UoSAT-OSCAR 11

Demos PACSAT Concept

The first demonstration of store-and-forward packet radio in an Amateur Radio satellite system has been successfully achieved by groups in England, Los Angeles and Hawaii. The demonstration is part of a proof-of-concept experiment. The PACSAT Project design may evolve from further DCE success.

According to Martin Sweeting, G3YJO, messages were exchanged between W3ZIA in Hawaii and G3YJO in Surrey, England, as well as NK6K in Los Angeles. The first success came on orbit 2057 of UO-11 according to G3YJO.

According to NK6K, the following messages were downlinked from UO-11 using an "embryonic" software package.

"ALL UOSAT TEST MESSAGE"

"ALL UOSAT DCE TEST MESSAGE FROM UNIVERSITY OF SURREY ENGLAND"

"ALL UOSAT These messages are a test of the embryonic store and forward packet radio service on UoSAT-Oscar-11."

"ALL UOSAT The tests are running on the Digital Communication's Experiment NSC-800 computer; assisted by the RCA 1802."

"ALL UOSAT They form part of a proof-of-concept demonstration of techniques by AMSAT; VITA; and INTER-PARES at the Pacific Telecommunications Council annual conference in Honolulu, Hawaii this weekend."

"ALL UOSAT The demonstration has been organised by Larry Kayser WA3ZIA; DCE software and support by Hugh Pett VE3FLL and Harold Price NK6K; UOSAT support and groundstation activities by Roger Peel G8NEF and Neville Bean G8NOB."

"ALL UOSAT Thanks are also due to radio amateurs in Hawaii; the Los Angeles area and the Ottawa area for their assistance."

"ALL UOSAT These messages are a test of the embryonic store and forward packet radio service on UOsAT-Oscar-11."

"ALL NK6K DCE message system TEST message; from Redondo Beach; CA."

The message system is a demo prototype developed by VE3FLL for the Hawaii demonstration. The software was up-loaded to UO-11 by NK6K over the weekend preceding the demonstration.

In addition to the DCE team in Canada and the US, and the spacecraft controllers at the University of Surrey, AMSAT members Rick Dittmer, WH6AMX and Chris Wachs, WA2KDL were instrumental in bringing off a successful demo. Rick provided support for the KH6 operation, Chris provided addition ground station support in Los Angeles.

Meanwhile, VITA, the Volunteers In Technical Assistance is promoting the DCE success in terms of its future impact on PACSAT prospects. The following was recently received from VITA.

VITA NEWS RELEASE

JANUARY 17, 1985
FOR IMMEDIATE RELEASE

BREAKTHROUGH IN LOW-COST TELECOMMUNICATIONS

RADIO AMATEURS COMMUNICATE WITH LOW-ORBITING SATELLITE

USING A TINY SATELLITE NOW ORBITING THE EARTH OVER THE POLES AT AN ALTITUDE OF 429 MILES (690 KM), A TEAM OF TECHNICAL VOLUNTEERS FROM THE U.S. AND CANADA YESTERDAY SENT LETTER-PERFECT PACKET RADIO MES-
SAGES TO ENGLAND FROM HAWAII, AND RECEIVED REPLIES. THE TRANSMISSIONS REPRESENT A BREAKTHROUGH IN THE USE OF LOW ORBITING SATELLITES FOR WORLDWIDE COMMUNICATIONS. INTRODUCING THE NEW CONCEPT AT THE PACIFIC TELECOMMUNICATIONS COUNCIL'S ANNUAL CONFERENCE IN HAWAII, HIGHLY TRAINED TECHNICAL EXPERTS FROM PRIVATE VOLUNTARY AGENCIES IN THE U.S. AND CANADA SENT MESSAGES TO THE UNIVERSITY OF SURREY IN GUILDFORD, ENGLAND, WHERE THE SATELLITE (UCSAT-2) WAS BUILT. THE MESSAGES-DIGITIZED PACKETS OF INFORMATION—WERE STORED IN THE SATELLITE'S ON-BOARD COMPUTER. A FEW HOURS LATER, AS THE SATELLITE PASSED OVER GUILDFORD, THE LETTER-PERFECT MESSAGES WERE DOWNLOADED AND PRINTED OUT AUTOMATICALLY BY THE SURREY GROUND STATION'S SMALL PERSONAL COMPUTER. USING AMATEUR RADIO FREQUENCIES, INEXPENSIVE TRANSMITTERS AND RECEIVERS, AND PERSONAL COMPUTERS TO COMMUNICATE WITH A LOW-ORBITING BIRD, THE SYSTEM WILL UTILIZE THIS TECHNOLOGY IN THE FUTURE (ALREADY KNOWN AS PACSAT), WILL OFFER TELECOMMUNICATIONS NETWORKING AT A FRACTION OF THE COST OF CONVENTIONAL TELECOMMUNICATIONS. ONCE OPERATIONAL, THE PACSAT SYSTEM WILL PROVIDE SERVICES THROUGHOUT THE WORLD MUCH-NEEDED ACCESS TO LOW-COST, RELIABLE TELECOMMUNICATIONS-GROUND STATION EQUIPMENT, COSTING NOT MORE THAN $2000 AND CapABLE OF OPERATING ON BATTERIES OR SOLAR POWER, CAN BE CARRIED IN A BRIEFCASE. THE FIRST FULL-SERVICE PACSAT SATELLITE IS SCHEDULED FOR LAUNCH ON THE SHUTTLE IN EARLY 1987. SPEAKING ABOUT THE DEVELOPMENT OF THIS TECHNOLOGY ARE VITA (VOLUNTEERS IN TECHNICAL ASSISTANCE), A PRIVATE VOLUNTARY DEVELOPMENT AGENCY IN WASHINGTON, D.C. THAT SPECIALIZES IN TECHNOLOGY TRANSFER; AND AMSAT (AMATEUR SATELLITE CORP.), AN INTERNATIONAL ASSOCIATION OF HAM RADIO OPERATORS WHO ALSO DESIGN AND BUILD SATELLITES. INTERPARES, A PRIVATE CANADIAN AGENCY ENGAGED IN COMMUNITY-BASED DEVELOPMENT, SUPPORTS THE EFFORT IN CANADA. IN WASHINGTON, PACSAT INTERNATIONAL APPLICATIONS MANAGER, DR. GARY GARROTT OF VITA, SAID OF THE CONTACT IN SPACE, "I JUST WANT TO TELL THE PEOPLE COORDINATING Famine RELIEF IN ETHIOPIA HOW A PACSAT TO COMMUNICATE WITH. THEY COULD USE SOLAR ENERGY TO POWER THE RADIO. IT WOULD SOLVE A LOT OF PROBLEMS IN GETTING HELP TO THOSE REMOTE PLACES."

The University of Surrey Bulletin #109 also contained news of the DCE success. ASR and AMSAT congratulate the many involved in the milestone achievement!

**ACSSB Experimenter Kits Are Ready**

The Amplitude Compondared Single Sideband (ACSSB) experimenter kits previously described in ASR and elsewhere are now ready for distribution according to the ARRL's Project Engineer for ACSSB, Greg Bonaguide, WA1VUG. ARRL has purchased the ACSSB industrial surplus of Sideband Technology, Inc (STI) for the purpose of inoculating the amateur bands with the newest and most advanced analog voice processing techniques and to support Project Companion. AMSAT and Project OSCAR are joint partners with ARRL in Project Companion. AMSAT's objectives are to improve the realizable signal-to-noise ratio using satellites such as AO-10. Scores of advanced experimenters had signed up for the very limited supply of ACSSB equipment at prestime. AMSAT had sent invitation replies to all those who had inquiries on file at WA2LQQ as of 15 Jan. 85. Among the experimenters proposing tests for the ACSSB equipment were active satellite users, eme- ers, UHF DXers and HFers.

There were seven different equipment and documentation packages available according to the announcement sheets provided by ARRL. The kits ranged in readiness from complete RF and audio processor boards with an extensive documentation package ($75) to scrap RF boards good for parts only ($10) shipping not included.

Meanwhile, it was learned that Yaesu Electronics, Inc. of Los Angeles has been granted an experimental license and callsign (KO2XHB) by the FCC for the explicit purpose of developing ACSSB equipment and techniques.

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Jim Smith, KA7APJ, of Seattle who is the proprietor of Spectrum West and who has donated a major prize to the member recruitment drive.

**Member Recruitment Drive Winners Claim Prizes**

The winners of the member recruitment drive were announced by AMSAT HQ recently. These individuals together with others accounted for more than 150 new members signed up during the contest period. Prize selection was incomplete at prestime and will be covered in the next issue. Meanwhile the top finishers were:

1. N3C6G 26 points (Selected the FT-726R donated by AMSAT)
2. KA1M 20 points (Selected the Dynetic dual axis rotator donated by Dynetic Systems)
3. N8ETY 11 points (Selected the ARR In-Line 2 meter GaAs-FET preamp donated by ARR)
4. WA5ZIB 10 points (Selected the Mirage D1010N 70 cm amplifier donated by Mirage)
5. WA6VGS 6 points (Selected the Landwehr 2 meter mast-mounted GaAsFET preamp donated by Henry Radio)
6. WA2LQQ 5 points (Disqualified self)
7. K8OCL 5 points (Tied with WA2LQQ, WA2LMJ. Selection pending)
8. WA2LJM 5 points (Tied with K8OCL, WA2LQQ. Selection pending)
8. Dick Ruhr 4 points (Tied with Paul Beeman and WB5PMR; pending)
8. Paul Beeman 4 points (Tied with WB5PMR and Dick Ruhr; pending)
8. WB5PMR 4 points (Tied with Dick Ruhr, Paul Beeman; pending)

**N2CF Moves To New ARRL Post**

AMSAT's General Manager/Executive Director, Bill Lazarro, N2CF is stepping down as a paid employee effective 18 January. In his statement to the AMSAT Board of Directors Bill said he feels he has accomplished many of the tasks he set out to do when he assumed his present post and that the position can best be staffed henceforth on a volunteer basis. Bill indicated he wishes to continue in that volunteer capacity.

Simultaneously, N2CF has announced his acceptance of a new ARRL post. Effective 21 January, he will become
Development Manager for the ARRL working in their Washington D.C. office. The post is a new one created recently in response to the ARRL Board's mandate to develop an aggressive membership growth program. Bill moved to Mt. Airy, Maryland, a Washington D.C. suburb, to assume the AMSAT post in 1983. It is understood his reticence to move to Newington prompted the decision to base the new ARRL position in the Washington D.C. office. The Washington office is staffed at present by ARRL General Counsel Chris Imlay, N3AKD, a law clerk and clerical staff. Perry Williams, W1UED, spends several days per week working from the Washington office as well. How (if) Lazzaro's new function will relate to the General Counsel's and that of Williams is unclear. Speculation that Lazzaro's assignment to the Washington office signalled the vanguard of a major ARRL move to that area was dismissed out of hand by a senior ARRL official.

The hiring of N2CF by AMSAT in March, 1983 culminated a search of nearly eight months and constituted the first time in its history that AMSAT had a paid General Manager. Previously founder Perry Klein, W3PK, had held the dual position of President and General Manager. The AMSAT Board decided to hire a full-time GM/ED in 1982 when it appeared a vigorous growth program was in order to advantage the organization of the new communication resource then about to be commissioned (Phase 3B, aka AMSAT OSCAR 10). See ASR 53/54).

AMSAT presently has two paid employees: Bill Lazzaro and Martha Saragovitz. Martha is Office Manager and has been with AMSAT for seven years. Ms. Saragovitz indicated to ASR last week that she is seeking clerical help now so she may assume some of the functions departing Lazzaro had fulfilled. The AMSAT Headquarters office functions have expanded in recent years to include the AMSAT Software Exchange as well as membership services.

Meanwhile many of AMSAT's vital functions continue to be filled by a staff of skilled volunteers. KB2M, editor of AMSAT Satellite Journal is, for example, a professional editor for a major microwave magazine. "Additional skilled volunteers are always being sought," said AMSAT Talent Scout WD4FAB.

Short Bursts

- The Southwestern Division of the ARRL will hold its Tropical Ham硼oree February 2-3 at the Flagler Dog Track in Miami. Area Coordinator Mike Crisler, N4IFD, has planned a superb program of activities for satellite enthusiasts including live AO-10 demonstrations, a well-staffed booth and free handouts and information. Mike could use your help in the booth and operating the demo station if you plan to be at the Ham硼oree. Contact Mike at 305-382-4044 evenings.
- New Area Coordinators announced by Chief Area Coordinator WA6VGS are Robert Dalleske, W6AMW (Northern California); Ross Forbes, WB6GFI, (North Central California); Cliff Buttschardt, W6HDO (South Central California); Harry Bluestein, N6TE (South Southern California I) and (rejoining the staff) Bud Schultz, W6CG (Southern California). Congratulations to the new (and renewed) appointees!
- An AMSAT Management Conference (AMC) similar to the one held in Ohio in early December is in the planning stages in California. Newly appointed Area Coordinator WB6GFJ is the focus of the planning.
- The Fourth Annual Space Development Conference sponsored by the L-5 Society will be held at the Shoreham Hotel April 26-28. Information may be obtained by calling 800-323-5155 (312-299-3131 in Illinois) or by writing Suite 203, 2400 E. Devon Ave., Des Plaines, IL 60018. The theme of the conference will be "The Returns From Space" and the conference will focus on the wide variety of benefits space development will provide during the next two decades. The L-5 Society will also be throwing a party to celebrate its 10th birthday.
- The Arrow Communication Association of Ann Arbor, MI has awarded AMSAT's Michigan Area Coordinator Larry Koziel, K8MU, a Special Service Award for his public relations efforts on behalf of AMSAT, packet radio and the PACSAT Project. The award was made on December 11 at the Association's annual Christmas dinner in Ann Arbor. Congratulations to Larry on this fine achievement and the well-deserved award. AMSAT is proud to have such highly motivated individuals on its team!
- The Project OSCAR orbital prediction calendars were due to be mailed the week of January 21.
- A new columnist in the new magazine, AMSAT Satellite Journal, is Ray Soifer, W2RS. Actually Ray has been around the satellite field for as long as there have been artificial satellites. Ray's early articles in QST with W3PK (then K3JTE) are now classics in early satellite literature. Now W2RS has agreed to pick up the notion of the G3IOR ORBIT column. Worldwide Satellite Activity in ASI. But he desperately needs material from which to distill the column. Please send your inputs to: Ray Soifer, W2RS, 60 Waldron Ave., Glen Rock, NJ 07452.
- In DX news, ON7HP was supposed to be working AO-10 from 457 for the month of January. Did anyone work him there? QSL direct. W1BIH/PJ2 active until late spring. ZD7KH now active. FK1SB on with great 5SB signal prior to civil unrest in New Caledonia.
- Tests of batteries of RS-5, 7 and 8 show various results according to UA3CR as reported by G3IOR. RS-5's battery is almost ruined. W6CY and others have reported anomalous telemetry from RS-5 during early January when the Russian birds were experiencing eclipses. RS-5 was falsely identifying itself as RS-3 and sending garbled telemetry. RS-7's battery is in mediocre condition while RS-8's is in excellent condition according to this report. RS-5 and 8 will be in transponder mode while 7 will be in robot and bulletin mode for the next period. All satellites will be off on Wednesday Moscow time which is from 2100 Tuesday to 2100 Wednesday UTC.
- Additional information on the newest Russian birds is filtering through now. Work is complete on RS-9 and it is undergoing bench test in Moscow. It's a Mode A bird with a beacon on 29,400 MHz. It's slated for launch late this year with RS-10 which continues under development. RS-10 will have a Mode A capability but will also have a new mode, Mode K. Mode K will have a 15 meter uplink and a 10 meter downlink according to G3IOR who attributes this information to UA3CR.
- An error crept into the AO-10 telemetry printed in ASR 93. Please re-label A7 to read "2 m x m temperature." The equation remains unchanged.
Voice Bulletin Service On AO-10 Begins

The splendid series of AMSAT nets has a legacy extending over a decade of performance. The calls W3PK, WA3NAN, W3TMZ, W3KMV, W82TNC, W6SP, W3WLI, K05I, N3AR, WB4ZXS, KE0T, W6CG and others are familiar ones to AMSAT veterans. These calls evoke memories of OSCAR 6, the heyday of Mode B on AO-7 and the beginnings of Mode J on AO-8.

Similarly, the callsigns W8GQW, N4HY, W7FF, WD9HU, N6TE, W8CY and WA2LQQ now ply the airwaves on behalf AMSAT. These fellows carefully sort, analyze, collate, verify, translate and then present news of AMSAT and related space activities on which the community thrives. Dozens of others operate local VHF/UHF nets in the interest of local satellite users groups.

Now however, the AMSAT HF Net Control Stations (NCS) are becalmed in the dog days of declining HF propagation. The higher frequencies (10 and 15 meter bands) are mostly poor with the former virtually unusable for scheduled activities and the latter spotty at best. This drives HF users down in frequency. The result is that 20 meters is seeing extremely high usage. This further degrades the performance of the AMSAT 20 meter nets which have suffered increasingly in recent years from QRM.

Moreover, the distribution of information from AMSAT HQ to NCS around the world and the ability of AMSAT to keep in contact with its Directors and Officers using the HF bands has been all but obliterated. Even the 75-Meter nets, which had been largely immune to the propagation decline and QRM aggravations, are now affected. Thus, according to AMSAT officials, it is time to begin an evolutionary process which will result in greater reliance on OSCAR 10 and its successors for Net operations and information distribution.

