MOUNTING BOOM
You can mount 2 meter and 70 cm twist antennas on the A14T-MB mounting kit. It has a 4.2 ft (1.3m) support boom with mount plate for the U100 elevation rotator. The easy way to a complete OSCAR station.

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Future and Present Married: Computers and Amateur Radio
(Are You Ready?)

So you think you know what Ham Radio is all about? Of course you do. It's your hobby that gives you so much pleasure and, of course, it involves radio and electronics and television and....well....satellites; them too. But do you really know what Ham Radio is all about? Stop a moment and think about it. Remember when you twirled the dial to the top end of 75 meters where the veteran rag-chewers hang out? You heard someone proudly boast that he's resisted the temptation of 2-meter FM because "It sounds just like CB!" How about that fellow just above 144.200 MHz who wondered aloud why anyone would want to operate on 20 meters with all its noise, overcrowding and interminable contesting? And then there's that bunch in the radio club who let their fingers do the talkin' on their computerized radio teleprinters. Humph, you thought, real RTTY operators have purple fingers (or black, depending on the choice of ribbons). Strange, isn't it? You have a good idea of what Ham Radio really should be but so many others don't.

It's a truism, of course, but Ham Radio's appeal varies widely among subjects. It's this and that to him and her and it's that and this to you and me. A simple truth known to any Ham with a few years experience is that nobody can say correctly and unequivocably, "This is what Ham Radio is!"

If you accept that variety is more than just the spice of life, but rather its natural and vital force, then I think you'd have no difficulty in accepting the previous truisms. Within the constraints of one's license privileges and to a lesser degree of one's disposable income and technical acumen, we are all more or less free to explore as many aspects of our splendidly variegated hobby as we choose. And as an AMSAT member, you certainly demonstrate an appreciation of the diversity set out before you. But have you partaken of all there is to enjoy? Many of us haven't and that's truly a pity. Let me tell you why.

A year ago the grand little computer on which I'm hacking this editorial didn't even exist. In fact, the silicon chips of which it is made might have been mere sand last year! The rapidly expanding microcomputer industry has rushed very sophisticated equipment from the drafting tables to your homes with dazzling speed. Take a look at the date code on your own personal computer if you already have one.

Now are we apt to look a gift horse in the mouth? Come now! What a delightful happenstance for Hammond. Sure, some entrepreneurs are gleefully skipping to the bank with their windfalls from Apples and the like. But the benefit to our hobby is becoming immense. Let's see why.

We suspect that by now many, many AMSAT members know well how neatly his slick little micro can handle orbital predictions. Enter a few numbers picked up from the AMSAT net or from ASR, dab a few buttons and without so much as a decent whirring, up pop the solutions on the CRT. Wow, you say. For less than a hundred bucks, AO-10's every movement is divulged. Nice, but that's not all.

RTTY you say? You replaced your Model 15 (which sounded more like a garbage grinder than anything else) with a plastic keyboard, a TV and you've just worked country number 40 on RTTY. Sure. That's nice too. But that little micro is hardly working at these mundane tasks. Those diddly-diddly sounds didn't even begin to challenge the Goliath inside that little box. For sitting on your desk is a powerhouse of enormous consequence. It's waiting to unleash a fury of problem solving for you given only the correct instructions. And it's waiting to be unleashed into a world without maps, charts, guidebooks, or, hopefully, prejudices about Ham Radio's future.

Well, now that we've heralded the coming of the Ham digital era, do we have any stunning predictions of the outcome? Perhaps it's not terribly visionary to forecast the day when voice processing techniques will scrounge impossibly poor signals from the noise and turn them into audible, recognizable human voices. Perhaps the voice will be machine-recognizable as well. Thus weak-signal work may evolve into a statistical analysis and number crunching exercise. Don't fret. The essential algorithms will, no doubt, be in ROM and available from Kantronics and MFJ! Nevertheless, bands and conditions heretofore thought unpromising may become surprisingly fruitful with some computer-enhanced detection.

Furthermore, wouldn't a truly computer-controlled shack be a splendid thing to have. Why, you could leave home for a weekend outing and return to find your computer busily and dutifully issuing QSL cards to all

(Continued on page 12)
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**HL-20U** UHF AMPLIFIER — This is another super compact from THL, and it's beautiful, with the controls on the brushed metal face panel to make operations as easy as touch and go.

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It features stable and powerful amplification along with excellent linearity, which is especially effective on SSB. With its built-in receiver preamp, the HL-90U enables you to enjoy more comfortable DX QSO’s. Accurate output power can be read with the built-in precision directional coupler, and power can be reduced by one half by the power level switch.

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Meets or exceeds FCC specifications.

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The HL-160V has convenient front panel controls and select switches, LED indicators and a very reliable RF wattmeter. This big amp works SSB, CW, FM and AM modes, and it has a true coaxial relay on the output side.

When you need the power, the HL-160V is the power you need. $349.95 Suggested Retail.

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The Death of OSCAR-8: Tribute to an Erstwhile Friend

A durable symbol of the Phase II era has gone silent, but even in its death, Radio Amateurs have gained great insight into how a satellite works.

By Frank M. Wiesenmeyer, K9CIS

Following the history of its two predecessors, OSCAR-8 developed serious battery failure in early June of 1983. As in the past, the problem was triggered by declining exposure to sunlight. After more than five years of flawless performance, most users had almost forgotten that OSCAR 8 too was vulnerable to the malady that haunts most aging satellites — shorted battery cells.

After being stuck in Mode A since June 2, 1983, and unable to respond to commands, OSCAR 8 finally stopped transmitting on June 24, 1983. The satellite was last heard at loss-of-signal (LOS) on orbit 27,026 at 1441 UTC.

First Signs of Battery Decline

The first hint of a battery problem came in late October of 1982, when the battery voltage abruptly began to sag by 1.5 V after 12 hours in the energy-taxing dual AJ mode (Fig. 1). By January 24, 1983, the spacecraft’s battery could no longer support both modes simultaneously. In fact, the battery voltage fell 1.5 V in a matter of minutes after the second transponder was added to the load (Fig. 2). After this problem developed, the operating schedule was modified to eliminate AJ days to ease the workload on the aging battery. Everything else, however, continued to work well.

With the satellite operating in each mode separately for three days each week and in the recharge mode on Wednesdays, everything seemed to be back to normal. Battery voltage profiles once again showed only small voltage fluctuation during a busy pass. Indeed, solar array output averaged more than 300 mA, nearly the same as on launch day more than five years ago. The only exception to OSCAR 8's nominal behavior during May 1983 was an elevated internal temperature reading of 48°C. That condition was undoubtedly because of the satellite’s continuous exposure to sunlight since the end of August 1982. The situation had been predicted by computer studies done by Bayman McWhan, W2GAX. Those predictions were verified by actual battery temperature profiles that matched the computer studies nearly perfectly.

During the spring and summer months of 1982, OSCAR 8 had been in the earth’s shadow for up to 20 percent of each orbit, allowing the satellite to cool down to less than 28°C, a very comfortable temperature for a satellite with nickel-cadmium batteries. During the past two years, the May through July cooling off period was the only time OSCAR 8 was not in total sunlight. That was because of the gradual drift in the satellite’s sun-synchronous orbit. Such drift was most noticeable to long-time OSCAR 8 users as a gradual change toward earlier passes.

The last recorded Channel 1 telemetry with counts of 101 (indicating the satellite was in darkness) were recorded in Illinois in late November of 1981, as shown in Fig. 3. Since then, OSCAR 8 had been in continuous sunlight, except for the May to July cooling off period.
Battery Temperature Hits All-Time High

The many months of continuous exposure to the sun thus caused the OSCAR 8 battery and internal temperatures to climb to a very warm 48.4°C by May 12, 1983. That temperature was of concern to ground controllers since operating a NiCd battery above 25°C for prolonged periods of time is known to significantly shorten its life expectancy. At elevated temperatures, the cells tend to lose electrolyte, reducing charge storage capacity. When a cell is at or near total discharge, it is very susceptible to shorts.

In an attempt to lower the internal temperature of the spacecraft, or at least to prevent it from climbing any higher, a new operating schedule of continuous Mode J operation was initiated by the American Radio Relay League. The battery temperature promptly fell as shown in Fig. 4. However, the coincidental decline in the amount of sunlight falling on the spacecraft was, no doubt, the main reason for the temperature plunge.

By the end of May, everything again seemed to be going well, with the spacecraft cooling off nicely, as it had the year before. A slight decline in the average battery voltage was noted, something that didn't occur in 1982. However, this minor anomaly was dismissed as a normal reaction to the heavier loading of continuous operation of the Mode-J transponder.

Spacecraft Battery Suffers A Shorted Cell

Suddenly, on June 1, 1983, the battery voltage plunged 1.2 V at 0025 UTC on Orbit 26,697, an 86.9°W pass. The event surely signaled the shorting of one of OSCAR 8's 12 cells, which are connected in series. A hurried phone call to Bill Clepper, W3HV, resulted in the satellite being shut off completely in what is called Mode D, or recharge mode. Then, only the command receiver is on, listening for further word from the ground. That greatly minimized the load on the spacecraft power supply system. Fortunately, Bill was at home, as usual, to take the emergency call and his quick action no doubt prevented further damage to the spacecraft battery.

After a day and a half in recharge mode, Norm, K3NW, turned the satellite back on, in Mode J, on the morning of June 2. It was assumed that the weakened cell had recovered sufficiently to resume the continuous Mode-J schedule. However, only one orbit later, at 1253 UTC, the telemetry encoder stuck on meaningless numbers, indicating a battery voltage of less than 13.25 V. Another hurried phone call to W3HV, to alert him to the problem, came several minutes late. Bill had just left for work. With the help of Bill's wife, however, he was quickly reached at work. Bill made a special trip home for the next orbit, which, at 294°W, was near the
western limit of his access range. Despite that handicap, after four or five tries, Bill successfully switched the satellite back into recharge mode. In Mode D, the satellite would be safely hibernating while ARRL satellite manager, Bernie Glassmeyer, contemplated the next move.

Latched Telemetry Encoder Not Unknown

The latched telemetry condition is not new. The same numbers had been observed once before with OSCAR 8, on June 11 and 12, 1979. At that time the satellite was mistakenly left in the dual AJ mode for several days, when it should have been in Mode A. Consequently the satellite was in either Mode J or AJ for 7 straight days. With OSCAR 8 receiving less than 70 percent sunlight exposure each orbit, several cells in the battery completely discharged and the battery voltage fell so low that the telemetry encoder no longer functioned properly. Fortunately, the command receiver still worked and Bud Schultz, W6CG, was able to rescue the satellite just in the nick of time, possibly preventing serious permanent damage to the spacecraft battery. Since the cells were only a year old, they quickly recovered and functioned well for another four years.