With the forward-planning expertise of Operations Vice President (acting) John Champa, K8OCL and Net Manager Wray Dudley, W6GQW, a series of experimental voice bulletins via OSCAR 10 began on 6 Jan. 85. The transmission of AMSAT Bulletins is similar to a service initiated by the RSGB last year. The RSGB service aimed primarily towards European consumers (See ASR #84, 13 Aug. 84). The new bulletins also build on the experience derived by W6KAG who had been retransmitting the pre-recorded AMSAT Southwest Pacific Net originated by W6CG. (See ASR #70, 24 Jan. 84)

According to AMSAT President WA2LQQ, the AO-10 bulletins will have several important functions:
1) Reliable, predictable, current information to consumers via easily heard satellite transmissions.
2) Reliable, predictable, current information to NCS for further dissemination to consumers.
3) High quality audio for real-time VHF/UHF gateway use.
4) High quality audio for recording and later retransmission on other nets and frequencies (particularly local nets).
5) Introducing ACSSB techniques using a highly practical application.

And, beginning in early spring, 1985,
6) Demonstrating the significant performance improve-

Sustaining Life Membership for 1985 Available

AMSAT HQ has announced the immediate availability of the 1985 Sustaining Life Memberships. Once again you, the AMSAT Life Member, have the opportunity to reaffirm your confidence and loyalty to the Amateur Space Program ideals by your participation in this meaningful program.

Last year hundreds of your fellow Life Members upgraded their membership class to Sustaining Life Member. Their reward was in knowing that they had once again supported the organization and helped to defray the cost of ongoing membership services. And their participation was recognized with a unique, handsome lapel pin which distinguished them as Sustaining Life Members.

Now the 1985 Sustaining Life Memberships are available. But this year it is more important than ever to have YOUR support. In addition to the membership services that are always provided, AMSAT has begun a new magazine to better serve you. AMSAT Satellite Journal, ASJ, will be on its way to you shortly. We plan 8 issues per year. But the really big news for Life Members to sit up and take notice about is the news that another Phase III satellite is on the way! That's right! Phase IIIC will be launched in 18 months. And it will have a great array of features bound to capture your attention. Features such as Mode B, Mode SL (A SUPER-performing Mode L); Mode L digital and an S-Band beacon. Plus an improved orbit and antennas that will make Phase IIIC a real "star" performer. But all this depends on your support now.

By becoming a 1985 AMSAT Sustaining Life Member today, you'll be helping AMSAT realize its goals and you'll be helping yourself into a new satellite system, a new magazine and the satisfaction of knowing you're an integral part of the team that makes it all happen. Your modest $15, tax deductible donation is all it takes. And your status as a 1985 SLM will be promptly recognized with a special new, distinctive SLM pin for 1985 which features the AO-10 tri-star silhouette in gold and blue finish. A proud badge for you to display everywhere. Send today. AMSAT, P.O. Box 27, Washington, DC 20044 or call 301-589-6062. MC/VISA accepted.
ments obtainable with Mode L compared with Mode B when the the bulletins are carried on both Modes for ease of comparison.

7) Laying the foundation for the anticipated Mode SL (Super-L) now being planned for Phase IIIIC. (due for launch Mid-86).

The 6 Jan. 85 (2130 UTC) inaugural of the bulletins had excellent results according to a sampling of listeners across North America. Early estimates indicate more than 100 stations were on line at the time. The satellite was positioned over 18N, 132W yielding excellent coverage for North America. According to command station VE1SAT/VE6, best operations under the present schedule and pointing angles can be obtained when the satellite is to your west and prior to apogee. The satellite is off-pointed to accommodate seasonal sun-angle variations and is not pointed at the geocenter when at apogee as had previously been the case. On the 6 Jan. inaugural session, the mean anomaly was 78 at the start of the bulletins. (MA 128 is apogee).

The second session came on 12 Jan. 85. As might have been expected, this Saturday session which began at 1700 UTC (MA 69) had good results but not quite as favorable as the first session. The satellite was over 19N, 75W at the time yielding an az-el of 102 by 64 from originating station WA2LQQ. As above, best results can be expected when looking west to the satellite under present satellite orientation conditions.

The Mode B bulletins had been transmitted on the AMSAT Calling and Net Frequency (ACNF) of 145.957. However, starting with Bulletin #5, Mode B bulletins will be transmitted on Special Service Channel (SSC) H2 with a nominal downlink frequency of 145.962 MHz. (Subject to SSC coordination)

Amplitude Compressed Single Sideband (ACSSB) bulletin transmissions will begin in early spring according to WA2LQQ. Stations equipped to receive ACSSB will enjoy a substantial improvement in signal-to-noise ratio. Stations which use only simple expander circuits in their receive audio circuits (such as ones designed by WB6JNN and N6TX of Project OSCAR) will enjoy a noticeable improvement. Others receiving on normal SSB receivers will realize no improvement in s/n but will hear what sounds rather like highly compressed audio not atypical of that already apparent in the ham bands. Also, the casual, non-ACSSB listener may note a low-level pilot tone offset from the "zero-beat" by exactly 3.1 kHz. (There is no zero-beat per se with SSB, of course). This pilot tone, 10 dB down from voice peaks contains coded information on compression levels at the source and provides a post for locking AFC circuits.

According to ARRL Officials, ARRL also plans ACSSB bulletins via OSCAR 10 later this year. Included will be the regular ARRL voice bulletin regime as heard on W1AW. Project Companion, a joint endeavor of AMSAT, ARRL and Project OSCAR aims to bring this advanced voice processing technique into the Amateur Radio community.

The following table presents planned bulletin transmissions.

<table>
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<th>Bttn#</th>
<th>Day</th>
<th>Date</th>
<th>Time</th>
<th>Orbit</th>
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<td>115W</td>
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<td>76W</td>
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<td>Sun</td>
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<td>1367</td>
<td>52</td>
<td>16N</td>
<td>154W</td>
</tr>
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</table>

Notes:
1. Downlink frequency 145.957 MHz; the ACNF.
2. Downlink frequency 145.962 MHz; SSC H2 (subject to SSC coordination).
3. Marginal performance anticipated due to poor look angle from originating station.
4. Assumes continuation of transponder schedule introduced 01 Jan. 85. If transponder schedule is adjusted, expect these schedules to be adjusted as well.
5. Marginal performance anticipated due to post-apogee timing.
6. Initial trial of Mode L bulletin service. Tentative downlink frequency is 436.280 MHz, USB.

Two-Meter QRM Threatens
OSCAR Operations

Distressed satellite users are reporting an upsurge in inadvertent interference to satellite operations. In many areas of the country, 2 meter operators are working within the 145.800 MHz to 146.000 MHz zone ascribed by gentlemen's agreement to OSCAR use. Mode A uplinks and Mode B downlinks both occupy this limited territory as a check of spectrum allocations will attest.

But satellite users may be inadvertently adding to the QRM by themselves conversing in terrestrial QSOs when the satellite(s) are out of view. What apparently happens is that hams not familiar with OSCARs happen upon the
QSOs of the satellite users. The satellite users incorrectly believe that since the satellites are out of view, it’s OK to work terrestrial stations. But the casual observer, not knowing this to be special turf, assumes he may proceed with QSOs there as well. Obviously the trouble arises when a satellite pops into view and the non-satellite occupant of 145.8 - 146.0 is suddenly accosted by those who would have that portion of the band instantly revert to “Satellite use only!”

The answer to the dilemma is to avoid using 145.8 to 146.0 MHz except for satellite communications. Even those who “know” where all the satellites are, using this turf for terrestrial QSOs opens the door for others. If we are to preserve any semblance of the gentlemen’s agreement regarding spectrum occupancy, we must observe our own recommendations and avoid terrestrial QSOs in the “satellite” portions of ALL the bands including 10, 2 and 0.7 meters.

Area Coordinator List

The following is the most recent update of AMSAT’s Area Coordinator list. Use your callbook for correct addresses.

- First Call District K1DS(RI); W1JSM (NH); KA1M, W11AS (MA)
- Second Call District N4EL2, KW2U (NY, NJ); WA2LJM (NY)
- Third Call District N3CEG (MD); W3KH (PA)
- Fourth Call District W4AUZ (KY); W8BCA/4, W4DWN, WD4HWO, N4IFD, WB4ZXS (FL); W4DAQ (AL); W4F; K4SR (VA); WB2LIE/4 (NC); N24Q (GA)
- Fifth Call District N5BRG, WB5PMR (TX); W5GCLD (OK); WA9PZJ/5 (LA); W9SWH (WA)
- Sixth Call District WH6AMX (HI); W6KAG, WA6VGS, WB6GFD, W6CCG, N6TE, W6HDO, W6AMW (CA)
- Seventh Call District K7APJ (WA); W7F, W7US (AZ); K17L (UT); W7LSV (OK); W7R5Y (MT)
- Eighth Call District N8ATB, N8ETY, W8BLAJ, W8BGP, W8BRVD, WB8IFM, N8AEG, WA6YBTB (OH); WB8ZTV (VA); K8MU (MI)
- Ninth Call District K9ID, N9HR (WI); W9JUV, W9MNC, K9RL (IL); K1FJ; K9PV (LA)
- Tenth Call District N0AN (IA); W0CA, K8GA (MN); W0GT (SD); K0RZ, W0VO (CO); W0SL (MO); W0CY (KS)

Nick Laub, W0CA, winner of the AMSAT-Stoner Challenge Cup.

yet, but in 1983 it was just $15. For further information, contact:

Mr. Bob Popham
Satellite Program Specialist NOAA/NESDIS
E/ER2, Room 3301, FB4, Mail Stop D
Washington, DC 20233
(301) 763-7289

New Tapes Available at Video Tape Library

The AMSAT Video Tape library is operated for AMSAT members by Dr. Roger Johnson, WB0GAI. The library was recently augmented with a series of videotapes recorded by WB0GAI at the 1984 Second Annual Radio Amateur satellite Symposium in Los Angeles last November. These tapes are now ready for loan to interested amateurs and groups. Roger tells ASR the new tapes are as follows:

#10 - Introduction to the Symposium; Advanced Gateway Concept by Al Dayton, KA4IFO; JA5-I by Harry Yonedo, JAIANG; Project Companion (ACSSB) by Paul Rinaldo, W4RI and Jim Eagleson, WB6JNN.

#11 - Computers and Satellites by Bob Diersing, N5AH; OX3FS Memorial Presentation to Dr. Bob Leonard, KD6DG by Vern Ripportella, WA2LQQ; Solar Sail Project by Mark Bergham, Robert Staehle and Chauncey Uphoff.

#12 - PACSAT Forum with Harold Price, NK6K, Wally Lindstruth, WA6JPR, Rick Fleeter, W8VFG, Phil Karn, KA9Q and Martin Sweeting, G3YJO; Satellite Economics by Dr. Tom Clark, W3IWI; Ham-In-Space Activities (shuttle)

WX-Sat Viewers To Gather Near Washington, DC

A satellite conference of interest to Radio Amateurs will be held in the Washington, DC area from April 15 through 19. The Second International Satellite Direct Broadcast Services Users Conference will be held at the Holiday Inn, near the Baltimore-Washington International Airport. The program, sponsored by NOAA/NESDIS, the National Aeronautics and Space Administration (NASA), and the World Meteorological Organization (WMO), will include formal amateur participation, an exhibit of commercial equipment, plus a variety of seminars. The previous conference, in 1983, attracted approximately 50 Radio Amateurs interested in weather satellite picture reception.

The conference provides a forum for designers and managers of the NOAA and GEOS environmental satellites and their users. The registration fee hasn’t been announced
by Bill Tynan, W3XO.

#13 - Phase IV and Future Projects by Vern Ripportella, WA2LQQ

#14 - The UoSAT 2/OSCAR 11 story. A brief account of the development and launch of the newest OSCAR. With an intriguing audio accompaniment.

These tapes are available in VHS format only at present. Tapes are available for a $6.00 per tape fee for a 3 week maximum borrow term. A check for the fee ($6 per tape) plus a second refundable deposit check for $25.00 should accompany each request. Mail orders or inquiries to: AMSAT Video Tape Library, c/o WBBGAI, 1627 36th Ave. Court, Greeley, CO, 80634.

Earlier tapes (#1 through #9) continue to be available. Send an SASE for a complete listing.

UoSAT Bulletin-109  18th January 1985
UoSAT Spacecraft Control Centre, University of Surrey

General News

Digital Communications Experiment on UO-11

The DCE on UO-11 successfully demonstrated digital message ‘store-&-forward’ techniques for the first time last week — with exchanges between UoS, NK6K (LA) and WH6AMX/WA3ZIA/VE3ALL in Hawaii — at the Pacific Telecommunications Conference held in Honolulu. Despite very poor weather in Hawaii making portable demonstrations difficult, messages were exchanged on 16 Jan, around 2100 gmt and the Special Event Bulletin received from UO-9 during the Conference.

Meteorological Spacecraft

NOAA-9

NOAA-9 was launched at 10:42 gmt on 12 December and is scheduled to enter service on 1st February 1985.

UoSAT Spacecraft

UoSAT-OSCAR-9 Schedule

The Bulletin/Digitalker/Telemetry mode at weekends has been changed to transmit approx 3 mins of 1200 bps telemetry alternating with approx 6.5 mins of Bulletin — we hope that this format will make it easier to receive complete copies of the Bulletin! The Digitalker experiment has been moved to Mondays where it will alternate with 1200 bps Telemetry, as it is primarily intended for educational demonstrations. The remainder of the formats are unchanged although the usual Wednesday & Thursday schedule has been switched to provide more regular telemetry coverage.

With the increasing use of home computers to display spacecraft telemetry — and the now familiar UO-11 telemetry format — we are seriously considering changing ALL UO-9 telemetry to error-protected or ‘checksummed’ data via the OBC. This has the very great advantage that the telemetry data can be checked for errors automatically by using a ‘home’ computer and automatic archiving and data analysis routines become practicable. The disadvantage is that, as seen on the UO-11 telemetry, the telemetry frame data cannot be so easily read by ‘eye’ — however we suspect that the majority of users employ computers to display the data and this format would allow real-time displays in ‘engineering’ units to become standard. Please let us have your thoughts/comments on this. The new schedule is as follows:

Friday - load Bulletin
Saturday - Bulletin/1200 bps telemetry
Sunday - Bulletin/1200 bps telemetry
Monday - DIGITALKER/1200 bps telemetry
Tuesday - CCD Camera - next week Radiation data
Wednesday - Computer check-summed telemetry
Thursday - Whole orbit telemetry survey

The 2.4 GHz Beacon will be in use this week.

UoSAT-OSCAR-11 Operations

The major activity this last week has been associated with the Digital Communications Experiment.

The DCE has been active since May 1984 when it was configured to provide the digital ‘bypass’ necessary to overcome the break in one of the uplink data paths that caused the communications problems just after launch last March. The provision of the ‘bypass’ by the DCE restored UO-11 to full operations and enabled the commissioning of the spacecraft to proceed. Software was developed by GB6NF at UoS over the last few weeks to enable the 1802 OBC to assume the role of providing the ‘bypass’ as part of its routine housekeeping functions (attitude control, whole-orbit surveys, packet communications, programmed command etc.) and thus release the DCE to embark on its own experimental programme to demonstrate the feasibility of ‘mailbox’ communications.

Preliminary software was developed by WA3ZIA/VE3’s group in Canada in conjunction with NK6K and loaded by NK6K into the DCE on UO-11 from the USA after the OBC had assumed responsibility for the ‘bypass’ functions on 090185. This preliminary test software enabled the DCE to support a very simple digital message ‘store-&-forward’ facility demonstrated regularly last week to coincide with the Pacific Telecommunications Conference. A great deal of hard work (& long hours) was necessary on both sides of the Atlantic to develop all the spacecraft & groundstation software and support hardware in order to mount this demonstration and get the DCE programme under way — thanks to all involved!

The DCE is intended to provide an experimental facility to evaluate the hardware, software and operational protocols that will be required for a fully operational satellite ‘mailbox’ system called PACSAT - Packet Communications Satellite. The DCE, with its limited up & downlink capabilities, will only be able to support an experimental rather than an operational facility, hence the DCE will only be available initially to a very limited number stations involved in the development of these experimental software, hard-
Orbit Predictions By KA9Q

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Amateur Satellite Report is published and mailed First Class bi-weekly for the Radio Amateur Satellite Corporation. The purpose is to enhance communications among the Amateur Radio Satellite Program. Subscription rates for the United States, Canada, and Mexico are $22.00; Foreign is $30.00. The rate covers 26 issues (typical one year). Send check or money order in U.S. dollars (drawn on U.S. banks only) to "Satellite Report," 221 Long Swamp Road, Wolcott, CT 06716. Information contained herein may be quoted without permission provided credit is given to Amateur Satellite Report, Wolcott, CT 06716. Amateur Satellite Report is Copyright Protected and duplication of this publication in any way including by the photocopy process or by electronic means (computer data banks, etc.) is not permitted under any circumstances. Amateur Satellite Report is endorsed by the ARRL as the special interest newsletter serving the Amateur Radio Satellite Community. The editorial opinions expressed are not necessarily those of the ARRL.
Mode L Performance Improvements
Surprise Even Optimists

The improvement in AO-10 Mode L performance over the last year has been astounding according to several veteran satellite users including Mode L expert Bill McCaa, K0RZ, and AO-8 Mode L expert Frank Wiesenmeyer, K9CIS. Recent tests show surprisingly moderate power levels are adequate for enjoyable QSOs on the newest OSCAR mode.

When first launched in 1983, AO-10 Mode L showed disappointing performance. The required uplink power was about 10dB higher than anticipated according to Engineering Vice President Jan King, W3GEY. Failure analysis first focused on an antenna relay used to select either the 1269 helix or omni antenna for the Mode L receiver. Subsequent analysis, however, now makes this possibility seem less likely according to W3GEY. On the other hand, diagnosis by specialists in AMSAT DL as well as by AMSAT now points towards the HELAPS (High Efficiency Linear Amplification by Parametric Synthesis) amplifier as the culprit. According to W3GEY, DJ4ZC and his team at AMSAT DL strongly suspect a bias regulator in the HELAPS, a JANTXV 2N2222, as the failure locus. The HELAPS is consequently running as a Class C amplifier rather than its linear mode as designed. This reduces the output which in turn forces a stronger uplink for a given downlink signal. Some estimates a year ago suggested upwards of 30 kW EIRP were required for usable QSOs. That value compared with the pre-launch estimates of 2 to 3 kW EIRP.

Now, however, due to a number of favorable circumstances, performance appears to have improved to not only pre-launch expectation but beyond. A recent demonstration by K9CIS, for example, showed that a mere 1.4 kW EIRP was sufficient for a very satisfactory SSB QSO on Mode L. Moreover, Frank’s straightforward approach to obtaining what at first blush seems prodigious amounts of power at 1269 MHz should encourage others to get started immediately on Mode L.

In a recent ASR telephone interview K9CIS described his Mode L transmitter. He uses a Microwave Modules transmit converter (2m to 24cm) which produces between 1 and 2 watts. This drives a single stage, one transistor amplifier which produces about 8 watts.

"I dump the 8 watts into a crummy piece of coax. About 3.5 watts comes out the other end to feed a 7-foot TV dish," K9CIS relates. "The feed is a simple 3½-turn helix wound for left-hand circular polarization. When reflected from the dish surface, that becomes right-hand circular, of course."

We inquired about the dish.

"A very old Channelmaster UHF TV dish; it's seven feet in diameter. At 50% feed efficiency I figure I get 26 dB gain. With 3.5 watts, that gives me about 1400 watts EIRP and an 8 degree 3 dB beamwidth," Frank related.

Using that equipment K9CIS was 6 to 7dB above the noise in 2.4 kHz on SSB at WA2LQQ (2 X 18 elements; 0.5 dB NF GaAsFET on the mast).

According to K0RZ, the improvements in Mode L performance derive from several sources. "Since Mode L comes on well before apogee now, as compared to previously, the satellite is closer. The path loss improvements add up to about 5dB improvement," Bill told ASR recently. "The major improvement is pointing angle," he added. "The Mode L receive helix has a fairly narrow beam width and the choice of Mode L operating times is absolutely critical if reasonable performance is to be attained. The other major improvement comes from the re-biasing of the faulty output stage with heavy loading. For example, as an experiment, Cor, VE7BBG, would aim his big EME array at AO-10 and transmit. Instantly signals which were not heard before come up by many dB. The output stage is self-biasing to an extent with load so that it is running in a more linear regime. The same effect is noticed to a degree when the RTTY beacon comes on to replace the PSK beacon."

K9CIS says the improvement in downlink when the RTTY telemetry is on can amount to as much as 6 dB. AMSAT is looking into ways to keep the RTTY beacon on more of the time according to W3GEY.

Meanwhile, satellite controller VE1SAT says that we can look forward to continued favorable pointing angles for Mode L for the foreseeable future. K9CIS adds that he is aware of Japanese Mode L operators having successful CW QSOs with only 10 watts to a single loop Yagi! In other words, if you do it right, you can get along with 1 kW EIRP or less. But (and this is a big "but"), you have to get all the parts "right". The point is that it would appear that at present Mode L performance can be not only as good as but superior to pre-launch estimates. The news of improved
Mode L performance is expected to strongly encourage further inroads on that mode by those now experienced on Mode B. Many Mode L newcomers are reportedly amazed by the absence of spin modulation and QRM. The lure of more than 800 kHz of spectrum is bound to be an attraction. Meanwhile, K8OCL has begun to identify those elements to be considered for a Mode L bandplan. With the advent of Mode L voice bulletins later this spring and the improved performance more than evident, John points out that it may be time to begin thinking about how this vast territory (Mode L spectrum) might be organized. With the Mode L performance improvements now manifest and becoming known to an increasing number of users, the stage may be set for Phase IIC now less than 18 months from launch. This bird may include a Super L mode with up to several hundred watts of downlink power available from its HELAPS amplifier. In an upcoming ASR we will highlight currently available Mode L equipment. According to K9CIS, he is on Mode L having made a nominal $200 improvement over his Mode B station.

**Short Bursts**

- February 17th has been declared "W6CG" day on AO-10 to honor the veteran spacecraft commander and operator. The announcement of this honor, virtually unique to date, was made at an AFCEA Ham Radio Luncheon 31 January in Anaheim, CA. An AMSAT Special Achievement Award plaque was presented to Bud along with a special citation from AMSAT President WA2LQQ. The presentation was made by AMSAT Chairman W6SP and arranged by N6DD. Congratulations on this truly distinguished award!
- Some rare satellite DX has shown up recently. XE1TU led a satellite DXPedition to Revilla Gigedo operating as DX4MDX 8-10 Feb. Unfortunately, the announcement was received too late for prior issue. But here's one that you can catch if all comes together as planned. WD4FAB is helping to arrange for an AO-10 station to be operated from the very rare W11BGD in Baghdad, Iraq! Watch for this one coming through your radio soon.
- Congratulations to two new Area Coordinators. They are Lyle Mabbott, W7KMF, for Wyoming and Robert Barbee, W4AMI, for Tennessee. Welcome aboard to these newest "A-Team" members! Additional team members still required in ID, ND, AR, MS, VT, NE, SC and ME. Any takers? These bills are going fast thanks to WA6VGS (Chief Area Coordinator).
- The first printing of the popular Satellite Experimenters' Handbook has sold out. The 13,000 copies of the first printing lasted about a year. ARRL advises a second printing will be off the presses on or about 1 Mar. 85. Orders for this excellent book by former AMSAT Director Dr. Marty Davidoff, K2UBC, will be filled as soon as copies are available according to AMSAT Office Manager Martha Saragovitz. AMSAT realizes a small commission on books sold through it so it naturally encourages your patronage to the AMSAT bookstore.
- The Project OSCAR orbital prediction calendars have been mailed according to Project OSCAR officials.
- Project OSCAR held its annual meeting at the Foothill College, Los Altos, CA, on Saturday, February 2. Several excellent presentations were given including a status report on Project Companion by Jim Eagleson, WB6JNN. Jim explained how ACSSB techniques are being introduced to amateur SSB equipment and what it can mean in terms of improvements in voice communications. (See related story elsewhere in this issue.) The major organizational business was the election of officers. At press time we were aware that W6SP was re-elected Chairman and W6XN was re-elected President. Congratulations!
- The launch of the next ham-in-space is holding at 9 July 85 according to AMSAT's VP-Manned Space, Bill Tynan, W3XO. W0ORE will carry a sophisticated equipment suite if the approval cycle goes as expected.
AMSAT's Software Exchange desperately needs a consultant who can help newcomers get started with the various programs the exchange has in stock. In particular, AMSAT needs someone who can answer telephone questions on using the IBM-PC version of the W3IWI orbital prediction program. Interested? Call Martha at 301-589-6062. Thanks!

The Institute is a monthly news supplement to the IEEE (Institute of Electrical and Electronic Engineers) journal, Spectrum. The February issue of The Institute has a fine article on PACSAT based on interviews with W3GEY and W4RI. Good reading in the professional media. Copies? SASE to WA2LQQ at P.O. Box 177, Warwick, N.Y. 10990-0177 will get you a copy.

Additional prize selections in the member recruitment drive (See also ASR 94/95) were: KBOCL selected the KLM 2m-22C antenna donated by KLM. John chipped in a few dollars of his own and upgraded the donated antenna to the new, super KLM 435-40CX. Ramon Traver, WA2LJM, selected the Tokyo High Power HRA-2 mast mounted GaAsFET preamp donated by EnComm. Dick Ruhr, WD5GLD, selected the new rotor control computer interface by Spectrum West. Dick selected the unit which works with the Vic 20 computer. Paul Beeman, K2MUM, selected the Tokyo High Power 70 cm power amplifier model HL-45U donated by EnComm. Al Brinkerhoff, WB5PMM, selected the KLM 435-18C antenna donated by KLM. Our sincere thanks to these diligent recruiters. A special note of thanks to the fine sponsors who donated these great prizes. Over the next few weeks we'll be featuring some of these products here to introduce AMSAT members to the distributors who have supported this important member recruitment drive. We say thanks and pledge our support to you in return. Thanks!

A German DXpedition to Antarctica features DP0G VN operating SSB on 145.920 MHz through March 1. His QTH is 71° south, 89° west. QSL to DJ4ZO. Thanks WA2RDE.

A 457 station using equipment loaned by ON7HP is expected on OSCAR-10 throughout March.

Companion Kits Coming Soon

Project OSCAR's Jim Eagleson, WB6JNN, tells ASR that while the ACS65 kits offered by ARRL in the Project Companion effort provide state-of-the-art analog voice processing, a meaningful improvement can be obtained with very simple compressor/expanded chips readily available. Jim says he and several others are putting together a simple bolt-on accessory kit which will be available soon. The unit will offer about 2-to-1 compression and expansion. This will provide some improvement but less than the 4-to-1 compression/expansion on the STI ACS65 design. If you'd like information on these kits send a SASE to WB6JNN, 15 Valdez Lane, Watsonville, CA 95076. These processors have the advantage of working in the AF circuits rather than in the IF. That qualifies them as "bolt-ons" rather than "surgical implants" as is most often the case with IF processors.

AMSAT Officials to Brief Nebraska Confab

AMSAT will be well represented at the upcoming Nebraska ARRL Spring Convention the last weekend in March. Symposium speakers will be John Champa, KBOCL, executive vice president and acting vice president of operations, as well as Ralph Wallio, W8RKP, assistant vice president for operations.

At a Saturday symposium, Champa will describe AMSAT, its current activities, and its plans for the future. Wallio will explain what packet radio is and how radio amateurs can participate in that new and exciting form of digital communications.

The convention will be hosted by the Midway Amateur Radio Club of Kearney, Nebraska, best known in the U.S. for its sponsorship of the popular North American Teleconference Radio Network. In fact, convention attendees will be treated to a first-hand look at how teleconferencing works when the club stages a live network on Friday night from the Holidome. The guest will be Jim Larsen, K7GE, of Larsen Antennas. The net will begin at 8 PM CST.

Other speakers planned for the convention are ARRL headquarters staffer Steve Place, WB1EYI, ARRL Midwest director Paul Grauer, W9OR, and his vice director, Dick Dyas, W9CP. Joe Eisenberg, W6WRI, will brief the convention on the difficult problems of frequency coordination and radio-frequency interference.

The convention will be held at the Holiday Inn in Kearney on March 30-31. For more information, contact the Midway Amateur Radio Club at P.O. Box 1231, Kearney, NE 68847.

Dayton Conference Caters to VHF/UHF Afficianados

Satellite operators and terrestrial communicators will both find this year's International VHF/UHF Conference of in-
The event will be held from April 26, 27, and 28 in conjunction with the Dayton Hamvention and will feature a noise-figure contest, antenna gain measurements, and technical forums.

There are no forums scheduled for Friday this year so that attendees can explore the famous flea market and commercial exhibits. But at 1800, after the Harra Arena closes and the RF interference drops, the noise-figure contest will begin. Prizes will be awarded to winners in the homebrew category for preamplifiers operative on amateur bands from 144 to 2304 MHz.

The technical forums begin at 0900 on Saturday and will cover such topics as antennas, propagation, dynamic-range measurements, and contesting. The antenna-gain measurements start at 0900 on Sunday behind the Harra Arena. A new and improved range is being prepared. Certificates will be awarded for the highest gain and the best figure of merit. Again, prizes will be garnered by winners in the homebrew category for antennas on 144, 220, 432, and 1296 MHz.

For more information, contact the conference moderator, Jim Stitt, WABONQ, at 311 N. Marshall Road, Middletown, OH 45042.

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**Final PACSAT Technical And Management Review Meeting 9-11 March 1985**

The following important announcement from VITA was received by ASR:

This meeting, funded by the Hoover Foundation, will be held in Washington, D.C. March 9-11. It is being co-sponsored by VITA and AMSAT. One, and possibly two days, will be held at Goddard Space Flight Center so that NASA GAS-can people and PACSAT volunteers can begin to interact. The remaining day(s) will be held at VITA in Roslyn (across the river from Georgetown, DC).

A detailed agenda is in the works. While there will be technical working sessions, the prime purpose of the meeting is to explore the options available to complete the project in time for a possible January 1987 launch within the context of likely limited availability of funding (although we are pressing for commitments from those foundations still “sitting on the fence” prior to the meeting).

We must decide on the course of action to take, with all its technical and management implications for this meeting. Parts of the Launch Service Agreement must be completed by 17 July 1985 or the project loses its place in line. Sometime shortly after this document is submitted, the Payload Accommodations Requirements document must be completed and submitted.

VITA special projects coordinator Sheila Ferguson will be coordinating details of the meeting. Both EIES and TELEMAIL will be read regularly. Sheila can be reached by telephone at (703) 276-1800.

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**ORBIT PREDICTIONS BY KA9Q**

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<tr>
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<tr>
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<td>Longitude increment:</td>
</tr>
<tr>
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<td>30.015164 deg w/orbit</td>
</tr>
<tr>
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The “Bob and Wray” team of Ohio comprises (left) Bob Roger, WJ8JE and Wray Dudley, W6GQW.
New RS Birds Undergo Ground Tests

Special to ASR by Dex Anderson, W4KM*

“’The successful operation over a period of three years of radio amateur satellites Radio 5 through Radio 8 has stimulated further work by radio electronics enthusiasts in creating new, improved on-board satellite equipment. In the volunteer space-technology laboratory of the Zhdanov Rayon radio club in Moscow city, tests have begun on one variation of on-board repeater and automatic operator “robot’. The following members of the laboratory took part in creating them: A. Leonov, B. Lebedev, A. Popkov, V. Solov’yev, B. Omel’chenko, A. Savchenko, Yu. Kornilov, V. Mironov, S. Rodin and many others.

“In November of last year, in the “satellite” segment of the radio amateur 10 meter band (frequency 29.402 kHz), the “RS-9”’ beacon went on the air. It transmits telemetry information analogous to that sent in the airwaves from orbit by the “Radio” series of satellites. At year’s end the repeater too was switched on translating the band of frequencies 145.860 to 145.900 MHz to segment 29.360 to 29.400 kHz. Many shortwaves and ultrashortwaves from Moscow and the Moscow area (UK3A, RS3A, RA3AHM, RA3AAMM and others) have already made initial contacts via this repeater. The principles for use of the terrestrial repeater are the same as those now operating from space orbits. The basic principle is choice by the operator of a transmitter power level such that the translated signal level does not exceed that of the beacon signal in which case mutual interference will be minimized.

“The repeater is switched on around the clock but the robot is on the air irregularly. It transmits its own CQ on the frequency on which it should be called. Operation with the robot is conducted in accordance with the same program as with the robots of the “Radio” series of satellites.”


Short Bursts

- Flying to the Dayton Hamvention this year! Piedmont Airlines is offering a 35% discount on all flights to and from Dayton, Ohio for the Dayton Hamvention. The discount is valid from 25 to 30 April and reservations must be made in advance. Call 1-800-334-8644 for further information. Thanks ARRL letter and W5YI.
- In DX news, a German Antarctic DXpedition is underway with DP5GYN operating from 71 degrees S, 8 degrees W. His downlink is most often around 145.920. Lothar will be operating this station until 1 March 85. QSL to DJ4SO.
- Although ON7HP will not be traveling to 457 as previously thought, word is that one of Peter’s colleagues from Belgium will. Watch for an ON operating portable from Sri Lanka, 457 anytime during the four weeks following 6 February.
- A meeting of satellite users and interested amateurs will be held at the Fort Mason Officers club in San Francisco on 23 Feb. at 10:00 AM. Contact WB6GFJ at 415-948-5000 for further information.
- AMSAT is pleased to announce the appointment of the following new Area Coordinators and Assistant Area Coordinators. For Southern Nevada, K7ZOK; for Alabama, Asst. ACs N4HY and W4KDP; for Sacramento area, Asst. AC WA6HBV. Welcome to the “A” team, gentlemen!

Robert Staehle, President of the World Space Foundation.
ASR At 4: What Next?

With this issue, Amateur Satellite Report, ASR, completes its fourth year of publication. Looking now into its fifth year, the newsletter is strong, vibrant and brimming with the same enthusiasm which led to its conceptualization late in 1980.

But things have changed. A lot of ink has gone on paper since the premiere issue went to press in late February, 1981. Is that all there is to tell of nearly 100 issues? A pile of paper and a lot of ink? Tons of thousands of stamps and envelopes?

For a moment let's look back to see where we've been. Then perhaps we can best understand where we are (or should be) going with the future of ASR.

The concept of ASR grew from the notion that active satellite users required information more frequent and current than that which came in their magazine. The concept also grew from the realization that active satellite users also often required information which was too detailed or too laborious to transmit and receive verbally over the various on-the-air nets. Finally, ASR arose from the need to provide authoritative, reliable information to the AMSAT leadership itself. That is, the net operators themselves required a regular source of reliable information to interpret and tailor for the particular segment of the community they intended to serve.

In sum, ASR was intended to be a small circulation (say about 100 readers or less) newsletter which would to help weave together the most active satellite users and a sizeable segment of the Area Coordinator corps as well as net operators. That's not what resulted, however.

Word soon spread widely about the new newsletter and circulation grew well beyond original expectations. Today, circulation exceeds 1000 worldwide.

One of the main intentions of ASR (AMSAT Satellite Report at its inception) was to highlight the excellence of its superb team of Area Coordinators and others who had manifestly improved or contributed to the amateur satellite community. So it was that the premiere issue featured none other than Michigan's veteran Area Coordinator, Dick Cotton, W8DX, of Detroit. In ASR #1 we said, "There are a few calligns which are widely recognized on the OSCARS. Few, if any, are as well known as W8DX. Dick has obtained the uncanny ability to be the first satellite contact for a truly amazing number of amateurs. Among those whose first AO-6 contact was W8DX is practically every HQ AMSAT staffer!"

Not much has changed here, apparently. Although recently retired as an AMSAT Area Coordinator, Dick still plies the airwaves on AO-10 trawling for new calls.