Important and valuable information was obtained from OSCAR 8’s first encounter with battery failure. The last good telemetry data on that occasion showed Channel 3 reading a 53 count, indicating a battery voltage of 13.55. Since the telemetry encoder malfunctioned on the next orbit, a bench mark was created by which to measure the voltage at which the telemetry encoder malfunctions. It is interesting to note that the same numbers were frequently generated by OSCAR 7 between October 11, 1978, and early April, 1979. That was during the initial phase of OSCAR 7’s battery failure. Fortunately the shorted cell later opened, allowing OSCAR 7 to function well until June 12, 1981.

Command Function Lost During Telemetry Check

Several days after the battery anomaly of June 2, Bernie, W9KDR, asked East Coast command station K3NW for regular peeks at the telemetry, once each day, to see how OSCAR 8 was doing. Those checks were performed using Mode A to minimize the risk to the satellite. The conservative strategy seemed to be to let the satellite hibernate in Mode D, until the end of July when 100 percent sunlight returned. Such a recommendation was made to the ARRL by telephone and by letter. Unfortunately, before more discussion of the options could take place, command stations lost all control of the satellite during a telemetry check on June 6, 1983, Orbit 26,780, at approximately 2310 UTC. After that, OSCAR 8 remained in Mode A, ignoring all further commands to return to recharge mode.

Fig. 2 — In early 1982, the weak cell in the satellite’s battery discharged after just several minutes of AJ use.

| ORBIT NO. 24, 924AJ JAN. 24, 1983 EQX 72.8°W 23:42:50 TO 23:56:34 UTC |
|------------------|----------------------------------|
| CH 1             | CH 3                             |
| CH 3             | SWITCH BACK TO MODE A ONLY       |

NOTE: BATTERY VOLTAGE FALLING BY 1.5V AS SOON AS J TPDR ADDED TO LOAD
WEAK CELL CAN NO LONGER HOLD A CHARGE

TIME - SECONDS

November/December 1983 9
another cell in the battery had shorted, causing the command receiver to malfunction. Since AMSAT engineer Jan King, W3GEY, had indicated that the satellite command system should work with battery voltages as low as 8 V it came as somewhat of a surprise when the satellite became stuck in Mode A so quickly.

It had been hoped that a rescue effort, similar to that used to salvage UoSAT-OSCAR 9 last fall could be put into operation in time for OSCAR 8. If the satellite could have been commanded into recharge mode until the end of the shadow period, perhaps one more year of Mode J operation could have been squeezed out. Although command stations experimented with different command frequencies to get the satellite to respond it is unlikely that anything short of extremely high power would have worked. Unfortunately time ran out before the rescue effort could be initiated.

**More Data From The Dying Bird**

While waiting for the command stations to regain control of the satellite or for a more favorable exposure to sunlight to allow the satellite to switch modes again, there was still a little information that could be extracted from the locked up telemetry encoder. Previous measurements had shown that the rate at which the telemetry data is sent is a good relative indicator of the internal temperature of the spacecraft. As of June 9, the telemetry frame rate was very close to 20 seconds per frame, which indicated moderate internal temperatures near 36°C or even lower. Many observations over the past several years have shown that high temperatures, about 42°C, consistently caused the telemetry frame rate to speed up to 18.5 seconds per frame. If all had remained static, the telemetry rate should have increased as the satellite came out of the shadow period at the end of July 1983, but destiny intervened.

While rescue options were still being considered, OSCAR 8 abruptly ceased Mode-A transmissions on June 24, 1983. Up to that point, the Mode-A beacon and transponder had sounded normal, except for the meaningless telemetry data. The important development was noticed seven orbits later on Orbit 27,033. Although no signals were heard on either beacon frequency, it was hoped that a command station had successfully regained control of the satellite and shut it down. However, a phone call to W3HV, after the pass, confirmed the worst. OSCAR 8 had shut itself off, probably due to the collapse of the remaining good cells.

Subsequent checks of seven in-range orbits, beginning with Orbit 27,038 on Saturday morning June 25, produced no hint of a signal on either Mode. It appeared then that the last message from OSCAR 8 had been

![Fig. 3 — Channel 1 telemetry from OSCAR 8 shows effects of the last long period of continuous darkness in late 1981.](image)
heard. However, OSCAR 7 was given up for dead many times during its final two years and then showed up again, unexpectedly. It was hoped that OSCAR 8 would come to life again, or respond to commands, as it emerged from the Earth’s shadow at the end of July. Unfortunately, such was not the case.

A Perspective

As of June 24, 1983, it appeared almost certain that at least two and possibly three cells of the 12-cell spacecraft battery had shorted. With a little luck, no more of the cells would have shorted before the seasonal tilt of the Earth caused the satellite orbit to be in 100 percent sunlight again. Nickel-cadmium batteries are most vulnerable to shorts when they are hot and in a state of complete discharge. After five years of use, the battery cells discharged very quickly under load and probably completely discharged during the 15 minutes of darkness that now occurs once each orbit far south in the Southern Hemisphere. The risk would, of course, have been much less if the satellite had been in recharge mode.

Looking back over the final days of OSCARs 6 through 8, it is apparent that battery failure has been responsible for the demise of all. It appears that all satellites need to be equipped with a system to disconnect the battery when it is no longer functioning. Such a disconnect function should be both automatic and ground controllable. Old, worn out battery cells are little better than large capacitors, at best, and short circuits in the worst case. Replacing the battery with a large capacitor, or an open circuit, would greatly reduce the risk of a shorted power supply bus, which renders the solar cells useless. The solar panels, which typically last much longer than the battery, could then power the satellite as long as it is in sunlight, which is frequently a large percentage of the orbital period for sun-synchronous satellites.

In the case of OSCAR 8, recent telemetry data indicated that there had been no apparent change in the current output of the solar panels since launch day in 1978. A popular rule of thumb states that solar cell efficiency should decrease approximately 10 percent each year due to the effects of solar radiation. Apparently the glass slips protecting the OSCAR 8 solar cells did a better job than expected.

An Epilog

It has been a most enjoyable and interesting five years, not likely to be soon forgotten by those who have used this highly successful mode. The early years were filled with technical challenges, as well as many new
friendships that have endured as long as OSCAR 8 itself.

Countless school demonstrations and scientific experiments were performed studying rotation rates, shadow periods and Doppler ranging, to mention a few. Through it all, the spacecraft electronics continued to work perfectly, right up to the day the battery voltage fell too low to sustain the command and telemetry subsystems. OSCAR 8's superior reliability is no doubt closely related to the elegant simplicity of its design. Keeping the hardware to a minimum and assembling the parts with painstaking care have clearly resulted in an ultra-reliable spacecraft. No one who has experienced the thrill of communicating through OSCAR 8, using the Mode J transponder, is likely to forget how well it performed. Our good friend OSCAR 8 served us well.

References

The Editorial Continues...

those stations "you" worked during the contest. You say that's not Ham Radio? Then perhaps neither are synthesized VFOs, iambic keyers, solid-state finals, LCD readouts and...satellites.

No. We're not seers of any particular skill. Neither do we claim true clairvoyance nor precognition beyond what seems enormously clear to anyone who cares to look. Computers and Amateur Radio are married hereafter. It's up to you to beg, borrow or steal one. Sneak it out of your son's room if you must; win one in a contest. But make it your friend and soon it will grow accustomed to your Ham Shack. From there on it's a marriage of mutual admiration and cooperation.

The Amateur Satellite Community has consistently upheld a leadership position within the Amateur Radio community at large. It is expected of us that the builders of OSCARs should be at the head of the pack as far as Ham Radio technology is concerned. The savvy that goes into building sophisticated communications and scientific satellites is the same savvy that will point the way in the future. Packet Radio is on the air and PAC-SAT is not far behind.

It's time to get on with the nuptials!

COMETS

Satellite Conference in Argentina

LU4ENQ at the University of LA PLATA presents Phase III to a conference of Amateurs. Carlos points out that in addition to LU1AHC and himself, many other Argentinians are on AO-10. Included are LU7DJZ, LU1ESY, LU8MGL, LU7DHC, LU8DYF, LU7FA, LU4HLM, LU2AH, and LU2DBJ. (Photo from AMSAT-LU).
A Survey of OSCAR Station Equipment, Part I

Building or enhancing your equipment? With some careful shopping, you can assemble a very capable station without breaking the family budget.

By Harold Winard, KB2M, and Roger Soderman, KW2U

The successful launch and operation of AMSAT-OSCAR 10 has rekindled an unprecedented interest in communications satellites and the equipment needed to use them. Although a complete system can cost thousands of dollars, it isn't necessary to spend that much to create a very adequate and serviceable satellite station. After a careful appraisal of your current resources, both equipment and financial, the newcomer should be able to assemble an economical, yet potent station.

Many Hams already have major pieces of equipment that can serve well in the satellite station. For example, low-band equipment, either a transceiver or a separate transmitter and receiver, can be hooked to several converters to generate the uplink signal and receive the satellite's downlink. Many hams already have multimode two-meter transceivers and they too can be used to receive the satellite's output.

Other pieces of equipment that might already be on hand or currently in use include an appropriate preamplifier, a small power amplifier, lengths of low-loss coaxial or hardline cable, rotors, and assorted feedline switches.

OSCAR-10 has been performing so well that some equipment may not be necessary. For example, the downlink is quite strong and a good antenna plus an inexpensive preamplifier may be all you will need to receive an adequate signal. Also, the bird's receiver is quite sensitive and a large power amplifier is often not necessary for satellite fun. QRP day has shown that the barefoot output of some rigs, about 10 watts, is often sufficient to work through the two-meter-to-70-cm transponder.

If you must buy or build all or part of your satellite station, what follows is a guide to commercial products currently available. It is by no means exhaustive, and you are encouraged to call or write to all those offering appropriate equipment for more information. Companies, both new and old, are introducing new OSCAR-related equipment each month so check the pages of Or-bit and other Ham magazines frequently for their names and addresses. Specifications given below are those published by the manufacturers.

The Signal Gets A Boost

There are several options for the amateur looking for a preamplifier. Just which to select depends, in large part, on the type of installation and involves some physical considerations and an honest appraisal of the amateur's financial resources. Although a gallium-arsenide field-effect transistor, or GaAsFET preamp is generally acknowledged to provide superior performance, on-the-air experience shows that quite adequate reception can be had with a less expensive bipolar device.

If the length of coaxial cable between the antenna and the rig is short, say 20 feet, a preamplifier in the shack itself can be a wise choice. Since it hardly ever rains in your shack, no weatherproofing is required and the dc power leads can be short as well. The same holds true...
for low-loss cable. If the feedline brings the signal to the rig with little attenuation, an indoor preamplifier may be sufficient.