In issue #2 we spotlighted another venerable DXer, JA1ANG, Harry Yoneda, an AMSAT Director, of Tokyo. Harry had first been elected to the Board some months earlier and his fortunate trip to New York gave ASR its first meeting with this distinguished visitor from abroad. Together with JA1NET, JA1ANG had founded JAMSAT, the Japanese AMSAT organization.

Later we featured some others active (most still active) in OSCARS including: W4MID, W2BXA, VE5XU, W7US, K2ZRO, WH6AMX, W8SL, W0CY, Martha Saragovitz, VE3TW, K2KLV, W6CG, W8CA, W2FY, Jorge Ordonez, KO5I, W6SP, WD4FAB, W0PN, ZL1AOX, W4PUJ, W2GFF. Then, with a clamar for more news content, we slowly abandoned one of the original goals; spotlighting AMSAT's key "doers".

ASR was initially written by WA2LQQ on a rickety old IBM typewriter, vintage 1950 or so, which had a strong propensity for eating ribbons. Then in 1982 we obtained some rudimentary digital equipment thanks to the late KA2JTS who helped tremendously in getting this Rube Goldberg system up and running and keeping it running. (You can imagine the teary irony we felt some months ago writing his obituary on the very equipment he helped establish and maintain!) Well it worked anyhow. For three years it got the job done. In the process we evolved from using the U.S. mails and the Interstate highways as delivery vehicles to electronic mail. (We logged several thousand miles at least trudging in occasionally ghastly weather from New York to Connecticut to get the ASR materials to W1XT and thence to the printer.) Recently we fulfilled a long-held dream and have added word-processing and telecommunications to our composition/editing capability thanks in large part to the thoughtful tutelage of KB2M who steered us through the labyrinthine decision process of which computer to buy.

Speed of transmission from editor to editor and to printer however, cannot compensate for one fundamental reality when it comes to ASR: There is NEVER enough time to get it done! Writing this newsletter is a voluntary act which at times seems to become too much a burden. We ask ourselves what manner of perversity, what maldirection drives us to leer into the lonely night at a screen full of green characters; a screen only seen dimly now through weary eyes teared with exhaustion. What manner indeed to leave family for the tap-tap-tap of the keyboard?

After four years the answer can be as simple or as complex as one cares to make it. There's a job here to be done: a story to be told and AMSAT members who want to know. Surely that's enough. (Now would someone please explain that to our families?)

So although the sophistication of the composition and editing equipment has improved and we can get copy through in half the time it used to take, we still have the gnawing disappointment to reckon with. That there is just not enough time in the day to do all the things that need to be done and still get the newsletter out regularly. So we find yet another way to compromise. We occasionally have double issues and occasionally have schedule slippages. On the whole though, ASR has been regular to a remarkable degree considering the workload of its staff and the pressures full-time jobs and family exert. We strive for better but are prepared to accept the current "mostly regular" as, under the circumstances, plainly the best that can be expected.

Over these four years ASR has been published we have seen a lot of history being made. We've seen the launch of OSCARS 9, 10 and 11, RS-3, 4, 5, 6, 7 and 8, ISKRA 1 and 2. We've seen the deaths of AO-7 and 8. We even had a Chicken Little contest to see when the sky (ISKRA) would fall!

We've anguished over the loss of several dear friends: W4KFC, K3ZRO, KA2JTS, W3KT, W6DOW, K3PNI.

But then we've delighted in the arrival of W3GEY's and WB2TNC's progeny.
In the future we see a slightly altered course for ASR. With the anticipated AO-10 bulletin system now spooling up and the continued HF net system which perseveres in spite of declining propagation, increased QRM and bare minimum staff levels, the past role of ASR as news carrier will be diminished slightly. The need for documented, detailed stories (such as telemetry equations) will of course continue to be fulfilled. But our new magazine Satellite Journal with its bimonthly cycle will help to pick up some of the slack here too.

In the near future ASR will rejuvenate one of its early features which proved so popular but which was eclipsed by the need for news items several years ago. Soon ASR will begin anew its series of mini-tutorials which many readers said they enjoyed so thoroughly. The first to appear was the landmark “Towards Liquidity” in ASR #4, 6 April 1981, which explained the benefits of a liquid propulsion system as compared to a solid fueled rocket as a kick motor. Phase IIIIB (now AO-10) used a liquid bi-propellant system in contrast to the ill-fated Phase IIIA which used a solid fuel kick motor. Somewhat later ASR looked at the “First Science OSCAR” when, in ASR #13, it explained some of the features of UoSAT-1, now UoSAT OSCAR-9.

Some new tutorials we’re planning include looking at why some stations on AO-10 are heard louder than others when each is running the same power; why off-pointing your circularly polarized antenna seems to change the polarization sense; why Mode L is inherently superior to Mode B; and more.

If you have some nagging question you’d like to see addressed in a mini-tutorial, send your brief question to ASR, c/o WA2LQQ, P.O. Box 177, Warwick, NY 10990. (It will be impossible to provide personal replies to each and every question but the best ones will be answered in ASR. Others will be collected and grouped for possible later tutorials.

Thus ASR will be shifting its focus ever so slightly. We have established a viable news processing system with ASR and it is regarded as one of the primary news sources in the amateur satellite community. Moreover, the mesh of ASR with the nets, with Satellite Journal and other news/information systems within AMSAT is sturdy and healthy. We see the change in focus as returning new to augmenting the Space Education role we had in mind some years ago.

While maintaining our primary function as news gatherers and editors, therefore, we will henceforth be slightly more inclined to investigate interesting questions which arise in the use of OSCAR satellites. We see the space education role as an adjunct to the overall role as news gatherer and editor. Thus, you will be seeing more of the “Towards Liquidity” type of mini-tutorials coming soon.

For an idea that was not given a lot a planning beyond a bare set of objectives and a meager framework of organization and tools, ASR has come a long, long way indeed. Nearly 100,000 copies have been printed. That’s nearly three tons of paper. The stamps placed on these 100,000 envelopes, if laid side by side, would stretch a nautical mile. But when it comes right down to it ASR is more than a stack of paper and the ink thereon. It is the effort of a very few individuals to do the best they can for their colleagues in this terribly fascinating hobby. And if it takes squinting through weary eyes to get it done...we’ll persist for as long as we can.

Entering now our fifth year of publication we gratefully thank our readership for its loyalty and understanding when things aren’t quite right (such as a lost or late issue). Most of all, though, we thank you for the opportunity of serving this fine community of ours with a meaningful vehicle for information and education! —WA2LQQ

_UoSAT Bulletin-111 1st February 1985_
_UoSAT Spacecraft Control Centre, University of Surrey_

**GENERAL NEWS**

The UoSAT Team says “goodbye” this week to Neville Bean (G8NOB) who will be working for an aerospace industry just down the road from UoS. Neville has been responsible for much of the groundstation data handling systems for both UoSAT’s 1 & 2 and, specifically, the Particle/Wave Experiment on UoSAT-2. He has also been responsible for the day-to-day operations of UoSAT-1, which will now be taken over by Richard Macbeth (GBVLY) and Keith Fisher. Neville will, coincidentally, be working on other satellite work with UoS and we will, no doubt, maintain close contact. We all wish him well and thank him for his very hard work over the last two & half years.

**UOSAT SPACECRAFT**

_UoSAT-Oscar-11 Operations_

(See Bulletin #112 for this section.)

Much of this week’s work was associated with the DCE — a report from NK6K indicates that the major accomplishments were the addition of up/down link quality tests to the DCE software, and the successful testing of the DCE interrupt structure.

Plans for the next period:

*Memory checkout routines have been tested on the ground and are ready to upload as soon as s/c operations permit. The current draw baseline experiment should be ready to try later in the next week.*

_UoSAT Bulletin-112 8th February 1985_
_UoSAT Spacecraft Control Centre, University of Surrey_

**GENERAL NEWS**

**PAC SAT**

A meeting will be held in Washington D.C. (USA) between 9-11 March 1985 to formulate detailed proposals for the PACSAT mission and fund-raising operations. With the successful demonstration of the Digital Communications Experiment on-board UoSAT-OSCAR-11, it has now become imperative that the fundamental design philosophies, resource requirements, schedules and launch interfaces for PACSAT be defined. Perhaps the overriding problem at this
stage is the identification of funding sources — without which the technical problems become somewhat academic. The March meeting will address this problem specifically.

**UoSAT SPACECRAFT**

**UoSAT-Oscar-9 Operations**

A problem occurred in the UO-9 groundstation at UoS on 310185 which meant that we were unable to load Thursday’s experiment and the weekly Bulletin until Sunday afternoon. As a consequence, we let the Bulletin run on Monday & Tuesday last week instead of the normal schedule and resumed as normal on Wednesday. The hardware problem has now been rectified and service should be back to normal.

The UoSAT-1 Experiment Schedule changed from 180185 to reflect major interests of the user community derived from an analysis of the many reports and suggestions received during 1984.

The Bulletin/Digitalalker/Telemetry mode at weekends has been changed to transmit approx 3 mins of 1200 bps telemetry alternating with approx 6.5 mins of Bulletin — to make it easier to receive complete copies of the Bulletin! The Bulletin “right justification” has been removed experimentally to save space — any comments? The Digitalalker experiment has been moved to Mondays where it will alternate with 1200 bps Telemetry, as it is primarily intended for educational demonstrations.

The schedule is as follows:

- **Friday** — load Bulletin
- **Saturday** — Bulletin/1200 bps telemetry
- **Sunday** — Bulletin/1200 bps telemetry
- **Monday** — DIGITALKER/1200 bps telemetry
- **Tuesday** — CCD Camera — next week Radiation data
- **Wednesday** — Computer check-summed telemetry
- **Thursday** — Whole orbit telemetry survey

The 2 GHz Beacon will be in use this week.

**UoSAT-Oscar-11 Operations**

The re-loading of OBC software has proved more complex than anticipated and work is still under way at UoS — however progress has been made this (Fri) morning.

During a routine “whole orbit data” survey on 290185, the WOD section of the OBC software “hung up” — as has occasionally happened in the past — necessitating the OBC software to be reloaded from UoS. The OBC, in this condition, is still able to provide the data “bypass” facility but not support WOD collection. However life is never simple and in order to reload the OBC software quickly it is necessary to re-establish the DCE “bypass” facility — which had temporarily been removed from the DCE software during tests! The DCE “bypass” therefore has to be reloaded first and then reloading of the OBC software can proceed. This has interrupted our experiment schedule on UO-11 this week, but we hope to be back in business soon.

When the OBC software has been reloaded, plans for the next period include memory checkout routines that have been tested on the ground and are ready to upload as soon as s/c operations permit. The current draw baseline experiment should be ready to try later in the following week.

The DCE has been active since May 1984 when it was configured to provide the digital “bypass” necessary to overcome the break in one of the uplink data paths that caused the communications problems just after launch last March. The provision of the “bypass” by the DCE restored UO-11 to full operations and enabled the commissioning of the spacecraft to proceed. Software was developed by GBNEF at UoS over the last few weeks to enable the 1802 OBC to assume the role of providing the “bypass” as part of its routine housekeeping functions (attitude control, whole-orbit surveys, packet communications, programmed command etc) and thus release the DCE to embark on its own experimental programme to demonstrate the feasibility of “mailbox” communications. Preliminary DCE software was developed by WA3ZIA/VE3’s group in Canada in conjunction with NK6K and loaded by NK6K into the DCE on UO-11 from the USA after the OBC had assumed responsibility for the “bypass” functions on 090185.

This week’s spacecraft operations:

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<th>Orbit</th>
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<td>Fri</td>
<td>4919</td>
<td>uplink tests</td>
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<tr>
<td>010285</td>
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<td>4920</td>
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<tr>
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<td>Mon</td>
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AO-10 Spring Schedule Unveiled

AMSAT has announced a new operating schedule for AO-10 which will go into effect at 0000 UTC on 1 Apr. 85. The new schedule responds to the changes in sun angle now being experienced. It also includes provisions for thermal considerations which will become increasingly important as the season wears on.

The new schedule is shown in the figure in this issue. The mean anomaly points for switchover are:

- 032 - 119 Mode B
- 120 - 137 Mode L
- 138 - 200 Mode B
- 201 - 031 Off

In order to begin maneuvering immediately, the operating schedule was modified slightly on 5 Mar. 85. That modification changed the Mode B startup time from 15 to 32. According to AO-10 command station VE1SAT, the change was required to provide the electrical energy for the torquing magnets. Magnetorquing is a technique for spacecraft attitude adjustment which uses pulsed electromagnets in the “arms” of the spacecraft. The field created by the electromagnets interacts with the geomagnetic field to produce a torque. Pulsing the magnets in a precisely timed sequence can change the orientation of the spacecraft. In effect, the satellite and the geomagnetic field form a motor wherein the spacecraft is the rotor and the geomagnetic field is the stator. Because the strength of the geomagnetic field varies with (among other factors) distance from the earth, it is most effective to pulse the magnetorquers at or around perigee. Thus the need to keep the transponders off slightly longer (from 15 through 31).

According to VE1SAT it would take about two days beginning 5 Mar. to change the orientation of AO-10 to its holding pattern for the month of March, 150 degrees longitude in the orbital plane. It had been at 131 degrees. By 6 Mar., KA0OOQ had noticed improvements in Mode B performance around apogee. This was interpreted as corroboration that the maneuver was working and was having the desired effect.

VE1SAT told ASR the operating schedule had been developed in consultation with DJ4ZC and W3GEY and represented a compromise between optimum operating time and schedule stability. Other key milestones pointed to by VE1SAT were as follows. By 1 Apr., the attitude of the spacecraft shall be 170 degrees and excellent operating conditions should have largely returned. The difficulty of working stations to your east will have largely mitigated by this time says VE1SAT. This was due to AO-10 antenna pointing. (See related story and figures herein.) By 1 May the longitude of the spin (Z) axis will be 180 degrees. At this point the spacecraft will be pointing directly towards the geo-center at apogee. This point, called apogee nadir pointing, should provide a perfect balance between east-west QSO ease. However, as spring ebbs into summer, the spacecraft will head towards its most difficult era yet. This will be a time of very serious eclipses and perfectly miserable sun-angles. The spacecraft is expected to emerge from the late summer travel unscathed, but it will take some skillful stewardship on the part of VE1SAT and the rest of the command team to set the appropriate geometry, thermal

AO-10 Transponder Schedule
(Effective April 1, 1985)

```
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  \node at (2.5,0) {256};
  \node at (0,2.5) {32};
  \node at (-2.5,2.5) {OFF};
  \node at (2.5,-2.5) {B};
  \node at (0,-2.5) {L};
  \node at (-2.5,-2.5) {138};
  \node at (-2.5,2.5) {201};
  \node at (0,2.5) {201};
  \node at (-2.5,-2.5) {120};
  \node at (2.5,2.5) {138};
  \node at (0,0) {WA2LQQ 6 Mar 85.}
\end{tikzpicture}
\end{center}
```

Numbers refer to Mean Anomaly. Perigee equals 000. Apogee equals 128. To convert to minutes of time multiply by 2.732.
and energy balance. According to VE1SAT, if we are imprudent here, we may wind up freezing the batteries. To absorb more solar radiation (especially infrared for heating), the spacecraft will be maneuvered in increments past the 180 degree optimum attained in June. By 1 July it will be set at 190 degrees but the operating schedule will remain unchanged. Between 1 July and 1 Aug., the spacecraft will be reoriented from 190 degrees to 230 degrees. The major series of eclipses commences on 4 Aug. and lasts until approximately 1 Sep. The eclipses will occur on each orbit from MA 75 to about 128. A transponder operating schedule change is likely to be required during this period to reduce risk. During this period QSOs to the east will be easier than those to the west. The satellite will be oriented so as to favor stations looking towards the satellite from west of it. This is opposite of the situation which existed late in 1984 and early in 1985 when AO-10 favored stations to its east.

In sum, the next three months may provide some of the best operating on AO-10 this year. By late summer the poor sun angle will be the dominant consideration and determine much of the operating characteristics of the satellite.

Short Bursts

- AMSAT welcomes a bumper crop of new Area Coordinators. In no particular order they are: N8DOD, AAC for NE OHIO; KASDNP, AAC for the Houston area; N5EAL, AAC for the Houston area; KBQQ AC for ND; KB4DVN, AC for SC; KG6LC, AAC for NH; K1ULJ, AC for VT; N1BRQ, AC for VT also; W6SKID, AC for MS; NC5Y, AAC for MS; AMSAT congratulates the new appointees and welcomes a hearty welcome to the "A Team!"
- G4CEO and G4ZHIG will set off for the Isle of Mann (GD) for an AO-10 DX-pedition 12 thru 18 Apr. Watch for them.
- WB8DX has worked H1TEJ on AO-10.
- Moreover, WB8DX has worked W3GEY on AO-10.
- And if you don’t know why that’s significant, you haven’t been around OSCARS long enough! Hi!
- Heath has its own packet TNC coming out soon. It’s a licensed version of the famous TAPR TNC. Called the HD-4040, it will be compatible with other AX.25 machines.
- Due to a poorly worded announcement in ASR 96, we may have led readers to believe there would be no forums on Friday, 27 April, at the Dayton Hamvention. The announcement pertained to the International VHF/UHF Conference only. Thus, although there will be no VHF/UHF Conference forums on Friday, there will be a complete program of other forums to attend and enjoy. Sorry for the confusion this may have caused.
- The Dayton Amateur Radio Association has presented AMSAT with a $1000 cash grant donation. K9PV/WW accepted the check from DARA in Dayton on 1 March.
- AMSAT’s forums at the Hamvention this year will cover three days. On Friday they will be from 1300 to 1500; Saturday from 0900 to 1100; Sunday from 1115 to 1300. All AMSAT forums will be in Room 3 this year.
- In ASR 96 in our story on the Mode L performance improvements, we mentioned the failure of a bias regulator transistor which has caused the HELAPS to operate in a nonlinear regime. W3GEY correctly points out that the regula-

Operating Event Set To Note Milestone

On 31 Mar. 85, AO-10 will reach an important orbital milestone. On that date the latitude of apogee will move to the Southern Hemisphere for the first time passing over the equator on the last day of March.