Alas, it is not always adequate to mount an antenna system close to the shack, so often a mast-mounted preamplifier is a necessity. If your antenna is used exclusively for receiving downlink signals, you're in luck. The preamp can be left in-line all the time. Such is not the case for those who must get extra service from the OSCAR antenna system by using it for terrestrial DX work. If a signal is radiated from the antenna, some additional hardware is needed to remove the preamp during transmissions. A set of low-loss external relays are a good choice but a more convenient solution is preamplifiers with integral switching systems. With no muss or fuss, those units switch between receiving and transmitting conditions and protect the sensitive preamp transistor from the relatively powerful surge of rf energy fractions of an inch away.

Current Amateur state-of-the-art is the GaAsFET, a device that offers the combined advantages of a very low noise figure and high immunity to overload. Leading the Advanced Receiver Research (Burlington, Conn.) preamplifier line are the P144VDG and P432VDG, two-meter and 70-cm units respectively (Fig. 1). Both use the MGF-1400 GaAsFET and have been equipped with protection against power-supply transients and destructive gate-voltage charges.

ARR's two-meter GaAsFET preamp sports a noise figure of less than 0.5 dB and offers a gain of 24 dB. The 1-dB compression point is +12 dBm and the 1-dB bandwidth, a wide 7 MHz. The 432-MHz unit is also an impressive performer. For example, it too has a noise figure below 0.5 dB but supplies an adequate 16 dB gain. The 1-dB compression point is also +12 dBm, however the bandwidth is a whopping 40 MHz. For a tidy installation, the preamp, which measures just 2.75 by 2.375 by 0.75 in., can be placed inside the receiver.

But for the best system noise figure ARR recommends putting its preamp at the antenna.

An old hand at commercial preamplifier development, Angle Linear (Lomita, Calif.) has recently introduced a series of GaAsFET preamplifiers for Amateur use. The extensive range includes units for all Amateur bands from 144 to 2304 MHz with some commercial and weather satellite bands thrown in as well. All are housed in rugged irradiated aluminum enclosures held together with stainless steel hardware. The signal path finds its way through silver-plated Type-N connectors with gold center pins.

The two-meter model has a typical noise figure of 0.5 dB and a gain of 23 dB. Common port inductance is part of the amplifier's design for low input and output VSWR (return loss). Also included is a metal-oxide varistor that helps protect the preamp against lightning. An internal voltage regulator offers protection of another type — stable biasing over an input voltage range of 9 to 12 V.

California's Lunar Electronics (San Diego, Calif.) manufactures two GaAsFET amplifiers of interest to satellite enthusiasts: the two-meter model PAG 144 and its 70-cm equivalent, the PAG 432 (Fig. 2). The former has a claimed noise figure of just 0.2 dB with 26 dB of gain. The 432-MHz model exhibits a 0.5-dB noise figure for 18 dB of gain.

An imported GaAsFET preamplifier, the Kenpro KP 145G (Fig. 3), is specifically designed for mast mounting and comes in an appropriate weatherproof case. According to the U.S. importer, Spectrum West (Seattle, Wash.), the unit has a noise figure of between 1 and 1.5 dB and a gain from 12 to 24 dB.

Another imported preamplifier comes from the British company Ambit (Brentwood, Essex, England) and is available from Radiokit (Greenville, N. Hampshire). Designed by Roger Ray and presented as a project in the October 1982 issue of Radio & Electronics.
**Snaring The Signal**

One of the most important parts of your satellite station, and often the most neglected, is the antenna. It must have sufficient gain to receive the satellite's output yet have a broad enough beamwidth to obviate the need for constant pointing adjustments. It also must be sufficiently strong to withstand the rigors of the environment but lightweight enough to be moved by inexpensive rotors.

The actual choice of an antenna is up to the individual but some guidelines can help. In general, linear antennas are not suitable for satellite use. Because the satellite’s pointing angle is constantly changing with respect to the user, the ground-based antenna must be capable of circular polarization. Indeed, “the circular advantage” is what KLM Electronics (Morgan Hill, Calif.) claims for its 2M-14C (Fig. 4) and 435-18C (Fig. 5) antennas for two-meters and 70-cm respectively. The former measures 12 feet 9 in. long and has 14 elements in all — 7 vertical and 7 horizontal. Rf power is supplied to a folded dipole driven element and, for control of the

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*Fig. 3 — Kenpro KP-145G.*

*Fig. 4 — KLM 2 meter antenna system.*

*Fig. 5 — KLM 435-MHz antenna.*

*World,* the GaAsFET unit is supplied in kit form. Included in a masthead box are the preamplifier and a pair of coaxial relays that can handle up to 400 W pk-pk. Power for the preamp and the relays is supplied through the same coaxial cable that carries the rf signal.

**Value For The Money**

The conventional bipolar or MOSFET preamplifier hasn't been displaced by the more expensive GaAsFET types and continues to be a good value for system upgrading. Hamtronics, Inc. (Hilton, New York) offers two types: the low-cost P30 and P432 models and the LNA series of low-noise preamps. The P30 is available for any band from 27 to 300 MHz and uses a protected dual-gate MOSFET. Its noise figure varies from 1.5 to 2 dB, depending on frequency. Gains from 18 to 20 dB are available.

A reliable stalwart of the UHF range, the MRF-901 transistor, is used in the P432 preamp. The unit has 16 dB of gain and a noise figure of just 2 dB. Its 1-dB bandwidth is 50 MHz and it offers 22 dB of rejection for two-meter signals, an important consideration for future Mode-J operation with JAS-1.

The LNA series touts the advantages of the bipolar preamplifier without the problems associated with GaAsFET units. For example, the two-meter LNA-144 offers 18 dB of gain and a noise figure of just 1 dB. Its maker points out that it will tolerate the static discharges and rf overloads that would destroy unprotected GaAsFET types. Hamtronics also offers a 432-MHz version, the LNA-432, as well as HRA Series preamplifiers with integral helical resonators.

MOSFETs and bipolar transistors are the active devices in Advanced Receiver Research’s standard preamplifier line. The P144 comes in two models, one with a 1.5-dB maximum noise figure and the other, just 1 dB. The 432-MHz versions have 1.8 and 1.1 dB noise figures. The latter two preamplifiers use bipolar devices and the former two, MOSFETs.
polarization, a circularity switcher is included. KLM claims 11 dBdc gain for its two-meter antenna and a beamwidth of 48°. The 435-MHz antenna has a gain of 12 dBdc and measures 7.3 feet along the boom. An optional circularity switcher is available.

A new addition to Cushcraft’s (Manchester, N. Hampshire) Boomer antenna series is the 416-TB, an antenna especially designed for the OSCAR-10 Mode B uplink. That 16-element model has a claimed forward gain of 12.5 dBi and a 34° beamwidth. The elements are insulated from the boom and the driven elements are T-matched. It joins the previously announced A144-10T and A144-20T two-meter antennas, which have gains of 10.5 and 12.2 dB respectively. See Fig. 6.

To trim the time needed to get your antennas up in the air, Cushcraft supplies a complete mounting boom for its antennas. Designated A14T-MB, the kit includes a 4.2 foot support boom with a mounting plate designed for use with the popular Alliance U100 elevation rotor. For convenient one-stop shopping, the company will supply you with its OSCAR Pack, Model AOP-1, which includes the 435-MHz antenna, the 20-element A144-20T, and the A14T-MB mounting kit.

Fig. 6 — The Cushcraft complete satellite array.

Fig. 7 — The Kenpro KR500 rotator.

Japanese manufacturer Taniguchi Engineering Traders (TET) also includes a satellite antenna in its line, the AX-210N. A 10-element crossed Yagi antenna, the AX-210N sports a claimed forward gain of 14.6 dB. Slightly better performance, 17.5 dB, is attributed to the two-antenna array designated the AX-210NW.

**Pointing At The Bird**

Much of the equipment used in the satellite station can be found in the well-equipped ham shack but one that cannot is the elevation rotor. Although few types are available, the most popular is also one of the least expensive. The U-100 rotor from Alliance Manufacturing, designed for light-duty TV use, can be mounted horizontally to elevate an antenna. A boom of up to 1-3/8 in. can be accommodated in the through-mast mounting system. However, because the rotor is designed for light-duty work it may not be able to handle large antennas or those covered with many layers of winter ice. Also, the rotor does not have a braking system.

Designed specifically for elevation chores, the Kenpro KR500 (Fig. 7) lifts even moderately large arrays with boom diameters of up to 1-1/2 in. The unit’s control-box circuitry is voltage regulated and provides an accurate indication of antenna position.

Part II of this article will appear in a future issue of *Orbit* Magazine.

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**NEW FROM LUNAR**

**HIGH PERFORMANCE COMMERCIAL QUALITY**

**UHF/VHF CONVERTER KITS**

Professionally engineered using the high performance IBM, these kits are designed with the active VHFer in mind. All parts, components and circuit board are of the highest quality. Gold platted case ensures circuit integrity. Each kit includes easy-to-read, fully illustrated instructions. VHF units use crystal control. UHF converters are tunable. Crystal control UHF models available soon. In the unlikely event of construction problems, complete factory back-up service is available from trained technicians.

**Typical Specs:**

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Crystals for VHF models available. $14.95 ea. Other frequency conversions available. Specify requirements.

2775 Kurtz St., Suite 11, San Diego, CA 92110
A Book Review:
The UHF Compendium
Part I and Part II
Author: K. Weiner, DJ9HO

By Dom Mallozzi, N1DM

With my curiosity aroused by favorable reports from a local UHF enthusiast, I purchased a copy of The UHF Compendium at a recent VHF-UHF conference. Despite some minor annoyances, which will be noted later, I wasn’t disappointed. The book is an excellent collection of valuable information on a broad range of topics. It covers everything from a theoretical understanding of the design of UHF equipment to a diverse selection of practical circuits and techniques.

The book’s 413 pages are chock full of diagrams, photographs, and other good photographs—all dispersed through seven meaty sections. The first, entitled simply “UHF Basics,” covers such topics as coupling methods, power amplifiers, passive and active mixers, and the various forms of tuned circuits. It also gives useful information for evaluating receiver performance, something of interest not just to the designer and builder, but also the prospective purchaser of commercial UHF gear.

Unlike some books, which regale a discussion of test equipment to the last several pages, the Compendium treats the subject in its 88-page second chapter. In addition to a discussion of VSWR bridges, power meters, and grid-dip oscillators, such relatively exotic ham gear as a VHF-UHF sweep oscillator is covered. Of special interest is a description of panoramic receivers for band scanning and signal analysis. Although one such project uses a standard television receiver for a display, differences in the European TV and power line standards may necessitate some changes by the American builder.