To note this significant occasion, AMSAT is sponsoring a weekend operating event on OSCAR 10. The basic objective is to work as many stations as possible in the opposite hemisphere. Here are the rules.

AMSAT First-Ever Trans-Equatorial DX Event

1. One point is awarded for each valid CW or SSB QSO on AO-10 with station in the opposite hemisphere. Northern Hemisphere works Southern Hemisphere and vice versa.
2. Event begins 0000 UTC 30 Mar. 85 and end 2359 UTC 31 Mar. 85.
3. No repeat contacts within a mode. You may work the same station on Mode B and Mode L and garner 1 point for each contact, however.
4. Exchanges shall be callsign, signal report and latitude in degrees north or south. Logs shall record this exchange.
5. Logs must arrive at AMSAT not later than 30 Apr. 85. Mail to AMSAT, P.O. Box 27, Washington D.C. 20044.
6. One prize (an article of radio equipment) will be awarded to the top finisher in each hemisphere. The value of the prizes shall each approximate at least $50 U.S.
7. Excessive dupes cause disqualification as do phony QSOs. Cheaters will be flogged naked at the masthead and otherwise humiliated!
8. Prizes will be awarded by 1 July 85. Notice of the winners will be published here and in the usual places.

First Details Of Phase 3C Satellite Revealed

With a mid-1986 launch date in hand, AMSAT teams around the globe are tooting up for an ambitious follow-on project to Phase 3B (now AMSAT OSCAR 10). The new project will lead to the construction and launch of Phase 3C. Announcement of preliminary details was made recent-
ly as proposals circulated among designers in the "Satellit-
en Gesellschaft" of AMSAT DL and AMSAT teams in
Washington and Boulder. If all the proposed commu-
nication subsystems options are implemented, Phase 3C could
carry as many as 4 transponders ranging in frequency from
2 meters to 13 cm. New modes and techniques could make
this project one of the most exciting ever.

Here are the preliminary details as announced recently
by AMSAT's Jan King, W3GEY, Vice President for Engineer-
ing, the hub of the newly organized Boulder, Colorado
team.

The first transponder to be carried aboard Phase 3C will
be a Mode B transponder quite similar to AO-10's. With
uplink on 70 cm and downlink on 2 meters, it will have
about 180 kHz of bandwidth. The frequencies used will be
dissimilar to AO-10's to avoid mutual interference. The
transponder used could be the actual flight spare which was
back-up for the flight unit flown on Phase 3B (AO-10). This
transponder has been in storage since AO-10 launch day.

The second transponder, if built as planned, could break
some new and interesting ground. Tentatively dubbed
Mode J, the transponder would combine uplinks from 2
meters and 24 cm into a downlink on 70 cm. Approximately
50 kHz of the 2 meter band would either overlap or be
placed adjacent to the downlink resulting from the 24 cm
uplink. Mode J gained popularity especially in Japan where
2 meter QRM is intense. Mode B, with its 2 meter down-
link is not popular in Japan for this reason. It's just too
difficult to hear well on the Mode B system with all the
QRM. Thus the Mode J synthesis with the Mode L trans-
ponder could open new vistas for Japanese hams as well.
Regarding the Mode L portion of the proposed Mode J/L
transponder, this would have up to 800 kHz of bandwidth
and an improved efficiency HELAPS amplifier according
to W3GEY.

The third transponder is one specifically opted by a new
group in West Germany. It will be a Mode L packet trans-
ponder. Details are sketchy for the present but it appears
the following represent initial directions. The packet trans-
pponder will use Mode L, require 2400 bps FSK on the up-
link and generate 400 bps FSK on the downlink.

The fourth transponder proposal has just recently been
codified in a written document so details here too are frag-
mentary. This much is known, however. The mode (at
present unnamed) will use 70 cm for an uplink and gener-
ate a 13 cm downlink in the vicinity of 2.4 Ghz. This trans-
pponder will be suitable for a single FM signal approximately
20 kHz wide. The downlink will be at approximately the
2 watt level.

To save time and added expense, it has been decided to
proceed with spacecraft construction using the backup
Phase 3B spaceframe. W4PUJ will modify the frame for use
with Phase 3C and the added subsystems.

The kick motor to be employed will be identical to that
used on Phase 3 B. Revisions to the plumbing associated
with the MBB 400 Newton motor, however, will be
designed to reduce the risk that unexpected low tempera-
tures as experienced with the Phase 3B launch could
preclude kick motor refiring. Loss of helium probably due
to very cold temperatures is thought to have contributed
to the inability to reignite the perigee kick motor on AO-10.

This resulted in an orbital inclination of 26 degrees instead
of the design objective of approximately 60 degrees inclu-
nation. The redesigned valves and plumbing should reduce
the risk of a similar misfortune on Phase 3C.

Phase 3C will use the bi-propellant system employed
by Phase 3B with one improvement. Whereas Phase 3B used
the hypergoly combination of UDMH and N2O2, Phase
3C used a fuel yielding an improved specific impulse; more
"kick" from the kick motor. The fuel, UDMH is un-
symmetrical di-methyl hydrazine. N2O2 is nitrogen tetrox-
ide, the oxidizer. When these two components are com-
bined they explode spontaneously without need for an
igniter or catalyst. The bi-propellant system to be used on
Phase 3C will be similar to the Phase 3B fuel and oxidizer
but will improve the specific impulse by 10%: This should
compensate somewhat for the anticipated increased total
mass of Phase 3C compared to Phase 3B. The Ariane
launcher will place Phase 3C in a geo-synchronous trans-
fer ellipse with zero degrees inclination. It is then up to AM-
SAT to accomplish two key maneuvers in a precise series
of steps. The first is to raise the perigee from its perilously
low point of a few hundred kilometers to a stable orbit. The
second major maneuver will be to accomplish a sizeable
plane change from zero to approximately 60 degrees. The
initial argument of perigee also must be determined and
set precisely in these initial maneuvers. The more mass is
represented by the spacecraft, the more "kick" is required
to accomplish a given maneuver. Thus the key to achiev-
ing the desired orbit with a more massive spacecraft is more
"kick" realized through a more potent fuel/oxidizer pair.
According to the report by W3GEY, AMSAT and AMSAT
DL will likely want to "revisit the overall antenna design
on Phase 3C." It is generally conceded that the 2 meter high
array on AO-10 could be better even taking into ac-
count the apparent damage sustained during deployment.
"The basic problem," says W3GEY, "is the spacecraft
is small compared to 2 meters. Consequently, the 2 meter
array is not terribly good. On the other hand, the 70 cm ar-
ray performs quite well as does the 24 cm helix. We'll want
to take a look at the entire antenna suite and see what we
can improve upon. We also need to see what we will do
for a 13 cm antenna. That will probably be a small helix."

The other key subsystems will be identical to that flown
of AO-10 or quite similar. Many sub-systems such as the
IHU, BCR and SEU are already built (as flight spares for
Phase 3B) and need only be verified and integrated, (IHU
is the Integrated Housekeeping Unit, a computer; BCR
is the Battery Charge Regulator; SEU is the Sensor Elec-
tronics Unit). According to W4PUJ, a new LIU (Liquid Igni-
tion Unit) will be required to work with the new plumbing
to be designed for Phase 3C.

A key decision made recently was to not employ an
experimental plasma kick motor aboard Phase 3C. The plas-
ma kick motor experiment was apparently judged too risky
(schedule and technical risks). Had it been employed, the
plasma kick motor would have had at least two major con-
sequences. First, because of the very low thrust of the plas-
ama kick motor system, the movement of Phase 3C from
the transfer ellipse to the final orbit could have taken several
months; a long, long time for a world of amateurs waiting
for a new satellite to come "on-line"! Second, if the plas-
ma kick motor had been opted, it likely would have re-
quired an increased battery capacity. With these larger
batteries aboard it might have been possible to power (for
short periods) a very high power Mode L transponder
for specific demonstrations. The available power of the
spacecraft depends on the solar panel capacity. AO-10 is
in the 50 watt class at start of life with a gradual reduction
in efficiency due to solar radiation. The larger batteries
aboard Phase 3C would have been needed for the plasma
engine and later could have been used for a very high pow-
ner transponder. The larger batteries would have required
a redesign of the space frame and added risk there too. Thus
the decision to employ the MBB kick motor stabilizes the
overall Phase 3C Program by eliminating the risks associa-
ted with new technology employment.

With launch less than 10 months away, the construction
teams are getting up to full speed to meet their dates with
history. Phase 3C...soon to take its place as the most capa-
ble OSCAR ever built!

**RS-10 Specs Told; Ground Tests Proceed**

Reliable sources have told ASR that two RS satellites will
be launched from the Soviet Union this year. In ASR 97,
we read of the tests being performed on RS9. Now comes
word of similar tests on RS-10.

According to G3IOR who quotes UA3CR, both RS-9 and
RS-10 are in Kaluga 200 km SW of Moscow undergoing
testing. The frequencies for RS-10 were provided by G3IOR as
follows:

- **Mode A**: 145.96 - 146.00 up
  29.46 - 29.50 down
- **Beacon**: 29.457 or 29.503 either 250 mW or
  1 watt
- **Mode K**: 21.26 - 21.30 up
  29.46 - 29.50 down
- **Robot**: 21.140 up
  29.457 or 29.503 down

A third (unnamed mode) transponder may also be includ-
ed. Its frequencies were specified as follows:

- 21.26 - 21.30 up
- 145.96 - 146.00 down
- **Beacon**: 145.957

At present, both RS-9 and RS-10 are to be orbited by a
single launcher. However, the builders and organizers are
thought to be seeking separate launches for each. The
desired orbits would be around 2000 km polar circular or-
bits according to G3IOR.

In related news, UA3CR has built a Mode J transponder
for which he is seeking a launch.

The current operating schedule for the operational RS's
is, according to G3IOR, as follows:

- **RS-5** Monday and Friday
- **RS-7** Tuesday and Saturday (Xpondr or robot)
- **RS-8** Thursday and Sunday

**Spacecraft Orientation and Sun Angle**

*Mini-Tutorial #1*

Spend a minute here and learn some more about satel-
lettes and their operation.

In order to understand why proper spacecraft orientation
is essential and the effect it has on spacecraft performance,
it is necessary to have only a visual picture of the geometry
involved.

Refer to Figure 1. The Z axis is the satellite's spin axis.
AO-10 revolves about this axis at about 36 rpm. In order
for the solar panels to make maximum use of available sun-
light, the sunlight must be normal to (perpendicular to) the
Z axis. In Figure 1, the sun, S, lies in the lower of two inter-
secting planes. The spacecraft's Z axis is normal to the plane

![Fig. 1 — Spin axis relation with the sun.](image)

and maximum energy is recovered and passed to the pow-
er storage and conditioning systems.

Note also that the Z axis is also the center of all antenna
beam patterns. This is called "boresight" meaning dead-
center in all beam patterns. The 2 meter omni antenna (the
axis of the helix seen in Figure 1) points in the direction
of maximum radiation of the antennas (except for the omni
itself which is designed to have a torus-like pattern where-
in the "hole" in the torus is the Z axis).

With changing seasons, the relation of the sun to the
spacecraft's orbit changes. Here we show that as a plane
change where the sun moves from S to S'. With the sun
in the new plane, the Z axis of the spacecraft must be
changed from Z to Z' to assure sunlight continues to ap-
proach the satellite perpendicular to the Z axis.

Figure 2 shows another point essential to understanding
the geometry involved. Here we see the three primary com-
munication antenna arrays and their relative beam widths
and directions. In order of increasing beamwidths are the
24 cm array, the 70 cm array and the 2 meter high gain
array. Thus it is possible under varying circumstances to be
within one beam and without another. For instance, when
working Mode B, it is possible to be hearing well by rea-
From Figures 1 and 2 we can infer that changing the spacecraft orientation to respond to seasonal sun-angle changes can have dramatic effects on satellite performance. This is clearly evident from Figure 3.

Figure 3a symbolizes the situation AO-10 has experienced for the last several months. Because of the sun angle and the need to have the Z axis near perpendicular to the incoming sunlight, it was necessary to off-point the satellite at apogee (MA 128). However, at MA 64, we can see in Figure 3a, the antennas were boresighted on the geo-center. On the other hand, at MA 192, we can see the cause of the severe degradation experienced in recent months. The satellite is off-pointed by a substantial degree. Moreover, stations to the east of the satellite had an easier time of it for reasons that may now be more apparent. (Off-axis by a lesser degree than those west of the satellite.)

In Figure 3b, the seasonal changes in the relation between AO-10’s orbit and the sun have allowed an improved orientation. Note that the satellite can now be nadir-pointing at apogee yet have sunlight incident perpendicular to the Z axis. Moreover, at MA 64 and 192 (¼ and ¾ thru the orbit, respectively), the relative off-pointing is equal. Finally, working east or west through AO-10 is equally facile at this orientation.

We can now see how the fundamental driver, sun angle, affects the orientation requirements of AO-10 and the effects such geometric relations have on satellite performance as observed from the ground.

**Satellite Construction Hits High Gear**

Several active projects could see as many as five major OSCAR launches in the next 18 to 24 months. Additionally, several GAS-CAN escape acts and more Ham-In-Space reprieves promise a bonanza in amateur space activity in the third quarter of this decade.

With the year not three full months complete, major announcements of new satellite construction projects have surfaced! From the traditional centers of OSCAR construction, Marburg, Washington and Moscow comes news of dramatic new space-borne capacity to be launched in the next two years. Further, from new centers of excellence, Boulder and Tokyo, teams have vibrant projects under way.

From Washington and Marburg, the home of AMSAT OSCAR 10 comes news that the teams will reprieve the Phase 3B act with an updated version, Phase 3C. Launch is now scheduled for mid-1986 from Kourou, French Guiana aboard the European Space Agency’s Ariane 4. Also aboard will be the French Amateur Radio Satellite called Arsene. For the Phase 3C project, however, a new team is emerging virtually from the slopes of the Rocky Mountains in Boulder, Colorado. This new team will join groups in Marburg and Washington in the design, construction, integration and test of the new spacecraft. (See related story on Phase 3C systems elsewhere in this issue).

From Moscow earlier this year came news of plans for the construction and launch of RS-9 later this year. As reported in these pages recently, RS-9 is completed and undergoing ground tests in the Moscow area presently. A late 1985 launch is expected for this newest Radio Sputnik from
the team of UA3CR. Now comes news of plans for RS-10. This spacecraft is also planned for launch later this year. (See related story on RS-10 systems elsewhere in this issue.)

The Marshall Amateur Radio Club Experiment (MARCE) which has already been in space via the Shuttle will fly again as soon as this May according to MARCE Project Leader W4QAU, Ed Stluka. The relight was offered to MARCE and will occur on flight 51G slated for May 1986. The MARCE package is in a Getaway Special (GAS can) but nothing will be deployed from the can. Instead, several active experiments will be performed and telemetry will be sent via the Amateur bands from a battery-powered transmitter during specific windows of the flight. ASR will detail the plans for MARCE including transmit frequencies and orbital information/tracking guides in an upcoming issue.

Meanwhile, progress is being made in Japan where teams from the Japanese Amateur Radio League and specifically from JAMSAT are hard at work on their first indigenous satellite, JAS-1 (Japanese Amateur Satellite -1). No stranger to satellite construction techniques (JAMSAT built the popular Mode J transponder for AMSAT OSCAR 8), this is the first occasion on which our Japanese colleagues will undertake the complete project from inception through to launch and operation entirely on their own. JAS-1, employing a Mode J linear transponder and a Mode J packet transponder as well, will be placed in a novel low earth orbit. The combination of inclination and height will lead to some unfamiliar visibility profiles. Launch is scheduled for early 1986, nominally February.

Topping the interest list of those digitally inclined is PACSAT. PACSAT will be a digital store-and-forward communications satellite. Placed in a low polar orbit from the Shuttle, the PACSAT has been affectionately dubbed the “Flying Mailbox.” PACSAT will accept messages from originsators on the earth and store them until the addressee interrogates the satellite for his mail. The choice of orbit allows several passes per day for every point on earth. A recent demonstration of the PACSAT-like store-and-forward function was accomplished by the Digital Communications Experiment aboard UoSAT OSCAR 11. (See ASR 94/95.) PACSAT is tentatively planned for a 1987 Shuttle launch. However, several significant hurdles must be overcome. One important challenge is authority to deploy from the GAS can. There is at least one GAS can deployment planned this year for a small, experimental payload. This satellite may act as a pathfinder and clear many obstacles to PACSAT deployment from the Shuttle in 1987. PACSAT is a joint project of AMSAT and VITA, the Volunteers In Technical Assistance.

With two successful satellites already in orbit, one might expect the University of Surrey to have plans for a third. Not to be outdone, Surrey’s English colleagues within AMSAT UK have floated several trial balloons recently to test sentiment for another British OSCAR.

In the Ham-In-Space department, AMSAT and ARRL anticipate continued success in efforts to place ham radio equipment alongside licensed Amateur Astronauts and Mission Specialists aboard the US Space Shuttle. Plans for the flight of Dr. Tony England, WØORE, with an impressive array of ham equipment aboard are coming along well. Except for some last minute glitches, we seem to be in good shape according to reliable sources in NASA and AMSAT. In a related development, history’s first Ham-In-Space, Owen Garriott, W5LFL, tells ASR that because his relight with Spacelab has been postponed from 1985 to 1986, he has temporarily transferred out of the Astronaut office to the Space Station Project Office. There Owen is Project Engineer for NASA’s Space Station Project. Could a permanent ham station be engineered into the station? Seems farfetched? How many a decade ago would have foreseen a ham-astronaut riding a space plane with an Amateur Radio 2 meter HT in his hand?