Other chapters in the Compendium describe various types of rf filters, including multiband diplexers and units to suppress interference from radar systems. The section on subassemblies such as preamplifiers, converters, power multipliers, transmitters, and power amplifiers, benefits greatly by the liberal use of photographs, oscilloscope displays, and schematic diagrams (drawn to the European standard). Performance data for the book’s projects are a great help for those trying to decide whether a particular project will be right for the job.

UHF antennas and feed systems are covered in great depth in recognition of their importance in the well-equipped station. Noteworthy are the sections on measuring antenna performance and the construction of coaxial relays. (When was the last time you saw an article on that?) Miscellaneous data and tables, plus operating information for European hams, round out the final two chapters.

The Compendium first appeared in German and was translated into English by DK7LF. Unfortunately, the translation is not

(Continued on page 34)
When a business or government leader presents his views to a largely sympathetic group, he may be chided for "preaching to the choir." In amateur space, however, one seldom encounters a comparable situation. The reason is obvious to anyone who participates in AMSAT nets or monitors conversations relayed through OSCAR 10. Although accustomed to receiving some criticism, amateur satellite program leaders are rarely faulted for parroting exactly what the members want to hear. In fact, our communications interests vary dramatically. Symbolically, the AMSAT "choir" is an international body composed of diverse "voices" each with personal "musical" preferences. The members enjoy different tunes, which they like to simultaneously sing in a variety of languages. To understand the situation, the resultant hymns are not universally harmonious!

Since most of us strongly advocate democracy, an obvious way around this impasse is to cater to the majority; force everyone to sing the melody monitor our enthusiastic yet discordant melody to discern the current theme? Listening carefully, we can just make out the haunting strains of the familiar "Mode A Forever."" In the foreground appears a clear voice chanting the classic "Morsekeeter's March." In a newer vein, we hear "Bits and Bytes" and the theme from "Thoroughly Modern Microwave." Occasionally we detect the powerful but staccato "Chewers Rag," augmented by sleepy renditions of "The Interminable Monologue."

Consider the dilemma facing Professor Iwi, the metaphorical choir director. He cannot possibly select a single theme from amongst the diversity. Yet somehow he must create a tolerable rendition by blending largely incompatible, loud sounds into a symphony. His difficulty is further compounded by substantial donors in the congregation who have strong musical preferences of their own. They easily tire of old tunes and constantly encourage the choir director to emphasize only progressive music such as the current favorite, "State of the Art." Since talented composers are rare, high-quality, popular material is extremely limited. Moreover, no one, it seems, volunteers to replace the old hymnals as they wear out. Eventually the choir director begins to wonder if the satisfaction derived is worth the long volunteer hours devoted to orchestrating this amateur satellite cacophony. As the choir grows larger, it learns a chorus of "There's No Business Like Big Business" and flexibility is reduced further. The choir director begins to think about retiring so once again he can relax with his own favorite style, country and western. This might include a stunning rendition of "Pick Your Packet" as sung by the Overbyte Sisters. He starts searching for a replacement. For its part the choir is abundantly aware of its achievement legacy. It is naturally anxious to insure continued progress and achievement. So it is justly nervous about potential change; the possibility of declining progress. For the first time the choir acknowledges the fragility of the organization which had provided it with considerable, yet incomplete satisfaction.

Those of us who are inurable optimists foresee a happy ending to the story. It will result from a general recognition by AMSAT supporters of the necessity for increased compromise and cooperation. Furthermore, it will result through the continued devotion of key individuals. With OSCAR 10 we have achieved excellent high-altitude relay capability. Efforts toward replenishment of that splendid asset require prompt, priority attention. Affordable new launch techniques will be identified. Progress is being made toward the development of practical digital communications satellites plus additional experimental spacecraft to be placed in low orbit. Multiple communications frequency and modulation preferences are being accommodated. Past progress has resulted from the dedicated collaboration of small groups of talented hams motivated by their vision of what makes sense to them. Historically, they have been encouraged (and funded) by thousands who display confidence, patience and an appreciation of the difficulties involved in conquering the hostile space environment. There is no reason we can't continue to sing from that same successful score. All together now....

Comets

New Antenna Rotator For Blind Hams

Minneapolis, MN -- Telex/Hy-Gain introduced the HAM-SP rotator designed for visually impaired amateur radio operators.

The control unit functions are marked in both braille and conventional lettering. The unit also emits a high frequency tone to indicate rotator action. Since the brake release as well as delayed brake engagement is automatic, operation of the rotator is a simple one-hand, one-touch operation to aid the blind.

When mounted inside a tower, the new HAM-SP rotator is designed to operate large antenna arrays up to 15 square feet (1.4 m²) wind load area. The HAM-SP (Catalog No. 307) carries a suggested list price of $337 and is available at amateur radio dealers.
Since our last column, we seem to have lost two more satellites, as the strong beacons of RS-3 and RS-4 have been switched off due to battery problems. However, RS-5 to 8 inclusive seem as perky as ever, having sustained the outrages of a further contest in early October, when high-power blocking was much in evidence. The hoped-for return of OSCAR 8 has not occurred, and the ailing battery has yet to show any signs of going open circuit as happened to OSCAR 7, RS-1, and RS-2. To compensate, we have, after many mail-biting events, the use of the first Phase III satellite, now OSCAR 10. Although it is only really working at some fifth of its actual intended potential, due to the much lower inclination, and the transponder being off toward perigee, it has such an enormous improvement in its communication coverage over all previous satellites that a quite dramatic enhancement can be seen.

To your scribe, it was quite traumatic to be able to hold sustained QSOs with VK and JA stations, and to be able to talk with exotic collars such as H44PT. Old friends such as 9M2CR, JA9BOH, W6CG, W6AMX, KV4AD, JA4BLC, JA1ANG, VE1SAT/6, VU1RM, VU6HH, Z51BI and L75DZ were not only in range, but could be worked for a functional period of more than a few fleeting seconds, as was previous. The OSCAR 10 passband includes, even at this relatively early stage, a greater variety of dispersed and rare DX than any of the hf bands under the current declining solar-cycle propagation conditions. WAC can be worked in a single day, and, with the current number of active countries already up to over seventy activated, DXCC will soon be possible within a week or so, without the vagaries of propagational disturbances.

The satellite is not without its problems, particularly on the user front. Many of the alligators that blocked OSCAR 6, 7, and 8, RS-1 to 8 also, are now present to an alarming degree on our newest satellite, making operations very difficult when the pass is within range of Central and Southeastern Europe, in particular on weekends. Appeals to those stations have had either no effect, or, a temporary abatement of the brute force power that shuts out so many of the reasonably powered stations because of ALC attenuation. Stations have been noted running 300 W to eight 23-element Yagis, 50 W to large dishes, and some even using up to 250 kW e.i.r.p. all to damaging effect.

On the other side, when the problem users are out of the way, stations running less than 20 W e.i.r.p. have been worked with full two-way copy, giving evidence of the amazing sensitivity of the Modc B transponder. The first Monday QRP day was a revelation, with a mass of stations with less than 50 W e.i.r.p. making lots of good contacts. The next day the satellite was within range of the main European alligators, when even the recommended normal day maximum of 500 W e.i.r.p. was being attenuated out of the passband, and the telemetered AGC showed it was up to 30 dB!

Hasan, N8AN, has been working on these folks and demonstrating that when they turn it down, they can still be heard at RS56 instead of RS58, and so can most other stations. Others are suggesting ignoring the offenders so that they make no QSOs. The general feeling is that if we wish to try to maintain an operational satellite, we must all do our bit in telling, writing, and telephoning those people, in order to educate them toward reasonable social behavior.

Another problem is the evidenced spin modulation on signals that are using the recommended thread of circular polarization, even when the satellite is at high angles. This is undoubtedly being caused by linearly polarized stations, nearly all horizontally polarized, in select areas, who are trying to overcome the points of QSB fade-out by using high power to 'fill in the holes' as the satellite spins. The result is that a heavy spin-QSB is imparted to that section of the attitude preferential to the polarization being employed, with ultra high ALC levels that are short-lived during the cycle. That causes severe spin-modulation QSB even to those who are using the satellite correctly, making them unreadable at times. It falls to us to educate these people, many of whom have licenses that do not allow them on hf to join the nets, who are unable to read the appeals on the satellite codeosette as they have no cw.

It is very noticeable that most of the problems are being caused by non-AMSAT members, who do not have access to our literary media either, so an offer of an AMSAT membership for them may not only help the problem itself but aid the fruition of the satellites that they are (mis)using. To this end, AMSAT is recommending that users exchange their AMSAT membership numbers via the satellite, as a change from the rather pointless QRA locator exchanges that are only meaningful on vhf and uhf QSOs. While not anxious to encourage too much competition via the media, AMSAT will give a prize to those working and collecting the greatest numbers of AMSAT numbers over the first
year of satellite operation.

On Mode L it has been necessary to employ high power in order to overcome the attenuation imposed by what is believed to be a coaxial changeover relay at the antenna, possibly contact-contaminated by a thin film of dielectric during spacecraft outgassing. It is hoped that successive actuation will gradually wipe-clean the contacts, leading to effective operation with only 1 to 1.2 kW e.i.r.p. (or less) instead of the current 10 kW necessary to overcome the 30-dB loss at the receiver. Some ten stations in Europe have already been heard on Mode L despite the problem, with ZSSAXT, Ivo as well, despite his mere single kW e.i.r.p. At least ten more are known to be ready with the theoretically-needed uplink requirements. Already in evidence, and heard, are DJ5KQ, F9FTI, DL7YC, OEFKJ, DL3NQ, and K8KZ. The Mode L downlink is superb, with strong beacons, clear telemetry, and no spin modulation.

On the second Mode L test, on Wednesday September 28, from 1414-1614 UTC, the loss was found to be down to -10 dB. DJ5KQ has confirmed that a period of relay on/off activation had reduced the loss by some 20 dB, and that AMSAT-DL are recommending the use of 100 W and a 20 dB gain antenna at this time clockwise circular. Also needed is a good noise figure at the receiver, as apparently many stations are unable to hear their own or others signals coming back. John, GM4HJ points out that he is surprised at the limit of only one hour either side of Apogee set aside for Mode L, as the 17 dB helix should give a much wider angle than that within the imposed restriction of earth illumination. John is looking forward to more Mode L and more Mode B also with the satellite active and transponding throughout the entire orbit, as he is anxious to study some of the propagation phenomena available from what he feels to be a superb satellite for investigation and path research.

Rich, WH6AX, has at last been worked from Europe, much to the delight of those who could never previously have hoped to get the 50th state by satellite. Rich runs an ICOM 451A to a 50W amplifier, going to a 7-turn RHCP helix for the uplink, he receives on a 20-element crossed yagi, to a pre-amp and a Kenwood TS900SP. His first European QSO was with G4CBW on 11 August 83 at 0136, and he has also worked JA, ZL, VK, H44, FK1, UA0, YB8, P29, KL7, 9M2, DU, VS6, plus, of course, KH6.

Mike, A71AD, is providing the rare State of Qatar to many callers with his regular AO-10 activity. He is the first foreigner to be licensed in that Gulf State since independence fourteen years ago. Mike runs his FT1 transceiver to a Yaesu FTV-107R transverter, then to a Mirage DI010 Linear, to a KLM 420-450-18C. His downlink system employs a GaAsFET pre-amp mounted at the antenna to good effect. Mike has no local Radio Club, and no QSL Bureau, so asks that those needing a QSL use either our AMSAT Bureau or send direct to C.G. Mike Smedal, A71AD, P.O. Box 4747, Doha, State of Qatar, Middle East.

Alan, J9YCF, has worked 120 contacts in 30 countries and 5 continents since the turn-on of the OSCAR 10 transponder, as A71, DK, E1, F, FC6, G, GM, GI, H44, HB, I, JA, LX, OE, ON, OH, OZ, PB0, P29, SM, SY, UA0, VK, VS6, W, ZS, ZL, Z2S, 9H1 and 9M2. Alan runs a FTV901R transverter to a FT101ZD, which, with a Mirage amplifier and a FRO7000, is connected to switchable circularity crossed Yagis with az-el motorized control, Lunar and Microwave Modules masthead pre-amplifiers add to the effective station. Tracking is performed by a Sinclair ZX81 with the AMS-81 program. Alan tells of the tremendous support that His Majesty King Hussein, JY1, gives to Amateur

Antennas at HBBXJ.
The antenna system at A71AD.
Radio in general, and AMSAT in particular, and hopes that he will have the chance to operate his fully equipped satellite station soon. The Royal Jordanian Radio Amateurs Society station, JY6ZZ, is also equipped for OSCAR work, and will soon be activated with a high level of usage.

Hans, H1B9X1, sends a picture of his imposing antenna array, consisting of two vertical and two horizontal 23-element Yagis, staggered at a quarter of a wavelength and connected for RHCP for the AO-10 uplink. A similar system consisting of 11 element Yagis is used for the 2-meter downlink. We saw Hans mobile and his shack in recent Obit columns. Hans runs GM4HJ’s computer programs to a Spectrum computer used for tracking.

Yoshi, JA4BLC, as evidenced by his 20-ft. dish (shown on the cover of this issue), has a good signal on 432 MHz. He is now enjoying OSCAR 10, using a homebrew transmitter with 50 W to a pair of 7-element Yagis, and a row of 7-element Yagis for the downlink. Junior, PY2BJO, is AMSAT Co-ordinator for Brazil, and is active with a FT901 DM and transverter to a linear, feeding a 17-turn Helix. His downlink receiver consists of a GaAsFET amplified signal from his 10-turn Helical going to a Kenwood 9130 receiver. DL1UK is Ernst, and for the uplink he runs a 9-element crossed quad from his IC-451E with amplifier. He receives on only a 4-element crossed quad to an FT-221. In South Africa, Bert, ZS6HS lives at 5500 ft. a.s.l., and runs a 2C39A power amplifier at 12 W to a pair of 17-element crossed Yagis. His equipment includes a Microwave Modules transverter and an FT101. For the downlink, he uses a 3SK97 mashead amplifier rotated. He first gets the az-el from his search antenna, consisting of 2 x 7 element Yagis, then scales the heights to set his OSCAR antenna to the value found. That combines some good exercise with his mental stimulation! He has problems with screening from the Mondeor Hills, and lots of QRN, the latter being overcome by the use of an audio filter. ZS6HS has been on the air since 1935, and is looking forward to getting on Mode L. Thus, we really have an “Around the World” vision of some of our fellow enthusiasts, and of the wide variety of systems and equipment that they have chosen to use for effective work on OSCAR 10. However, with all the excitement generated by the new satellite, little has come in by way of news on our old faithful satellites. Cam, HPIAC reports that he is still virtually alone on the birds in his general area on cw, but has heard CX8BL, CX18BO, LU9PC, LU4RLM, LU8HHJ, PY3RI, and LU1DITK, but they are all on ssb and do not respond to his calls on the key. He too has been hearing regular signals from RS1/2 sending it’s “5501” corrupted telemetry, and has been making some Robot QSOs.

From Leo, UA3CR, comes news of the enormous number of QSOs that have been made by the RS-5 and RS-7 Robots since their launch. From a Continental aspect, North America has clocked up 10,595 QSOs; Europe, 9,044; Asia, 2,532; South America, 205; Oceania, 628; and Africa, 180 — all up to the end of September 1983. Looked at in terms of countries, we have USA (excluding KH6) with 9,172, (KH6 adds a further 152), 5,764 from the USSR, 2,479 from JA, 2,434 from DL, 1,746 from G, 1,298 from VE, 1,149 from F, 786 from SP, 757 from I, 595 from PA, and 472 from EA.

John, GM4HJ, with his usual enthusiasm for precision mathematics and for Mode J, has set out to calculate some of the long-haul DX that was worked while OSCAR 8 was with us and working. In our last column I credited John and Nick, W8CA with the record breaking QSO on Mode J, but it was John himself who wrote to modestly deny himself the honor, and gave the following tabling:

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<th>G3JOR</th>
<th>GM4HJ</th>
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It appears that the ultimate may have been reached, as I looked often for Shep, W4AUZ, and he for me, but we never heard each other once. We would like to hear from anyone who feels that they may have got that bit further!

(Continued on page 32)
OSCAR SYSTEMS FROM SPECTRUM INTERNATIONAL

Mode-A

TEN METER TRANSMITTER

Mmt 144-28

10W

TRANSMITTER

PA 28

LOW NOISE PRE-AMP

10-METER BEAM

8XY/2M TWIST

Mode-B

TEN METER TRANSMITTER

Mmt 435-28(s)

10W

TRANSMITTER

MMt 144-28 or
Mmc 144-28

RECEIVE CONVERTER

10W

LINEAR AMPLIFIER

if required

8XY/2M TWIST

70/MBM48 MULTIBEAM

Mode-J

TEN METER TRANSMITTER

Mmt 144-28

10W

TRANSMITTER

MM 435-28(s) or
Mmc 435-28

RECEIVE CONVERTER

10W

LOW-PASS FILTER

8XY/2M TWIST

70/MBM/48 MULTIBEAM

Mode-L

2-M XMTR

(or Mmt 144)

MMu 1268

1W

TRANSMITTER

MMc 435-28 or
Mmc 435-28(s)

RECEIVE CONVERTER

1W

LINEAR AMPLIFIER

BANDPASS FILTER

70/MBM/48 MULTIBEAM

CONVERTERS AND TRANSVERTERS FOR

OSCAR-8

OsSAT/OSCAR-9

OSCAR-10

(Phase III)

Specifications:
Output Power: 10W
Receiver N.F. 3 dB Typ.
Receive Converters:
UHF Filters:
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MMC 435-28(s) $69.95
MMC 435-28(TC) $69.95
MM 200-5 $31.95
MM 200-7 $42.95
PSI 432 $74.95
Mod. kit to adapt original MMt 432-28 to Mode J: oper: $26.50

AMSAT/OSCAR-10 Mode-L Equipment:
Transmitters: 3 Models: selection of 10, 6, 2-meter i-fs.
Transmit only converters: 2 Models: sel. of 10, 6, 2-meter i-fs.
Receive only converters: 3 Models: sel. of 10, 6, 2 meter i-fs.
Antennas: Loop Yagis, single, twin and quad stacking.
Tx Power Amps (Transistor): 3 Models, 1/2 W/1W input, 8W, 10W, 17W output.

Transmitters by Microwave Modules and other manufacturers can convert your existing low-band rig to operate on the vhf and uhf bands. Models also available for 2m to 70cm and for ATV operations from ch2/ch3 to 70 cm. Each transmitter contains both a Tx up-converter and an Rx down-converter. Write for details of the largest selection available.

Attention owners of the original MMt 432-28 models: Update your transverter to operate OSCAR-8 and AMSAT/OSCAR-10 (Phase III) by adding 435-437 MHz range. Mod. kit including full instructions is $26.50 plus $1.50 shipping.

ANTENNAS

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Phasing Harness Model PMH/2C .................... $13.35
48 el. 70 cm Multibeam Model 70-MBM-48 .......... $75.75
88 el. 70 cm Multibeam Model 70-MBM-88 .......... $105.50

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Model 64 Airfoil Soft $94
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PB 144 $25
PB 220 $25

KDK FM 2030

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ST-LS Leather Case $53
SETM 9000 Multi Charger $80
ST-1404 Portable Talkie $260
ST-4452/4453 kHz $270
ST-5000 Ni-CD Battery $35

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- Fully Electronically Regulated - 5mA Maximum Ripple
- Current Limiting & Crowbar Protection Circuits
- M Series With Meter - A Series Without Meter

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November/December 1983 23
“Best Ever” Say Meeting Attendees

According to many attending AMSAT’s Space Symposium and Annual Meeting 12 November, it was the best of its kind ever. Held at the Kossiakoff Center, Applied Physics Laboratory of the Johns Hopkins University, the day-long Saturday event capped months of planning to make the event noteworthy. The Applied Physics Laboratory is 30 miles northwest of Washington, D.C.

The first of approximately 200 to attend began arriving for registration at 8:00 AM. They were greeted by hostesses for AMSAT including XYLs of W3IW1 (Elizabeth), K1HTV (Phyllis), W3XO (Matie) and ZL1AOX (Margaret). The registration went smoothly; typical of the entire day’s events. The thorough preparation by W3TMZ and W3XO was evident throughout.

The day was divided neatly into three modules. The morning session, afternoon session and the evening Annual Meeting.

The morning session opened with a welcome by W3TMZ, Jack Colston, an employee of the Applied Physics Laboratory (APL). Jack introduced Dr. A.G. Schulz, Associate Director of APL. Dr. Schulz explained how APL was founded during World War II and how Hams had always been well-represented since scores of APL employees were amateurs. He went on to explain how APL had been involved in space technology from the start; that navigation satellites were largely pioneered at APL. A film was then shown amplifying on Dr. Schulz’s assertions.

Next another APL employee and co-organizer of the symposium W3XO, Bill Tynan, explained the role of the APL Amateur Radio Club.

AMSAT’s Chairman of the Board W6SP, John Browning, then welcomed all the attendees on behalf of AMSAT.