Judging from the foregoing, even with this superficial treatment, the future bodes well for those in Amateur Space endeavors. And we have listed here only those projects which have firm, identifiable projects with fixed schedules. We have not mentioned the Solar Sail Project of The World Space Foundation, the Amateur Space Telescope of the Independent Space Research Group. Surely there are others which will emerge. In sum, if the harbingers are correct, the next few years will see an unprecedented level of activity in Amateur Space and low-cost satellites.

Operating Aids To Provide User Insight to AO-10 Condχ

Responding to a need for a simple means of understanding and predicting AO-10 operating conditions (especially attitude and orientation as it affects performance) AMSAT will shortly introduce two measures designed to aid the user.

A computer program under development will compute the satellite antennas off-pointing angle. In essence, given a simple two-number input, the program will compute the off-pointing angle for a given QTH at that instant. This, in turn, will afford the user a better grasp of what to expect in terms of satellite performance. For example, it has often been perplexing for users who on one occasion are strong through the transponder and on other occasions are weak

Rick Fleeter of TRW explains details of an ion propulsion system which future OSCAR’s might use.
despite similar passband loading and range. This program will show the user the apex angle of the cone which intersects the beam from the satellite to the user. If the angle exceeds some given value, the user will know not to expect too much in the way of returns. It will also help to explain why “Joe is so much louder than me when he claims to be running the same power!” The program is being developed by a team of outstanding AMSAT mathematicians and programmers including W3IW, KA9Q and N4HYH. It should be ready for distribution in various (computer) languages and dialects by about 1 May.

How strong a given station is heard depends on a multitude of factors. If all stations were using identical uplink power (ERP) and had identical receive stations, then the factors determining strength of received signal would narrow to three:
1. Passband loading
2. Range to satellite
3. Angle from bore-sight
(We’ll ignore some other subtle causes and effects for this discussion.)

The second measure to be put into effect soon involves the use of a simple, three tier benchmark for operating conditions. Based on a loose set of criteria, AO-10 conditions will be described as either “Green”, “Amber” or “Red.” Using this system, AO-10 has been in an amber condition for the last several months as a consequence of poor sun angle and the necessary orientation of the satellite to respond to the angle. Similarly, as described in another story in the issue, AO-10 will be in condition green for the next three months, approximately. There may be a few weeks of condition red next August.

While at present the criterion for a given condition determination is qualitative and subjective, as the computer program above is developed and an analysis of the AO-10 antenna patterns is performed, a more quantitative and objective set of criteria may be devised. For now, however, the three tier system shall provide merely a general guide as to what may be expected now and for the future as regards AO-10 operation performance.

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**ORBIT PREDICTIONS**

**Oscar-11**

- Catalog number: 14781
- Epoch time: Wed Feb 20 05:26:20.242 1985 UTC
- Element set: 0
- Inclination: 98.2082 deg
- RA of node: 118.2460 deg
- Eccentricity: 0.0012191
- Arg of perigee: 229.5884 deg
- Mean anomaly: 130.4237 deg
- Mean motion: 14.61945915 rev/day
- Decay rate: 2.5e-07 rev/day
- Epoch rev: 5194
- Semi-major axis: 7062.113 km
- Anom period: 98.498856 min
- Apogee: 704.723 km
- Perigee: 687.504 km
- Ref perigee: 260.2081458
- Sun Feb 24 19:27:52.534 1985 UTC
- Beacon: 145.8260 MHz

**Oscar-10**

- Catalog number: 14129
- Epoch time: Mon Feb 23 10:26:38.884 1985 UTC
- Element set: 162
- Inclination: 26.0672 deg
- RA of node: 151.3504 deg
- Eccentricity: 0.5990479
- Arg of perigee: 351.0336 deg
- Mean anomaly: 1.8484 deg
- Mean motion: 2.05855313 rev/day
- Decay rate: 2.9e-07 rev/day
- Epoch rev: 1281
- Semi-major axis: 30610.553 km
- Anom period: 699.520444 min
- Apogee: 35365.965 km
- Perigee: 4099.032 km
- Ref perigee: 2611.81102471
- Sun Feb 24 19:27:52.534 1985 UTC
- Beacon: 145.8100 MHz

**RS-5**

- Catalog number: 85055.81351891
- Element set: 192
- Inclination: 26.0672 deg
- RA of node: 151.3504 deg
- Eccentricity: 0.5990479
- Arg of perigee: 351.0336 deg
- Mean anomaly: 1.8484 deg
- Mean motion: 2.05855313 rev/day
- Decay rate: 2.9e-07 rev/day
- Epoch rev: 1281
- Semi-major axis: 30610.553 km
- Anom period: 699.520444 min
- Apogee: 35365.965 km
- Perigee: 4099.032 km
- Ref perigee: 2611.81102471
- Sun Feb 24 19:27:52.534 1985 UTC
- Beacon: 145.8100 MHz

**RS-7**

- Catalog number: 85055.81351891
- Epoch time: Mon Mar 11 01:26:29.438 1985 UTC
- Element set: 162
- Inclination: 26.0672 deg
- RA of node: 151.3504 deg
- Eccentricity: 0.5990479
- Arg of perigee: 351.0336 deg
- Mean anomaly: 1.8484 deg
- Mean motion: 2.05855313 rev/day
- Decay rate: 2.9e-07 rev/day
- Epoch rev: 1281
- Semi-major axis: 30610.553 km
- Anom period: 699.520444 min
- Apogee: 35365.965 km
- Perigee: 4099.032 km
- Ref perigee: 2611.81102471
- Sun Feb 24 19:27:52.534 1985 UTC
- Beacon: 145.8100 MHz

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Jim Smith, KA7APJ, AMSAT Area Coordinator for Washington State and Alaska, and proprietor of Spectrum West, donated a Control Autotrat Interface Board to the AMSAT Member Recruitment Drive. Shown here are a VIC-20, a C-64, a T/S 1600, Kenpro rotors and the bare board.
Satellite: RS-5
Catalog number: 12999
Epoch time: 85054.26819137
Sat Feb 23 06:26:11.734 1985 UTC
Element set: 220
Inclination: 82.9602 deg
RA of node: 6.8376 deg
Eccentricity: 0.0009750
Arg of perigee: 311.2350 deg
Mean anomaly: 48.7073 deg
Mean motion: 12.05058932 rev/day
Decay rate: 1e-08 rev/day^2
Epoch rev: 140.18
Semi major axis: 8033.815 km
Anom period: 119.496231 min
Apogee: 1765.415 km
Perigee: 1659.749 km
Ref perigee: 2610.25694542
Sat Feb 23 06:10:00.04 1985 UTC

Satellite: RS-6
Catalog number: 12998
Epoch time: 85053.41517227
Sat Feb 2 10:26:38.884 1985 UTC
Element set: 310
Inclination: 82.9573 deg
RA of node: 20.5848 deg
Eccentricity: 0.0020315
Arg of perigee: 43.9804 deg
Mean anomaly: 316.2968 deg
Mean motion: 12.0295923 rev/day
Decay rate: 1e-08 rev/day^2
Epoch rev: 13743
Semi major axis: 8043.191 km
Anom period: 119.205333 min
Apogee: 1691.543 km
Perigee: 1658.863 km
Ref perigee: 2589.45256222
Sat Feb 2 10:41:11.1 1985 UTC

Satellite: RS-7
Catalog number: 13001
Epoch time: 85056.23680768
Mon Feb 25 05:41:07.95 1985 UTC
Element set: 192
Inclination: 82.9565 deg
RA of node: 1.2332 deg
Eccentricity: 0.0020829
Arg of perigee: 228.1513 deg
Mean anomaly: 131.7764 deg
Mean motion: 12.0889800 rev/day
Decay rate: 1e-08 rev/day^2
Epoch rev: 14084
Semi major axis: 8017.699 km
Anom period: 119.137070 min
Apogee: 1667.942 km
Perigee: 1634.542 km
Ref perigee: 2612.20660324
Mon Feb 25 04:57:30.519 1985 UTC

Satellite: OSCAR-9
Catalog number: 12688
Epoch time: 85052.15431026
Thu Feb 21 03:42:12.406 1985 UTC
Element set: 734
Inclination: 97.6206 deg
RA of node: 37.2521 deg
Eccentricity: 0.0002079
Arg of perigee: 355.7450 deg
Mean anomaly: 4.3044 deg
Mean motion: 15.26999174 rev/day
Decay rate: 1.47e-05 rev/day^2
Epoch rev: 16752
Semi major axis: 6859.921 km
Anom period: 94.303223 min
Apogee: 483.118 km
Perigee: 480.465 km
Ref perigee: 2600.15351268
Thu Feb 21 03:41:03.495 1985 UTC
Beacon: 145.8250 MHz

Roger Johnson, WB8GAI, partially hidden by the video camera.
ARRL Foundation Votes Phase 3C Matching Fund

At its January 26, 1985 meeting at ARRL Headquarters, Newington, CT, the ARRL Foundation voted in favor of a motion to support AMSAT's Phase 3C construction project. The Foundation voted to:

"Authorize a grant of Ten Thousand Dollars to the AMSAT Corporation, Washington, D.C. as matching funds for the AMSAT Phase 3C satellite launch fund raising effort. This grant will be made available in two payments of Five Thousand Dollars upon confirmation of AMSAT matching fund accomplishments."

In a follow-up letter to AMSAT President WA2LQQ, ARRL Foundation President Paul Grauer, W0FIR, indicated the funds would be transferred to AMSAT as stated in Minute #7 of the Foundation meeting. President WA2LQQ's reply to Mr. Grauer indicated "AMSAT's gratitude for the Foundation's steadfast support of the Amateur Space Program and its ideals as manifested in part by the construction and launch of Phase 3C."

Phase 3C is a joint endeavor of AMSAT and AMSAT DL. The project seeks to prepare for launch an advanced version of AO-10 by mid-1986. (See ASR 98/99).

The ARRL Foundation, Inc., is a separate entity established by ARRL for the advancement of Amateur Radio. W0FIR was recently elected President replacing the retiring Robert York Chapman, W1QV. W0FIR is ARRL Midwest Division Director. The ARRL Foundation had previously provided a matching fund for Phase 3A.

According to WA2LQQ, donations earmarked for the matching fund may be sent to AMSAT, P.O. Box 27, Washington, D.C. 20044. AMSAT will maintain an accounting at its Headquarters Office of funds donated and, when the first $5,000 increment is attained, AMSAT will apply to the Foundation for the first $5,000 grant.

Support AMSAT with your donation today! Every dollar you donate now results in two dollars towards Phase 3C!

On the Shoulders of Giants

Editorial Opinion by WA2LQQ

The communication of ideas among and between interested individuals is an important, if occasionally overlooked, function of AMSAT. AMSAT has relied on several means to accomplish this communication with various degrees of success. The AMSAT Quarterly Newsletter, Orbit Magazine and recently Satellite Journal and ASR have striven to tighten the lines of communication. All have succeeded in filling a niche where previously an evident need existed. All fell (fall) short in one regard or another in bridging the chasm extant between the most complex ideas with which we deal and the most mundane.

AMSAT is a curious admixture of thinkers and doers; of flighty tinkerers and serious students; of competent science and unmitigated tomfoolery; of selfless public service and unabashed, self-aggrandizement. With this diversity of interest, this spectrum of skills, this breadth of topical familiarity, is it any wonder no single publication has completely succeeded in embracing the whole of AMSAT.

We may be a tad too parochial to abide the starkly foreign when it appears in our magazine or newsletter. To the beginner, solutions to differential equations are as baroque as a medieval monastery and somewhat less appetizing. To the seasoned expert, on the other hand, discussions dwelling on the merits of weekly updates to NASA element sets may be sonorous.

What does all this mean? Is he who seeks to please many condemned to satisfy none?

Perhaps, just perhaps.

Witness the obvious. The technical wizards (let's call them Twizs) recently have been challenged not by the depth of new ideas published in AMSAT's various vehicles, but rather with the pedestrian challenge of merely staying awake while reading them.

The typical NICE guy, (Normal, Intelligent, Communicative, Entity) for his part is often intimidated by exotica appearing in his bill-of-fare. Moreover, he might conclude much of the mumbo-jumbo is merely the jargon of AMSAT's hypothetical "secret" society; the "They" to whom is attributed all those arcane wonders in orbiting little black boxes.

"Why", he plaintively inquires, "need it all be so complex? Is there nothing which can be explained in simple, down-to-earth terms?" Justly he points to the lack of art in our writings "For it is in your art, Sirs, that you make the complex less so!"
Both groups have their points. Yet despite the bleatings of both and the occasionally forceful tactics of their advocates and proponents, we have sought, with various degrees of success, to synthesize the requirements of each into a single publication. We believed, perhaps wishfully, that forged in the symbolism of a single publication lay the key to continued organizational unity. In emphasizing unity, however, we tended to ignore inherent diversity.

Rather than a homogenous group with largely correled interests, we find ourselves a lumpy amalgam; an agglomerate; heterogeneous in a very real sense. Why then ought we expect a single publication to suffice? We ought not!

Neither should we despair in the dissolution of symbolic organizational unity manifested in specialty publications for disparate tastes, aptitudes and predilection. A completely adequate organizational model for "e pluribus unum" exists.

The Twizs require a diet of highly nutritious technical hay to sustain the growth of both their personal interest and the technical base of the organization. The NICE folks similarly need a satisfying diet of appetizing things which make sense to them; things like helpful articles on improving station operating, new equipment reviews and tutorials one can understand without requiring an advanced degree in salutary debunkery!

Moreover, why should we conclude that merely two communities (the Twizs and the NICE folks) are all there is? One could argue further a whole new cult of organizers and managers is emerging. And what about the communicators themselves? The folks who write for Satellite Journal and ASR? Are they yet a fourth community?

Simply put, we need to develop the communication vehicles necessary and sufficient to meet the present and changing needs of our members. With the proportion of NICE Guys to Twizs now standing at somewhere between 5-to-1 and 20-to-1, the needs of at least 80 percent (4000) of the members could be well served by Satellite Journal.

The introduction of the AMSAT Technical Journal makes this year an attempt to redress the absence of a suitable vehicle for professional-level papers in the field of Amateur Radio satellites and related space activities. It will be available to anyone who wishes to receive it at a nominal charge. All will be encouraged to subscribe to it. One edition is planned for 1985. If successful, perhaps as many as two editions will be forthcoming in 1986.

The strength of an organization lies as much in its diversity as its vision and purpose. Inasmuch as the fundamental vehicle for our major activity (using satellites) is the satellites themselves, it seems perilously short-sighted to not nourish the minds which conceive these marvelous contraptions. Conversely, by stimulating new ideas, approaches and talent with an advanced communication vehicle such as the AMSAT Technical Journal, we can only enrich the soil in which brilliance may come to flourish!

Welcome the new AMSAT Technical Journal, soon to take its place alongside AMSAT's flagship publication, Satellite Journal.

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**Short Bursts**

- In ASR #98/99 we stated the new, yet unnamed mode on RS-10 would have a beacon on 145.957 MHz. We erred. We should have said 145.997 MHz instead. Thanks G3IOR.
- Pat also points out the AO-10 GD DXpedition will be "Manned" by G3CUO and G4ZHG rather than G4CEO and ZHG as reported. Thanks for this correction too.
- Eric Rosenberg, WA6YBT, is seeking to establish a photographic base for a paper on AO-10 operations. He is seeking good quality slides of various stations to include in this presentation. If you would care to loan a slide or two to Eric, please send your 35 mm slides to Eric Rosenberg, 1467 Beaverton Drive, Dayton, OH, 45429. All materials will be returned later. Thanks from Eric!
- WA6VGS has appointed a new group of Area Coordinators. In random order they are: Bill Parris, N5ARS, AC for Arkansas; Paul Beeman, KA2MUM, AAC for Long Island, New York; Byron Lindsey, W4BIW, AC for Georgia; Frank Dzurida, K7SFN, AC for Northern Nevada; David Brunette, WAIAYT, AC for Maine; George Tew, NC5Y, AAC for Mississippi; John Low, K3L, AC for Delaware; and Tim Kearney, NZ4Q, AAC for Indiana (transferred from Georgia). Congratulations to the new appointees!
- GB8RAK (formerly GB2RS) news broadcasts on AO-10 SSC H2 are scheduled as follows: 12 May, 0600; 19 May, 0200; 26 May, 0830; 2 Jun, 0600; 16 Jun, 0800; 23 Jun 0130; 7 Jul 0530; 14 Jul 0030. All times are in UTC. Tks G3IOR.

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**N2CF Departs As ED/GM**

In a short message to the AMSAT Board of Directors and Officers dated March 26, 1985, AMSAT's Executive Director and General Manager Bill Lazzaro, N2CF, announced his withdrawal from further direct involvement with AMSAT business. He cited "responsibilities in my position with the ARRL which have the potential for a clear conflict of interest" as the reason for his departure from the scene.

N2CF accepted the post of Development Manager for ARRL in January and at that time stepped down as one of AMSAT's two salaried employees. (See ASR #94/95) He remained on, however, as nominal ED/GM while in the ARRL's employ until now. AMSAT has no immediate plans to seek a replacement although the subject does appear on the April Board Meeting agenda according to Chairman W6SP.

**Call For Papers**

AMSAT, The Radio Amateur Satellite Corporation, Inc., has issued a call for professional papers reporting original work and/or significant findings in the field of low-cost satellite engineering, space communications, space sciences and related social value issues. A list of suggested topics is provided below. The list is not comprehensive.

Accepted papers will be published in the premiere edition of The AMSAT Technical Journal which has a publica-
Revised Phase 3C Mode S Proposal

Special to ASR by Bill McCaa, K0RZ

Background

I believe the addition of an S-band transponder on Phase-3C would help the transition of the average satellite user to microwave frequencies. The ready availability of good low cost receiving equipment in the MDS (2150-2160 MHz) service can find immediate application to receiving a Phase-3C transponder in the 2400-2450 MHz band. The Colorado group is quite excited with the prospect of building this transponder.