The symposium then began in earnest with a sparkling presentation by Vice President for Engineering W3GEY, Jan King. Jan spoke about OSCAR 10, its design, construction and an assessment of the results of the effort. For much of his well-attended presentation Jan spoke to a slide set assembled by W4PUJ. Many of the slides had not been seen before in public. In any case Jan’s unique perspective of the program added immensely to the overall understanding of the program according to the comments of those viewing the program. Of especial interest were Jan’s comments regarding the value of software flexibility in AO-10. The ability to rapidly reconfigure and adjust was critical to saving the spacecraft after the post-separation incident with the launcher sent AO-10 into a near fatal attitude and spin. It was only DJ4ZC’s quick, expert hand on the controls, said King, that alleviated total disaster. Nevertheless, he concluded, the spacecraft is very usable and should prove a valuable resource for years to come.

After Jan’s presentation the symposium separated into two concurrent sessions. In the auditorium KOSI, Doug Loughmiller explained basic AO-10 ground station requirements. In adjoining classrooms K9Q, Phil Karn detailed some of the intricate engineering challenges involved in AO-10 and some of the challenges remaining to be faced. Phil highlighted the prospect of coming...
eclipses and the required attitude changes they will dictate.

Following these talks and immediately before lunch N2CF, Bill Lazzaro, and W3XO demonstrated live AO-10 QSOs. Also on display were packet radio transceivers, computers, and software. G3HR demonstrated a program for the Times 2000 developed by GM4HJ. WSSXD demonstrated a special purpose computer for producing computer graphics of satellite tracks. Prizes for the AMSAT membership drive were on display too. The Grand Prize Yaesu FT-726R (demonstrator furnished by Electronic Equipment Bank) was the center of attention. Other prizes donated by Mirage, KLM, KJI, Spectrum West, Spectrum International, Advanced Receiver Research and Lunar Electronics were likewise on display.

The buffet lunch was served to more than 100 enthusiastic guests.

The afternoon sessions began with K2UBC, Marty Davidoff, and K2ZRO, Kaz Deskur, explaining the fine points of map-based satellite tracking systems. They spoke in the auditorium while a panel discussion on Packet Radio, PACSAT, UoSAT-B and packets on AO-10 carried forth in the classrooms. Panelists consisted of NK6K, W31WI and K9Q with others chiming in at times.

Next in the auditorium N5AHG, Bob Diersing, who manages the AMSAT Software Exchange Bulletin Board system, told of using personal computers to aid in tracing satellites and making access predictions. Bob's talk was followed up with one by Jan King who provided the latest assessment of Mode L operations. According to King it appears at least one and possibly two failures have marred the Mode L performance although it remains usable by stations able to field the 25 kW ERP estimated to be required. Jan suggested that the 1269 MHz receive antenna relay may have stuck and there appears to be a problem with a Mode L transmitter power stage. Jan said it appeared to be running in a Class C domain. A switching regulator failure could cause this, King said.

After a coffee break at 1430, the symposium visitors were treated to a glimpse of a new organization now forming, the Independent Space Project Committee. Its prospectus was presented by Bob Molz. Following this talk K8OCL, John Champa spoke on the Solar Sail Project. John's talk was followed by one given by Jesse Eichenlaub on the Amateur Space Telescope Project of the Independent Space Research Group.

Meanwhile, in the adjacent classrooms W3GEY, W4PUJ and K9Q were addressing a full-house on present and future spacecraft technology. They were followed by K2UBC with an abbreviated reading of his paper on circularly polarized antennas (which appears in ORBIT #15).

Back in the auditorium Amateur Space Telescope had yielded to W3XO with an STS-9 W5FL Ham-In-Space update. Finally W31WI wrapped up the symposium with a brief talk on World-wide amateur satellite projects now under way or planned for the future. Tom touched briefly on Phase 3C, UoSAT-B, PACSAT, ARSEN, JAS-1 to name a few.

Following a full day of listening and discussing, the crowd milled about in the traditional cocktail hour. Many old acquaintances were renewed and new friends were made and introduced to still newer friends. Many familiar voices heard on OSCARs became (at last) last associated with faces.

The buffet dinner was enjoyable and tempted several to neo-gluttony. Others, slightly more reserved, were content to savor the dessert, coffee and to enjoy the pleasant after dinner repast.

At 1930 the annual meeting began with President W31WI at the podium. The Directors election results were announced as follows:

- Jan King, W3GEY, 1131 votes
- John Browning, W6SP, 999 votes
- John Pronko, W6XR, 790 votes
- John Henry, VE2VQ, 720 votes
- Jack Colton, W3TMZ, 679 votes
- John Montague, W8RUE, 458 votes
- Wray Dudley, W8QGW, 369 votes

According to the Bylaws, W3GEY, W6SP, W6XR, VE2VQ are elected Directors. W3TMZ and W8RUE become First and Second Alternate Directors, respectively. One wag observed that it seemed to help if one's given name began with 'J'!

Several honored guests were present at the meeting including distinguished visitors Vic Clark, W4KFC, ARRL President; Dave Sumner, K7ZZ, ARRL General Manager; Paul Rinaldo, W4RI, ARRL Technical Department Manager; Jay Holladay, W6EJJ, Southwest Division Director. Also on hand were members of the ARRL Forward Planning Council including AMSAT Chief Area Coordinator Jim Mc Kin, W8CY.

KIZZ presented a special plaque to Marty Davidoff, K2UBC, honoring him for his efforts in connection with Marty's forthcoming book, Satellite Experimenters's Handbook. The ARRL publication will be shipped beginning in 4 weeks and has been heralded widely for its potential to upgrade the amateur satellite community's insight to the finer
points of the hobby. The book will be available from AMSAT Headquarters for $10 postpaid, U.S., Canada, Mexico; $11 elsewhere. Amateur Satellite Report is told orders for the book will be accepted beginning 1 Dec. 83.

W3IW1 spoke on some ongoing programs and what is needed to maintain a healthy organization. He acknowledged numerous individuals and teams that had contributed to the successful year past experienced by AM-SAT. (Too many to mention.)

The meeting adjourned with all expressing thanks for a splendid program.

Amateur Satellite Report spoke with a number of attendees who felt the program should be built into a two day event next year. G3IQR in particular expressed this wish since there were so many good speakers and he found it impossible to attend as many as he would have cared to.

The entire day's events were videotapec by technicians from APL. According to W3TMZ arrangements are being made to edit the material for distribution through the AMSAT Videotape Library managed by W6GJG. Watch Amateur Satellite Report for word of availability of these program tapes. The desire here is to provide excellent program material for club meetings. The materials might be partitioned in modules by subject so the local club program committee can more easily evaluate suitability.

All in all the Space Symposium elicited great praise for its organization, the quality of the speakers and their program materials. Amateur Satellite Report congratulates the organizers, helpers, speakers and officials who made it a sparkling success! Those who missed it will want to reserve early for next year! — Amateur Satellite Report

Davidoff Book Readied For January Delivery

ARRL is planning to begin shipping its newest major publication, "Satellite Ex-perimenter's Handbook" by Martin Davidoff, K2UBC, in mid-January Amateur Satellite Report has learned. The long-awaited work represents several years of ef-fort by K2UBC, a long-time AMSAT supporter and former Director of AMSAT. Marty teaches mathematics at Catonsville College near Baltimore, Maryland.

The book is designed to teach an intelligent beginner a great deal about orbits, satellites and the like. It is partially based on Dr. Davidoff's prior work in the area, "Using Satellites in the Classroom." This work was privately printed in limited editions but was well-received by science educators interested in bringing space-age science to the high school and undergraduate college curriculum.

The format of the new book is similar to the ARRL Radio Amateur Handbook. Besides Amateur Radio satellites, the book also addresses weather and TV broadcast satellites.

AMSAT will be a primary distributor for this new book and will realize a handsome commission on each volume sold. Naturally all AMSAT members are strongly encour-aged to obtain their copy from AMSAT. The price is $10 U.S., $11 Canada and elsewhere. See pages 34 and 35 in this issue.

Teleconference Radio Net Airs To Nationwide Audience

The most recent airing of the now-famous Honeywell North American Teleconference Radio Net (TRN) was on Thursday evening, 1 Dec. 83. The topic was the Amateur Space Program and the speakers were AMSAT officials. The program reached a radio audience exceeding 30,000 by some estimates. Other estimates put the listening audience in Canada and the U.S. as high as 75,000.

The network involved over a hundred repeaters linked by a dial-up telephone bridge arrangement operated ad hoc by the Honeywell Amateur Radio Club, Rick Whiting, W8TN, is the prime-mover at Honeywell, Minneapolis.

AMSAT speakers included Rich Zwikko, K1HTV, retiring Vice President for Operations; Jan King, W3GEY, Vice President for Engineering; Bill Lazzaro, N2CF, General Manager and Tom Clark, W3IW1, President. Verna "Rip" Riportella, W8LQQ, executive Vice President, moderated the "panel of experts" for the event. The presenters and a local Honeywell coordinator, Jeff Brennan, W64WLW, were all situated at the AMSAT Headquarters office in Silver Spring, Maryland just outside of Washington, D.C.

The program began at 8:15 PM EST with a previously taped interview with W8LQQ filling the airtime as various stations around the nation integrated with the network. At 8:30 the first part of the net began with opening remarks by W8TN and W64WLW. Then W8LQQ led off with remarks which set the tone and objectives for the evening. Rip touched on the challenge and fascination in dealing with Amateur Space topics. In noting the untimely passing of ARRL President Vic Clark, W4KFC, the previous Friday, Rip noted that it was W4KFC who had worked hard for the then-in-progress flight of Owen Garriott, W51LF, the first Ham-in-Space operation. Rip noted the irony in his passing on the eve of one of Amateur Radio's major achievements and dedicated the evening's net.

Part of the crowd at the weekend Symposium.

Attendees at an A-O 10 Ground Command Station Meeting at the home of W3IW1 are (L. to r.) W3GEY, VE1SAT/VE6, W8PN, ZL1AOX, KA9Q and N56X (W4PUJ photo).
to Vic's memory on behalf of AMSAT.

Next up was K1HTV. Rich covered operational aspects of the present satellites including the operational Mode A birds (RS6) and AO-10. He stressed the entry level equipment required to operate and described some of the DX possibilities that could be enjoyed immediately on the present satellites.

Following Rich, W3GEY developed a theme of encouraging more direct participation in technical projects by individuals and groups around the world. He spoke of the possibility of a dual tier approach to projects wherein a strictly domestic satellite project might be under way concurrently with more ambitious projects requiring the full, international cooperation and the fullest support possible of all the major AMSAT affiliated organizations. Next Jan addressed future projects and where they are going. He mentioned that UoSAT B was racing towards a launch date of March, 1984; that Phase IIIC launch possibilities were being raised and that the JAS-1 and Arstene projects of Japan and France, respectively, were on their way as well.

Bill, N2CF, spoke about AMSAT, the organization. He explained what it is, what it does and where it derives its resources. Bill detailed the benefits of membership including discounts at Ham Radio stores, discounts on AMSAT Software Exchange products and a host of services provided by AMSAT. Bill strongly suggested AMSAT membership as the best way to keep the primary objective intact: the provision of more Amateur Radio satellites.

Then W3IWI picked up the topic that was foremost in many minds: WS1FL. Tom led the listeners through an explanation of the mission of Owen Garrett and what the fundamental motivations of WS1FL were as perceived by AMSAT. (To encourage technical careers among youth.) He then listed many of the orbits that WS1FL would be working throughout his mission in space and explained the procedures.

About halfway through Tom's presentation, Rip announced that WS1FL was in view of California on a south bound track. Coincidentally, *Amateur Satellite Report* has learned that the JPL operation at W6VIO had been playing the TRN audio on its normal Shuttle Audio frequencies. Someone had apparently picked up the TRN and to everyone's chagrin, retransmitted it right smack on 145.55! Right on top of Dr. Garrett's downlink! To make matters even more bizarre, here was W3IWI beseeching everyone to avoid transmitting on the Shuttle downlink of 145.55...and what should be heard by all of Los Angeles on 145.55? W3IWI's melodious voice saying please avoid 145.55! Ouch! Zounds! Only in L.A.!

Not that that was the only amusing event of the evening. Known only to the huddled 6 at the microphones at Silver Spring, Dick Daniels, W4PUJ, was present as backup for the speakers. Dick had gotten relatively comfortable on the carpeted floor and by the time Jan's talk was in progress there was heard a series of pronounced snores. Daniels was quite oblivious to the racket his snoring developed, of course. But the assembled speakers had a supreme challenge to avoid being convulsed with laughter at the predicament Jan was in. Jan was obviously amused but intent on maintaining an unperturbed demeanor. The rest were just as intent on venting their amusement at both Dick and Jan.

In the end, however, after several ill-muffled guffaws, the "show" went on with the rhythmic W4PUJ "sawmill" hopefully a decibel or two below audibility to the thousands listening!

After Tom's presentation the TRN swung into part 2 with questions coming from all around the U.S. and Ontario too. The questions were generally excellent and came from obviously well-informed individuals sincerely interested in AMSAT and Hams-in-Space. One pleasant surprise came when Dick Cotton, WS6X, who was mentioned by WA21QQ in the first 15 minute, pre-net warmup, showed up as one of the early questioners. Dick wanted to know when the AO-10 telemetry would be corrected and updated. Many folks were interested in that theme, he said.

After nearly an hour of questions and answers the TRN ran out of time. It was 10:30 PM EST. All of HQ thought it had gone very well. By the next day the first critiques to come in concurred. It HAD gone very well indeed. The concurrent flight of WS1FL, far from detracting from the evening's program, likely further heightened interest.

Numerous stations recorded the program on audio cassette tape. Dr. Norm Chalfin, K6PGX, is offering good quality copies of the tape for a $5 donation. Write to K6PGX at P.O. Box 463, Pasadena, CA 91102.

Software Booklet by NSAHD Is Offered

AMSA Headquarters announces the availability of a booklet by Bob Diesing, NSAHD, of the AMSAT Software Exchange. Entitled "Using Microcomputer Programs for Radio Amateur Satellite Orbit Prediction", the approximately 40-page booklet is appr...
designed “primarily for Radio Shack, IBM PC and CP/M-Based S-100 Bus Microcomputers.” It contains chapters on Keplerian elements, AO-10 orbit loading, updating and running your programs. It also contains complete program listings for many of the popular micros.

The booklet is available from AMSAT Software Exchange through AMSAT Headquarters, P.O. Box 27, Washington, DC 20044. The price is $8.50 for AMSAT members or $5.00 when purchasing software. For non-members the price is $10 alone or $5.00 when purchasing software. — Amateur Satellite Report

Project OSCAR Calendar Announced

Project OSCAR President W6XN announces that the new Project OSCAR orbital prediction calendar will soon be ready. The 1984 version will feature accurate predictions for the time and longitude of equatorial crossing (EQX) for the RS satellites RS-5, 6, 7 and 8. For AO-10 the time and position (latitude/longitude) of the subsatellite point for every apogee during 1984 will be documented. This information is suitable as an entry to any of several manual plotters now being readied for market. (K2ZRO’s new Satellite plotter will probably be available soon.) A plotter was described in detail in Orbit Magazine #16. A minimum donation of $10 is requested for the calendar mailed first class to U.S., Canada and Mexico. The donation is $12 elsewhere. Mail your order to: Project OSCAR, P.O. Box 1136, Los Altos, CA 94022. Delivery begins in late December. Order now.

ARRL Scholarship Announcement

Vic Clark, W4KFC, shown here last November with Senator Barry Goldwater, K7UGA, at the Senator’s Washington office on the occasion of the announcement for an ARRL Scholarship of $5000 in Senator Goldwater’s honor.

The League will award the scholarship to a licensed Radio Amateur enrolled in a college-level study of electronics communications engineering or a related field. The program will be administered by the ARRL Foundation, Inc., the League’s tax-exempt research and educational organization.

Senator Goldwater, known to thousands, made the announcement from his Ham Shack on Capitol Hill.

W4KFC explained that the Senate was selected as honoree for the new scholarship because of his “selflessness and dedication to purpose as a government servant which is deeply appreciated by both his fellow citizens and Radio Amateurs of our country.”

Senator Goldwater, whose interest in Amateur Radio dates back to his teenage years, said the value of Amateur Radio Operators has been demonstrated repeatedly in times of local or national emergency. The recent Grenada mission is a case in point. Ham Radio operators quickly opened links with the island passing messages relating to the safety of several hundred Americans attending St. George’s College. It was through

Amateur radio lost a good friend and dedicated servant on November 25, 1983 when Victor C. Clark, W4KFC, passed away near his home in Virginia. His most recent service as president of the American Radio Relay League (ARRL) capped many years of dedicated efforts on behalf of the amateur radio community. Vic never missed an opportunity to promote the avocation he loved and further its interests throughout this country. One of those interests — the Amateur Satellite Program — benefited greatly by Vic’s interest and our valued friend and staunch defender will be missed.

It is not surprising that even up to the time of his death Vic was championing the welfare of Ham Radio. One of his and Amateur Radio’s greatest accomplishments — ham radio operation from the space shuttle Columbia by Dr. Owen Garriott, W5LFL — was just three days away when Vic suffered a fatal heart attack. Indeed had it not been for that fateful event, Vic would have been in the VIP grandstand at the Kennedy Spaceflight Center in Florida to personally witness the liftoff.

Vic was a Charter Life Member of AMSAT and helped develop the interest and financial support that have spurred the organization development, and construction.

Just two weeks before his death, Vic attended the AMSAT Annual Meeting and brought to it not only the prestige of his high office, but also his personal enthusiasm and excitement for Amateur Space activities. It was a great pleasure for me to have met and spoken with Vic on that occasion. I’m sure that I join all AMSAT members in extending to Vic’s wife Hester, WA4PAE, and to his entire family our sincerest sympathies and best wishes. — KB2M

28 Orbit
these channels that the press and the public received most of their information during the early days of the mission.

Information about the program can be obtained from the ARRL Foundation, 225 Main Street, Newington, CT 06111.

**WSLF Launches First Ham-In-Space Operation**

After more than a decade in planning the first amateur radio station to be operated from a space-borne platform is a reality, NASA Mission Specialist Dr. Owen K. Garriott, W5LFL, thus becomes the first active Ham-in-Space.

The first confirmed contacts between W5LFL and Hams on *terra firma* probably occurred on orbit #40 Wednesday evening, 01 Dec. 83. The orbit passing from northwest to southeast off the U.S. west coast was widely monitored. First reports to *Amateur Satellite Report* of confirmed contacts came from Washington Area Coordinator Jim Smith, KA7APJ, of Seattle. He played recordings over the telephone which documented W5LFL’s contacts with several stations in the seventh call district. The signal heard by Smith was strong and steady.

Earlier reports of contacts made on orbit #35 remain unconfirmed although widely reported by usually reliable west coast sources.

By the time orbit #96 zipped up the east coast on Sunday morning at 830 AM EST, thousands had managed to snatch a fleeting second or more of W5LFL’s voice from the Space Shuttle Columbia. Apparently far fewer than anticipated have heard their calls acknowledged. Dr. Garriott has explained on the air several times that he is hampered by the background noise in the shuttle and by having but a single earphone which leaves the other ear uncovered. Nevertheless, dozens of contacts have been confirmed, AMSAT regular K4OFG was one whose call was read by W5LFL and recorded at W4ZLQQ.

Meanwhile Associated Press accounts report that King Hussein of Jordan, also known as JY1, engaged W5LFL in a 4 minute QSO early on Sunday 4 Dec. Sources indicate it probably was orbit #91 which passed over Jordan at 0007 UTC on Sunday. His Majesty and Dr. Garriott were said to have exchanged pleasantries and shared in the pride of bringing the hobby of Ham Radio into space with W5LFL. King Hussein has been an ardent supporter of the amateur space program. In 1981 he donated $10,000 to AMSAT during a trip to the U.S. that included a telephone call to AMSAT President W3WI. (*Amateur Satellite Report* #20, 16 Nov. 81.)

Signals received from Dr. Garriott’s HT were excellent copy on the ground as most reported full quieting signals whenever W5LFL was heard. Confusion was evident on the ground, however, as ill-informed ultra-lids repeatedly called on the downlink frequency, 145.55. The lids and n’er-do-wells were immediately pounced upon by a score of would-be spectral policemen each of whom, in turn, was accosted by a covey of airborne philosophers discounting the value of berating or disciplining the original intruder. By our reckoning, the leverage exerted by a single lid had never been higher. A single syllable uttered out of turn on 145.55 catalyzed a torrent of discipline and philosophy which grew exponentially. Only minutes later would tranquility be restored. Then, it would seem, someone would sigh a sigh of relief into a hair-trigger VOX... and inadvertently launch another amateur radio chain reaction detonation. Ah, the sociologists!

More troubling, it seems, than the ultra-lids, were the super-hogs and nihilists, mostly in California, who largely succeeded in converting the tremendous leverage afforded them into total malam. Here one found the perfet amateur radio soup. Take 50,000 radios. Spread them among 40,000 competent operators, 8,000 beginners, 150 incompetents, 300 Neanderthals and 200 anarchist/nihilist types. Mix slowly for several days under a strong onshore breeze and what have you got? Los Angeles, naturlich!