Considering the presently available transistors and the power budget of the spacecraft, I propose that the transponder be hard limiting, and have at least 2 Watts of average output. The bandwidth would be about 20 kHz which would be suitable for transponding a single narrow band FM signal and allow for Doppler and other frequency errors.

I propose that this transponder be called the Mode-S transponder.

Link Calculations at 2.4 GHz

Transmitter output power at antenna +3 dBW
Spacecraft antenna gain (8 turn helix) +14 dBic
Spacecraft EIRP +17 dBW
Free space path loss (40,000 km * 2.4 GHz) -192 dB
Signal level at receive antenna -175 dBW
Receive antenna gain (1 meter dish * 50) +25 dBic
Signal level at receiver -150 dBW
Receive sensitivity (75K, 20 kHz, BW) -160 dBW
Received signal to noise ratio +10 dB

A 10 dB signal to noise ratio would constitute a minimum but useful signal level for FM communications.

Implementation in Phase-3C

The S band transponder would use a portion of the mode-B transponders receiver. A buffered output at 53 MHz would be needed following the mode-B receivers first mixer. The transponder would be operated only when the mode-B receiver is active. The following details the frequencies used in the S band transponder.

Input frequency to the S band transponder 435.210 MHz
Input frequency from Mode-B transponder 53.250 MHz
Local crystal controlled oscillator (LO) 41.930 MHz
IF frequency including filter (IF) 11.32 MHz
IF filter bandwidth 20 kHz
1st upconversion frequency (F1 = 3XLO + IF) 137.11 MHz
2nd upconversion frequency (F1out = 54XLO + FI) 2401.33 MHz
Output frequency from the S band transponder 2401.33 MHz

The spacecraft antenna would be a left hand circular 8 turn helix that could be counter wound around the omni antenna and inside the 1269 helix. The power drain at 14 volts should be less than 10 Watts. Transponder placement is yet to be determined but could be configured to fit in an arm of the spacecraft close to the arms outside edge. Placement in ARM-1 next to the mode-B and mode-L receivers is a possibility. Jan King has offered to locate and
size the possibilities for the placement of the transponder in the spacecraft.

General Comments on Use

The transponder could be used for bulletin services, as well as normal voice and data communications via the narrow band FM channel.

The ground station receiver could use AFC to overcome receiver drift and Doppler. The transponder downlink channel would be easily located as a near constant output signal (2 Watts) would be present at all times. For example with no signal input, the downlink signal would be soft limited noise (approx 6 dB down from hard limit) distributed across the 20 kHz downlink channel. With the downlink channel identified, the uplink transmitter frequency could be adjusted by the user so as to be centered in the downlink channel. A squelch system will be incorporated that would defeat the transmitter whenever the transponder uplink frequency was inactive for more than one minute.

S-Band (Mode-S) Transponder Functional Block Descriptions

The following describes the functional blocks for the S-Band transponder. With the exception of the local oscillator signals, signal flow it from left to right and top to bottom on the page.

**Mode-B Transponder Receiver output**
- Input freq. = 435.225 MHz
- Input signal level = -107 dBm
- Mode B internal gain = +26 dB
- Mode B output freq = 53.265 MHz
- Mode B output level = -81 dBm

Drivers 1st Mixer

Alreadly contained in the Mode-B transponder, but will require an additional 53 MHz output port.

**VHF 1st Mixer**
- Input signal level = -81 dBm
- Input freq. = 53.265 MHz
- Mixer gain = +20 dB
- Output signal level = -61 dBm
- Output frequency = 11.32 MHz
- LO input freq. = 41.93 MHz
- LO input level = -20 dB
- Driven by the IF filter
- Drives the Mode-B output port
- Drives the IF filter

**Local Oscillator (LO)**
- Xtal freq. = 41.93 MHz
- 1X output level = -20 dBm
- 3X output level = -125.79 dBm
- 5X output level = -20 dBm
- 5X output level = 2.262 GHz
- 5X output level = > +6 dBm
- Drives VHF 1st mixer with 1X
- Drives VHF 2nd mixer with 3X
- Drives S-band mixer with 5X

**IF Filter**
- Input level = -61 dBm
- Input/output freq. = 11.32 MHz
- Filter gain = +10 dB
- Filter bandwidth = 20 kHz
- Filter bandwidth = 60 kHz
- Driven by the 1st mixer
- Drives IF amplifier/limiter

**IF Amplifier/Limiter**
- Input level = -71 dBm
- Input freq. = 11.32 MHz
- Stage gain = +35 dB
- Output signal level = -36 dBm
- Output frequency = 11.32 MHz
- Driven by the IF filter
- Drives the VHF 2nd mixer
- Control is provided to the S-band power amplifier for transmitter shutdown one minute after the absence of signal.

**VHF 2nd Mixer**
- Input level = -36 dBm
- Input freq. = 11.32 MHz
- Mixer gain = +16 dB
- Output signal level = -30 dBm
- Output frequency = 137.11 MHz
- LO input freq. = 125.79 MHz
- LO input level = -20 dBm
- Driven by the 1X port of the LO
- Driven by the IF amplifier
- Drives the VHF amplifier

A meeting to discuss, modify, and define work assignments relative to the revised proposal and functional block diagram for the S-band transponder was called by KB6Z and attended by W3G, K6GOY, WA6E, WA6VL, KD7BNM, and KB6Z. It was also held in Colorado Springs, CO on March 31. It was decided to advance the proposal through the design phase and to pursue the development of the transponder as quickly as possible. The following work assignments were agreed upon. The goal is to complete the first pass preliminary design by the next meeting on May 5, 1985. The designs should include:

1. The power required at 14 volts.
2. The physical volume and weight.
3. The circuit.

**Task Area**
- Project Coordination
- S-Band Mixer
- Local Oscillator/Multiplier
- Intermodal
- VHF Mixers, IF Amplifier/Limiter
- Placement in Spacecraft
- S-Band Power Amplifier (Tentative)

**Responsible Persons**
- Bill McCaa, KB6Z
- Brad Bradley, KD7BNM
- Ray Uberrechen, AA6L
- Steve Ernst, WB6WED
- Brad Bradley, KD7BNM
- Gordon Hardman, K6GOY
- Bill McCaa, KB6Z
- Jan King, W3G
- Charley Mangus, W8BN
- George Noyes W1XE

The next meeting will be on May 5, 1985 in Boulder, CO with the purpose of discussing the functional designs completed and the integration of the designs of the component blocks.

**ZRO-Tech Award Dry-Run Initiates New Awards Program**

As previously announced in these pages, the ZRO-Memorial Station Engineering Award is a component of AMSAT’s new Technical Achievement Awards Program. The objective of the ZRO-Award is to encourage better satellite receive capabilities. This is accomplished through on-the-air tests wherein calibrated signals are sent via the transponder at successively lower levels. An individual qualifies for the basic award or a subsequent endorsement by demonstrating his ability to successfully copy the cw code groups sent at various low amplitudes. Signal strength is referenced to the beacon.

The first dry-run was held on Sunday, 7 April at 1730 UTC. The satellite was over the mid-Pacific so coverage was in-
complete. The signals were originated at WA2LQQ using a special arrangement of spectrum analyzers, preamps, splitters, attenuators and receivers. The beacon level was displayed. Next a test signal downlink equal in amplitude to the beacon (as heard at WA2LQQ) was generated. This reference level was denoted by a series of cw “O”s. Next the amplitude was reduced by 3 dB and a series of “1”s was sent indicating the level was “1” increment (3 dB) below the beacon. Next, transmit power was again reduced to produce a downlink signal 6 dB below the beacon. A series of cw “2”s denoted that level. The process was repeated through levels 9, 12, 15 and 18 dB below the beacon. These levels were indicated by cw signals of “3”, “4”, “5” and “6” respectively. At WA2LQQ the ERP required to generate a signal 18 dB below the beacon was approximately 10 watts ERP. This downlink was not copyable at WA2LQQ while level 5 (beacon - 15 dB) was partially copyable. The CW was machine generated using an AEA M8ARC and keyboard.

For the actual test runs next month, a slightly different protocol will be used. As before the levels will be indicated by a series of exactly five numeric characters. For example, the string “44444” would indicate the test sequence to follow is 12 dB below the beacon. The actual test message will be a random group of exactly 5 numeric characters repeated exactly three times. The test group of five characters will be different for each test level and for each test session. The test character group can be distinguished from the level markers characters in that the latter five character group has all five characters identical, e.g., “44444”.

A typical test sequence might proceed thus:

```
00000 00000 00000 72518 72518 72518
11111 11111 11111 94220 94220 94220
22222 22222 22222 31965 31965 31965
33333 33333 33333 44336 44336 44336
44444 44444 44444 80123 80123 80123
55555 55555 55555 09172 09172 09172
66666 66666 66666 56340 56340 56340
```

If the participant correctly guessed 80123 for level 4 but missed at 09172 for level 5, he would receive the basic ZRO-Award plus all endorsements down to beacon minus 12 dB. Endorsments will be attractive stickers for affixing to the basic certificate. An individual can qualify for the basic award using either Mode B or Mode L. A nominal processing fee will be assessed to offset the cost of the certificate and handling. The exact amount will be determined after the certificates are in hand.

The first two Mode B test runs for the ZRO-Memorial Award are scheduled as follows:

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Time</th>
<th>MA</th>
<th>PA</th>
<th>Az</th>
<th>EL</th>
<th>SSP</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>5 May</td>
<td>1130</td>
<td>106</td>
<td>9</td>
<td>182</td>
<td>42</td>
<td>ON, 76W</td>
<td>1.2</td>
</tr>
<tr>
<td>Fri</td>
<td>24 May</td>
<td>1015</td>
<td>108</td>
<td>9</td>
<td>179</td>
<td>39</td>
<td>25, 73W</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. PA is pointing angle; the off-bore sight angle from WA2LQQ at the test epoch. Chosen to minimize spin modulation. Near apogee also chosen to broaden coverage and reduce range differences between contestants (to normalize path loss).
2. Az and El are from WA2LQQ only.

Report forms will be available from AMSAT shortly.

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**Spring Satellite Bulletin Schedule Announced**

The spring schedule for the satellite bulletins has been announced. The voice bulletins will appear on Special Service Channel (SSC) H2, nominal downlink frequency of 145.962 MHz.

<table>
<thead>
<tr>
<th>Btn#</th>
<th>Day</th>
<th>Date</th>
<th>Time</th>
<th>Orbit#</th>
<th>MA</th>
<th>SSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Sun</td>
<td>14 Apr</td>
<td>1500</td>
<td>1381</td>
<td>124</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>Sat</td>
<td>20 Apr</td>
<td>1200</td>
<td>1393</td>
<td>148</td>
<td>65</td>
</tr>
<tr>
<td>16</td>
<td>Sat</td>
<td>4 May</td>
<td>1400</td>
<td>1422</td>
<td>146</td>
<td>85</td>
</tr>
<tr>
<td>17</td>
<td>Sat</td>
<td>11 May</td>
<td>0600</td>
<td>1436</td>
<td>75</td>
<td>6N</td>
</tr>
<tr>
<td>18</td>
<td>Sat</td>
<td>18 May</td>
<td>1400</td>
<td>1451</td>
<td>100</td>
<td>0N</td>
</tr>
<tr>
<td>19</td>
<td>Sat</td>
<td>25 May</td>
<td>1300</td>
<td>1465</td>
<td>183</td>
<td>17S</td>
</tr>
</tbody>
</table>

Bulletins normally last 10 to 12 minutes and are followed immediately by orbital predictions. Bulletins are currently transmitted using 2:1 amplitude compression. A 4:1 compression rate will be implemented using a modified ST1 ACSB radio later this spring. Recovery techniques using expanders of complimentary rates will enhance audio quality and intelligibility.

Mode L bulletins are planned to begin in May. Initial downlink frequency is 436.280 MHz, USB. Mode L will eventually employ ACSB as well as Mode B.

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**PACSAT Meeting Minutes Offered**

Compiled by PACSAT Program Manager Harold Price, NK6K

Minutes of PACSAT Design Review Meeting
VITA Headquarters, Arlington, VA
Goddard Space Flight Center
March 9-11, 1985

Thanks to Paul Rinaldo for his assistance in the preparation of these minutes.

**Present were:**

John Biro, K1KSY, AMSAT
Ed Brandon, International Development Research Centre, Ottawa
Dr. Thomas A. Clark, W31WI, Director, AMSAT
Richard Daniels, W4PUL, AMSAT
Rick Fleeter, WA8GVK, Propulsion Systems
Dr. Gary Garriott, WA9FMQ, VITA Technical Advisor
M. Stephen Hodgart, University of Surrey
Anne Heyniger, VITA Resource Development Manager
Lyle V. Johnson, WA7GXD, digital systems design
Phil Karn, KA9Q, AMSAT
Dick Kutz, KS3Q, Goddard SFC
Richard Kerr, Canada
Jan A. King, W3GEV, Vice President, Engineering, AMSAT
Larry Kayser, W3ZIA, Ottawa group
Stan J. Kazmieruk, VE3JBA, Ottawa group
William McAlister, W3AUN, Goddard
Henry Normal, VITA Executive Director
Hugh Pett, VE3FLL, Ottawa group
Harold Price, NK6K, PACSAT Project Manager
Bill Reed, W8ETZ, Ground station design
Paul L. Rinaldo, W4RI, ARRL Publications Manager
Robert Stricklin, N5BGR, Ground station design
Dr. Martin Sweeting, G3YJO, UoSAT Program Manager
Jeffrey W. Ward, K8KA, ARRL Laboratory Engineer
Jean Wilkowski, Chairman, VITA Board of Directors
David MacQuarri, CBC Reporter

Dr. Gary Garriott: Opening Remarks

Jean Wilkowski: Conference Objectives

- Technical refinement & definition
- Exact budget?
- Big name/benefactor to attract people to idea and money

Henry Norman: VITA Mission and PACSAT

- VITA is involved in appropriate technology -- latest, not basic.
- Trying reach people at village level.
- Concerned about how technology is transferred and applied.
- Emphasized interest in communications -- PACSAT is an important part.
- Ethiopia could use PACSAT now.
- Promised that VITA would find funds.

Harold Price: Conference Focus

- Primary problem is funding.
- Confident that electronic package for a meaningful proof of concept can be developed that will fit in a GAS can.
- Launch services agreement must be at NASA in Jul 1985, to maintain our place in the reservations list.

Lyle Johnson: PACSAT-Related Activities in Tucson and TAPR

- Description of El Paso GAS-can experiment controller. Took on the job to gain experience that would be useful in PACSAT project.
  Used NSC800 microprocessor and 128-byte mass storage - gain experience windowing in memory.
- TAPR involved in design of UoSAT 2 Data Communications Experiment (DCE).

Larry Kayser: Ottawa Activities

- Commented on his trip to Hawaii at which he demonstrated packet radio through UoSAT DCE at the Pacific Telecommunications Conference. Got message to UoSAT and received answer from Surrey using DCE.
- Wants to get demonstration in Third World country.
- Performed PACSAT memory experiments to reduce power drain.
- Received new CMOS memory chips from Lyle Johnson.
- Wants to be battery clearing house - has test facilities.
- Prototype of large memory array is ready to build, funding required for parts.

Dr. Martin Sweeting: University of Surrey Activities

- Working on UoSAT DCE and higher data rates.
- First DCE demo in Jan 85.
- Harold Price to get improved software (when ready) into DCE.
- In March, will release functional description on TELENET.

Bill Reed: Dallas Projects

- VITA HQ/AMSAT Command station -- fully automated, crossed Yagis on az/el mount, high power (100 W+), large storage and processing, 10-Mbyte Winchester IBM PC
- VITA regional center/AMSAT gateway -- Xerox 820, 50 W
- VITA end user -- suitcase, ground-plane antenna, 10 W, lap computer (e.g., RS Model 100), solar powered, all CMOS.
- In common to all of above stations: 9600-Bd TNC, frequency-agile radios to select uplink channel and compensate for Doppler.
- Need demo package ASAP.
- Stress need for hard copy in demo package.

Phil Karn: PACSAT Modem System

- Operates BPSK at 300-9600 Bd, laid out on 4 X 5-in PC board.
- Costas-loop demodulator is a power hog needing redesign.
- Hasn't done BER testing - needs help.
- Thinking about adding data scrambler similar to that of Steve Goode, K9NG.

Anne Heyninger: PACSAT Funding

- Best news on funding was Herbert (Pete) Hoover III, who very interested in relief -- American Red Cross, Int'l Red Cross.
- Tektronix Foundation gave $5 k.
- Expect money from UN/PADAS, headquartered in Addis.
- UNEDO, Vienna, pledged $5 k.
- Public information is out, but money has not come in.
- Hoover suggested his foundation will entertain $40-50 k proposal from VITA for PACSAT fund-raising consultant.
- Current prospects: AT&T (DC), Fairchild (VA), Keck Foundation (CA), Lockheed (CA), RCA (NY), Rockefeller Foundation (NY), TRW (CA).
- Harold Price says that $15 k is available now for hardware.
- Funds for Harold Price came from AID.

Paul Rinaldo: FCC Licensing

- Group was confused on responsibility for dealing with FCC.
- Licensing paperwork has been filed and is in FCC's court.
- VITA would like to know status.
- ARRL willing to take point on FCC liaison but need timely technical information, which to date has been slow coming.
• There was consensus for periodic Williams/Garriott/AMSAT rep meetings to coordinate liaison with FCC.

Harold Price:

Discussed various orbit possibilities (97, 26, 57 degrees).
• Garrett defined VITA needs orbit to cover not only equatorial areas but VITA Headquarters, Wash, DC.
• Rinaldo recommended VITA consider HF and VHF packet for in-country packet radio.
• Consensus was to target for high inclination orbits (greater than 57°) vs low inclination orbits had too many negative effects on command and control functions.

Rick Fleet: PACSAT Propulsion System

• Discussed propulsion system requirements, design, and construction. Initial design study is complete, design of the first prototype is underway.