East Coast Garriott-watchers did not go unscathed or unabused. New York probably makes up for the number of free spirits found in the L.A. environs with a higher per capita lid rate than most places. Chaos was the rule in N.Y. as well with threats, counter-threats and visions of black-hatted hoodlums taking to the highways to mete out some vengeance contracted for by Costa Nostra types.

The sometimes circus atmosphere carried over, for better or worse, into the general media. Press and broadcast media seem taken up in this extravaganza and few if any of the normal precautions seem to have been observed as a notably high ratio of aired and printed stories contained serious flaws. Some were laughable and even forgiveable. Others were serious enough to cause serious discomfort in the informed reader. One Associated Press story quoted by Phil Karn, K9Q, had the frequencies wrong, the operating procedure (odd/even minutes) reversed and other non-trivial faults. Phil did manage to straighten the author out on the offending points.

TV crews were out with a vengeance as well, W8PN, KA7APJ and KW2U, among others, were all the focus of TV interviews.

The National News Team from ABC visited KW2U. Shown here, Roger describes some of the equipment he is using for working W5LFL.

ABC News tapes ORBIT Magazine Director of Advertising, KW2U, during an actual pass of STS-9/W5LFL while a contact is being attempted.

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W5LFL Continues...

and reports. All are AMSAT "experts" and thus are sought out by the media for these types of reports. Other Hams around the nation were also much sought after and it seems fair to say that the press coverage given amateur radio in the past week has been unprecedented in any circumstances. Coming as it does on the heels of the Granada reports in which Ham Radio for days captured the headlines as the major conduit of world headline news, the W5LFL coverage seems certain to cap what has got to be the best year ever for amateur radio media coverage. Many wonder if this interest by the media will soon be reflected in the populace with a rise in new license applications. Amateur radio growth has slumped after the collapse of the CB boom. ARRL membership similarly has flattened out. Newington stands to reignite the growth patterns of a decade ago if it correctly proceeds to corral the interest stirred by W5LFL and the media coverage. AMSAT similarly is positioning itself to capture the wave of new enthusiasm many see in the offing.

Amateur radio coverage of the event has been excellent with professional-quality, on-the-air services rendered by WAIJAN, W5RRR and W6VJO. The station at W1AW has carried a full basket of W5LFL bulletins as well. WAIJAN at the Goddard Space Flight Center in Greenbelt, Maryland has been on the air on hf and vhf with NASA-sourced Shuttle audio feeds. These apparent-
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W5FL Continues . . .

ly have had a huge following. The 500 watt HAM vhf fm signal on 147.45 MHz was audible well up and down the east coast. Likewise the club stations at W5RR (Houston, Johnson Space Center) and W6VIO (Pasadena, Jet Propulsion Laboratory) served large listener communities for nearly the entire mission. The effort was most impressive and probably marks the high point in coverage of these types of missions.

QSO and SWL reports should be sent to ARRL, 225 Main Street, Newington, CT 06111. You must include a business size s.a.s.e. Please mark the outer envelope: "STARS-9" and indicate either "QSO Report" or "SWL Report".

With the Ham-in-Space mission of Owen K. Garriott, W5FL, now complete one is tempted to offer assessments as to the merits of it all. Recognizing that history requires the added perspective of time to obtain clear focus, it seems W5FL will have succeeded in his most fundamental endeavor. He will in the end have reached millions of otherwise ambivalent youngsters with the notion that amateur radio is not necessarily an end unto itself. Seen in the correct perspective it can become a mode for channeling creative, youthful energies into productive technical careers. This was Garriott's message. We perceive that the substance will have gotten through, albeit by a circuitous and often tortuous route. And so the years of planning by W3XO, W5AVI, K6DUE and scores of others appears, at this juncture, to have succeeded. — Amateur Satellite Report

G3IOR Continues . . .

UoSAT OSCAR 9 has been participating packet radio tests, with the UOS builders now working frantically in the hope of having a new UoSAT with packet capabilities aboard for a February 1984 launch opportunity. The essential mission of hints and tips to help with OSCAR 10 satisfaction, from common joint sources of agreement. For the downlink, try to use the lowest possible Yagi consistent with low side-lobes, such as the WEYE or NBS Yagi, which will markedly reduce man-made QRM (QRN) at low angles. Although ideal, a GaAsFET is not vital, and a 35dbK, or even a MOSFET, used as a pre-amplifier and tuned to the optimum signal-to-noise ratio will give an enormous improvement. A reversing switch on the polarization circularity, from RHP to LHP, will give strategic advantage at parts of the orbit outside apogee. Do not rely implicitly upon your calculated elevation, as often small propagation anomalies, such as tropospheric ducts, and the E layer, will give a better signal at an exaggerated azimuth (up to some 15° higher) and reduce ground noise in addition. On the transmit side of things, obviously keep your power down to that level giving communication, and always well below the beacon in downlink strength. Remember that many people in the rarer countries are limited in finances and equipment and may be extinguished by unnecessarily high uplink powers. Do not use speech processing on ssb, as not only is adequate audio tailoring present in the circuitry of the transponder, but your average power demand is greater with a consistently high peak level, that raises the ALC and increases the attenuation. Do use the circular polarization that gives the smallest return, and not that giving the highest peak S-meter peak on the downlink. Finally, keep to the band plan and the correct sideband.

Editor's Note: In ORBIT 15, page 22, a line was omitted which gave the appearance that Z25J was running 120 kW ERP. In fact, its 10 watts to a 30 dB gain dish yields a somewhat less immodeate 10 kW ERP.
Satellites & 73

When it comes to covering satellite communications, 73 runs rings around the competition. 73 publishes more articles about satellites and TVRO than any other ham radio magazine.

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728RBT

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Book Review Continues...

the best and apparently no attempt was made to present the text in good English-language style. Because of that, the book occasionally becomes somewhat tedious. Also, some captions and notes within figures have been left in the original German. Even though the meaning could be deciphered by reading the appropriate portions of the text, such lack of attention to detail is a bit of an annoyance.

The construction projects can, for the most part, be built without too much difficulty. The parts specified are either of U.S. origin or can be otherwise obtained here. For the few exceptions, substitutions can be made or parts can be purchased from one of the West German suppliers listed in Chapter G.

Many of the projects include PC-board artwork and board layout photographs. Those circuits that require complex mechanical work are well illustrated with line and cutaway diagrams, as well as photographs.

In spite of its translation problems, The UHF Compendium is a useful addition to the VHF and UHF enthusiast's library. Both Parts 1 and 2 are contained in a single volume that is published by Verlag Rudolph Schmidt (Rudolph-Dieschtr. 1, D-6670 Hof-Saale, West Germany) and is available from a number of sources, including the Ham Radio Bookstore (Greenville, NH 03048).

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Space Symposium attendees (l. to r.) VE1SAT/VE6, VE3XT, W3GEY and W4RI. See related story beginning on page 24 of this issue. (W4PUJ photo)
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Factory equipped for 2 meter operation, the FT-726R is a three-band unit capable of operation on 10 meters, 6 meters, and/or two segments of the 70 cm band (430-440 or 440-450 MHz), using optional modules. The appropriate repeater shift is automatically programmed for each module. Other bands pending.

**Advanced Microprocessor Control**
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.

**Full Duplex Option**
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.

**High Performance Features**
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.

Leading the way into the space age of Ham communications, Yaesu's FT-726R is the first VHF/UHF base station built around modern-day requirements. If you're tired of piecing together converters, transmitter strips, and relays, ask your Authorized Yaesu Dealer for a demonstration of the exciting new FT-726R, the rig that will expand your DX horizons!

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU ELECTRONICS CORPORATION 6851 Walthall Way, Paramount, CA 90723  •  (213) 633-4007
YAESU CINCINNATI SERVICE CENTER 9070 Gold Park Drive, Hamilton, OH 45011  •  (513) 874-3100
TR-9130

All mode (FM/SSB/CW) 25 watts, plus...!!!

The TR-9130 is a powerful, yet compact, 25 watt FM/USB/LSB/CW transceiver. Available with a 16-key autopatch UP/DOWN microphone (MC-46), or a basic UP/DOWN microphone.

TR-9130 FEATURES:
- 25 Watts RF output on all modes. (FM/SSB/CW).
- FM/USB/LSB/CW all mode. Selectable tuning steps of 100-Hz, 1-kHz, 5-kHz, 10-kHz.
- Six memories. On FM, memories 1-3 for simplex or ±600 kHz offset, using OFFSET switch. Memory 6 for non-standard offset. All six memories may be simplex, any mode.
- 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.
- Automatic band scan.
- Dual digital VFO’s.
- Transmit frequency tuning for OSCAR operations.
- Squelch circuit for FM/SSB/CW.
- Repeater reverse switch.
- Tone switch.
- CW semi break-in; sidetone.
- Compact size and lightweight.
- Covers 143.9 to 148.9959 MHz.
- High performance noise blanker.
- HI/LOW power switch. 25 or 5 watts on FM or CW.
- RF gain control. • RIT circuit.

Optional accessories:
- KPS-7A AC power supply.
- PS-20 AC power supply (TR-9500 only).
- BO-9A system base with memory back-up supply.
- SP-120 external speaker.
- TR-1 AC adapter for memory back-up.

TS-780

All mode “Dual-Bander”... 2-m & 70-cm all mode, dual digital VFO’s, 10 memories, scan, IF shift...

TS-780 FEATURES:
- USB, LSB, CW, FM all mode, covering the 2-m band (144.000-148.000 MHz) and the middle 70-cm band (430.000-440.000 MHz). UP/DOWN band switch.
- Dual digital VFO’s with normal/tight drag switch. VFO steps in 20-Hz, 200-Hz, 5-kHz, or 12.5-kHz, plus “FM CH” channelized tuning. Split (cross) frequency operation possible. F. LOCK switch provided.
- 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.
- IF shift circuit rejects adjacent interference.
- High sensitivity and wide dynamic range.
- 7-digit fluorescent tube digital display.
- 10 watt RF output.
- 2-m ±600-kHz TX offset switch with reverse switch.
- Tone switch for optional TU-4C programmable two-frequency CTCSS encoder unit.
- VOX and semi break-in CW built-in.
- FM center-tune meter.
- Noise blanker for SSB, CW.

TU-4C programmable two-frequency CTCSS encoder.
- MC-42S 500 Ω UP/DOWN hand microphone.
- MC-48 16-button Autopatch UP/DOWN microphone.
- MC-60A deluxe desk top microphone.
- MC-60A desk top UP/DOWN microphone.
- TR-1 AC adapter for memory back-up.

Subject to FCC approval.