Jan King: Spacecraft Main Problem Areas

• 57-degree orbit will require work in the thermal control area to protect batteries.
• Fast-acquisition demodulator capable of locking in few ms.
• Gravity-gradient boom competes with volume for electronics and position for second thruster.
• Prefer octagonal (to cylindrical) shape as it easier to mount replace solar cells. Tank would be cylindrical, so corners of octagon used for wiring channels.
• GAS-launched spacecraft is volume limited not power limited.
• For program to succeed, need managers for: Spacecraft bus PACSAT instrument PACSAT user equipment Command/control station
• Sees as two-year program

Dr. Martin Sweeting: Design Considerations

• Feels that PACSAT should pursue both Shuttle and expendable-vehicle launch opportunities. Shuttle GAS-can configuration necessitates use of unproven designs. Expendable-vehicle launch would permit use of proven hardware.
• Reported experiments with several BPSK modem designs which showed difficulty getting them to work and be replicable, even in tens.
• Using UoSat-Oscar 11 as a test bed for modem development.
• Has 2400-Bd AFSK-PM modem routinely working.
• Despite general dislike of programming RCA 1802 microprocessor, there is much UoSat spacecraft control software for it.

Phil Karn, KA9Q: BPSK 9600-Bd Modem

• Everything works except Costas loop, to reduce power consumption.

• Needs help doing PC layout. Surrey agreed to handle.
• First few will require lots of tweaking. Reproducibility has not yet been determined.
• Plans to have modem built into the radio so users can just plug unit into TAPR TNC.
• Tom Clark asked whether Steve Goode, K9NG, 9600-Bd FSK modem could be used for uplink. Harold Price estimated a 6-dB penalty for FSK. Additional uplink power could be supplied by amplifier with small heat sink because of low duty cycle.
• Harold Price proposed use of the microprocessor present in every ground station to determine transmit frequency. Jan King favored solving fast frequency-acquisition circuitry for satellite.

M. Stephen Hodgart: Modulation and Coding

• Assumptions:
  Constant-envelope power
  Capable of reception with ordinary receiver
  Minimum bandwidth/ratio from carrier
  Potential S/N performance near that of BPSK
  Demodulates independent of bit sequence
  BPSK can be filtered (Feher). Linearity needs to be maintained after modulation or effects of filtering destroyed.

• PM-FSK is not optimum but it works.
• PFM-MSK uses 1/2 cycle of frequency for one state, 1 cycle for the other state. It is not purely FM or PM. DC free. No level or slope discontinuities. Any bit pattern can be demodulated. Produces good eye pattern with coherent receiver.
• Showed cumulative power spectra for different modulation schemes. PFM-MSK is particularly good recovering after fades, regardless of pathological bit sequence.

Lyle Johnson: New Technologies since 1983 Boston Meeting

• Can pack a lot more memory in same space and with lower power than two years ago. One CMOS serial input/output (SIO) chip does the same job as 35 chips to do HDLC encoding and decoding.
• Larry Kayser said that overall memory board is half the size of that flown in UoSAT 2/OSCAR 11.

Harold Price: Design Discussions

• PACSAT to be designed for GAS can. (See paper by Jan King, S/C Main Problem Areas for drawing of internal construction.)
• Diameter to be 19" (corner to corner of octagon).
• Battery compartment to be 4 in high.
• Tank to be 4-1/2 in high.
• Electronics boxes may be trapezoidal segments of octagon, based on further study by Surrey.

Meeting at Goddard Space Flight Center with Mr. Clarke Prouty, Technical Liaison, Gas Program, GSFC and Ms. Donna Miller, Gas Program, NASA HQ

• Cost of a gas can with deployment mechanism and Motorized Door Assembly is estimated to be $20,000
- Standard GAS procedures do not include clean room facilities during the final payload integration.
- The next GAS experimenters conference will be October 8 & 9, 1985.
- The group inspected the GAS deploy mechanism, the NUSAT spacecraft, and several standard GAS cans.
- The importance of submitting the Payload Accommodations Requirements document and the Launch Services Agreement were repeatedly stressed.

**Action Items**

- Phil Karn to contact JAS team about thermal implications of the 57 degree orbit.
- Phil Karn to send the result of his modem research and current designs to Surrey for implementation.
- Phil Karn to send K9NG modem designs to Surrey.
- Larry Kayser to send DCE non-flight batteries to Dallas for ground station development.
- Tom Clark to send TELEMAIL command summaries to all users.
- Surrey will refine spacecraft mechanical design details.
- Kayser will start flight battery testing as soon as batteries received (takes 18 months).
- Tucson will do PACSAT instrument design, CAD, and prototyping, by December 1985.
- Engineering design review to be held in January 1986.
- Ottawa will begin flight hardware fabrication by before May/June 86.
- Software team will devote next 3 months to UoSAT 2 DCE testing and will work on PACSAT software after PACSAT hardware better defined.
- ARRL lab will complete the microprocessor az/el controller being designed by Jon Bloom, as it appears to be ideal for PACSAT demonstration unit. (Larry Kayser stressed need for RFI-tight box.)
- Surrey will continue its modem experiments and compare results with K9N (BPSK) and Goode (FSK) designs.
- Harold Price to institute regular status reports to and from all team members.
Call For Nominations

AMSAT Headquarters announces that nominations for the office of Member of the Board of Directors are now in order. The seats of four directors—John Henry, VE2VQ, Jan King, W3GEY, John Browning, W6SP, and John Pronko, W6XN—are up for election in this cycle. Last November three directors (Thomas Clark, W3JWI, Vern Ripportella, WA2LQQ, and Harry Yonedo, JA1ANG) were elected. The term of office is two years.

An AMSAT member who agrees to serve can be nominated by any five current AMSAT members or by an AMSAT member society. Nominating petitions may be sent to: AMSAT, 850 Sligo Ave., Silver Spring, MD 20910.

Petitions must arrive at AMSAT not later than July 31, 1985. Nominees will be asked to provide minimal background and biographical data for inclusion with the ballot forms.

Publisher Wanted

AMSAT is soliciting applications for the position of volunteer publisher of Satellite Journal. The successful applicant should be a radio amateur with experience in business, preferably publishing. He or she should be capable of handling an important and highly visible position within the AMSAT organization and the amateur-radio community.

Responsibilities of the position include administration of advertising sales efforts, management of the magazine's budget, and policy determination in concert with the editor and key AMSAT officers.

Remuneration includes a sense of accomplishment in helping further the goal of AMSAT to provide reliable satellite facilities and services to radio amateurs. It also includes valuable experience in the administration of an important, technically-oriented publication, as well as an opportunity to learn and help the amateur-radio manufacturing and sales industry in the U.S. and abroad.

Teacher in Space

An AMSAT member, Jeannine Duane of Long Valley, New Jersey, is among 118 semifinalists competing for a chance to be the first citizen space traveller. Jeannine, WB2MBW, is a teacher at the Black River Middle School in Chester, New Jersey.

In response to President Reagan's suggestion that it would be fitting that a teacher be the first citizen invited for a ride in the space shuttle, Jeannine joined 40,000 others in mailing in an application. Her selection as one of two teachers from New Jersey to compete for the prized berth on the shuttle was announced by Governor Thomas Keane.

Plans now call for a meeting of all 118 semifinalists in Washington, DC in late June. After an evaluation, 10 teachers will be selected for an intensive review at the Johnson Spaceflight Center in Texas. The field will be narrowed to five before just two are selected to be the prime candidates and the back-up.

Jeannine is married to Richard Duane, WB2VAT. She has taught all levels of school, including classes for the talented and gifted, and has made science and amateur radio in particular, tools for use in the classroom. A teacher for 30 years, Jeannine has been a ham for 17. She and her husband have been AMSAT members since the late 1970s.

Short Bursts

- In new AMSAT appointments, Joe Flaska, WB0RLY, has been appointed Area Coordinator for Colorado replacing KB0RZ who is busy on the S-Band transponder for P3C. WB0RLY joins W0VQ in Colorado as Area Coordinator. Other new Area Coordinator Appointments announced recently include Robert Thannish, KN5D, AAC for New Mexico; Lee Owens, W61FW, AC for Kansas; Vic Politi, W1NU, AC for Connecticut; Ken Cole, KY7I, AC for Idaho; Dan Coleman, W9UFZ, AC for Nebraska. Mike Crisler, N41FD, has been appointed Assistant VP for Hamfests/Conventions by Executive VP KBOCL. President WA2LQQ has appointed WB8ZTV, Don Knollinger, Special Assistant/Gateway Coordinator reporting to the Vice President of Operations. Congratulations to the new appointees!
- Radiokit of Greenville, NH has a version of the G3RUH PSK demodulator available for $135. At presstime they hadn't got all the bugs out but were hopeful it would be up to snuff soon. Check with them before purchasing. Problems had to do with lock-loss with temperature and voltage stability likely the cause. Otherwise may be useful for your shack. RS-232C output.
- AMSAT/VITA meeting is shown in the "Up Front" sec-
tion of the May QST, page 12.

- W8CA will be joining the AO-10 satellite bulletin team in early June. Nick will be concentrating on Mode B bulletins during the week while WA2LQQ will carry the weekend duty. W8GQW will be doing both as time allows, Wray will be moving to Arizona permanently this year and so his exact schedule is in flux.

- Indications were at pretime that the re-orientation of AO-10 for nadir pointing at apogee which had been due for completion on 1 May was incomplete. Substantial spin modulation is the tip-off.

- The ARRL Matching Fund drive is in full swing now. Every $10 donated generates $20; every $50 yields $100, etc. Simply send your tax deductible donation to AMSAT, ARRL Matching Fund, P.O. Box 27, Washington, D.C. 20044. Show your appreciation for all the fun you have with OSCAR with a generous donation, today!

First ZRO-Test Is History

The first record run of the ZRO-Memorial Technical Achievement Award for Station Engineering is now history! The first run took place early Sunday morning on 5 May at 1130 UTC. The object of the test is to provide objective standards for calibrating satellite receive sensitivity measurements. First indications were that scores of stations took part with several hearing the weakest signal levels of 18 dB below the beacon.

There were 7 levels transmitted in the format described in ASR 101/102. Level 0 was at the beacon level and represented a transmitted ERP of nearly 2000 watts, far exceeding the recommended levels. Remarkably, several European stations including a notorious French station exceeded the beacon by more than 10 dB suggesting an ERP exceeding 20 kW!

On the low end of the test, several stations heard the level 6 transmission at beacon – 18 dB. The transmit level at the lowest test level was just over 30 watts ERP.

No Mode L tests were made on this occasion.

Entries should be in the following format:
1. Callsign and address of contestant.
2. Date of test
3. Number groups of each level copied, e.g., level 0: 12345; level 1: 23456; level 2: 34567; level 3: 45678; level 4: 56789; etc.

Cost of entry is as follows: Current AMSAT member: $3.50. (include member number). Non-Member $5.00. Covers cost of certificate, mailing and subsequent endorsements. Make checks payable in U.S. dollars to AMSAT. Mail to AMSAT, P.O. Box 177, Warwick, NY 10990. An SASE is appreciated. Entries must be submitted within 120 days of the test. Next run will be on 24 May at 1015 UTC. Frequency will again be 145.840 MHz.

The handsome certificate has the basic award in your call-sign together with space for all endorsements for higher levels of achievement in both Mode B and Mode L. The endorsements are in the form of silver and gold satellite stickers denoting the level of achievement attained by the certificate holder; a proud addition to your shack indeed!

Teleconference Net To Feature AMSAT Speakers

On Friday evening, June 14, once again the North American Teleconference Radio Net (TRN) will air with AMSAT as the theme. When last heard on the TRN on December 1, 1983 (see ASR #67) AMSAT speakers addressed more than 30,000 listeners. This year the listener base promises to exceed 50,000 according to reliable estimates. Nearly 250 repeaters may be linked together for the event.

At pretime planning was in progress for the event, the high point of AMSAT's development campaign for 1985. Speakers already identified include some of the best AMSAT has to offer. W6SP, W3IWI, W3GAY, N6K6, W3XO, K8OCL and WA2LQQ will lead the listener through virtually every facet of OSCAR satellites during the 90 minute telecast.

Speakers will gather in Silver Spring, Detroit, Boulder and Los Angeles for the event. Repeaters across North America will be linked to provide real-time coverage. Recordings of the event will be re-broadcast later over AO-10.

Area Coordinators are especially encouraged to coordinate local presentations to clubs and informal groups with the TRN.

June Is AMSAT Hi-Pro Month

According to AMSAT President WA2LQQ, this June will mark the kickoff of a special AMSAT Hi-Profile campaign to focus attention on AMSAT and ultimately to bring in new members. Several major events are coordinated to bring OSCAR and AMSAT high into the consciousness of hams.

The Teleconference Radio Net June 14 is the centerpiece. (See story elsewhere in this issue.) Other attractions include the ARRL Field Day. This has always been a fine opportunity for newcomers to see satellite activity in action. AO-10 will be in Mode B throughout Field Day this year.

In the print media AMSAT will kick off a new ad campaign with a dazzling new ad in the June QST. Moreover, a new satellite column debuts in June QST; one that seeks to entice the many standing on the sidelines to try satellites for themselves.

Dayton Success Shatters Prior Marks

The 1985 Dayton Hamvention set a new high water mark as far as AMSAT's presence and overall AMSAT goals. There were more AMSAT forums, more top-notch speakers, more new software, larger booths, higher donations and more new members and renewals than ever before. The success capped a year long planning effort by W9BQW, W8JLE and K8OCL along with a supporting crew of local Area Coordinators.

As detailed in Satellite Journal #4, the program was chock full with AMSAT forums on Friday, Saturday and Sunday.
Under the skillful moderation of W8GQW, W8JLE and KB2M, all the forums came off like clockwork. The forum rooms were generally packed to overflowing with excellent presentations made by all.

Speakers included W6SP, W4RI, NK6K, W3IWI, KBMU, KE3D, N4HY, JA1ANG, WA2LQQ, ZS6AKV, K8OCL, WA6YBT, N8ETY, WB8ZTV, WA8RYD, W3XO and W8WKA.

Activity at the dual-booth was hectic. Several new tracking software packages stirred interest among newcomers and veterans alike. The VR-85 by W6WNK et al with its graphics capability for the Commodore 64 was very popular. Similarly the new QUIKTRAK by N4HY for the IBM-PC was on display. Roy Welch, W0SL, demonstrated his new graphics-capable tracking program for the IBM-PC. All these programs are now available from the AMSAT Software Exchange. N4HY reported later that a minor glitch developed in the QUIKTRAK version designed for the C-64. He and KA2MUM found a simple fix. They say to add a new line at 5325 which says PRINT "<cntr 7>".

New members totaled over a hundred while renewals edged towards 50 according to Martha Saragovitz who made the trip to Dayton this time. Husband John, N4QQ, accompanied Office Manager Ms. Saragovitz. Martha indicated that in all, donations exceeded $10,000 topping the prior record by nearly $3,000 due in large part to the tremendous support from those staffing the booth and the excellent organization of this year's activities.

### New AMSAT Presidents Attend Dayton Hamvention

AMSAT Presidents from four national AMSAT organizations attended this year's Dayton Hamvention. Harry Yone-da an AMSAT Director for several years, was recently elected President of JAMSAT, our Japanese affiliate. Harry had been on the Board of JAMSAT and recently was elected JAMSAT President following the untimely passing of JA1NET.

Also present was Junior DeCastro, PY2BJO, President of the newly formed Brasil AMSAT called BRAMSAT. Junior tells ASR he plans to form his organization similar to other AMSAT affiliates with an internal newsletter and national nets. AMSAT congratulates the newest affiliated AMSAT organization, BRAMSAT!

SA AMSAT President Hans Van de Groenendahl, ZS6AKV, represented South Africa.

AMSAT President WA2LQQ represented AMSAT U.S. at the Hamvention.

### Mini-Board Meeting Meets During Hamvention

Meeting in Dayton this year pursuant to last November's decision to hold a special Spring 1985 session, four of the seven AMSAT Board members reviewed several key issues on Friday evening, 26 April. Present were Directors W6SP, WA2LQQ, JA1ANG and W3IWI. First Alternate Director KE3D was authorized by the Board to vote for Director W3GEY who, along with W6XN and VE2VQ, were absent.

The Board took no action to replace recently departed General Manager/Executive Director N2CF. Instead, the Directors voted to amend the Bylaws to the wording which existed prior to the hiring of the General Manager. In a practical sense this means AMSAT will operate without a GM/ED for the present. The President will review the tasks required to be performed by the GM/ED and reassign those still relevant. Office Manager Martha Saragovitz is expected to absorb several additional areas of responsibility as a result.

The role of Publisher (of Satellite Journal) was discussed and announcement/solicitation will be posted for a volunteer for this vital role. (See elsewhere in this ASR).

The AMSAT OSCAR Spacecraft Laboratory (AOSL) at the Goddard Space Flight Center, Greenbelt, Maryland will be returned to NASA custody upon the recommendation of W3GEY, W3IWI and WA4PU. Some additional work will be performed there by the Washington Phase 3C team, but when complete the lab will be released. The "fishbowl" had been obtained from NASA at the Visitors' Center at Goddard to facilitate the assembly of Phase 3A. Prior satellites through AO-8 had been assembled in basements and on workbenches. P3A was too large and thus the AOSL deal with NASA was implemented. Work on P3C is being performed at Marburg, AOSL and Boulder. When the work on P3C at the AOSL is complete, the facility will be returned to the custody of NASA.

President WA2LQQ presented an interim report on organizational direction, goals and methods. WA2LQQ also announced he had received proposals from two groups to organize the 1985 Annual General Meeting. Proposals from Dallas/Fort Worth and Houston were received and said. The Board asked the President to establish an objective selection criteria and decide where the 1985 AGM should be held. The 3rd Annual Space Symposium will likely be held in conjunction with the AGM it was stated.

A number of individuals were cited for their contributions to AMSAT. Cited were: W3XO and W4PU (Ham-In-Space); KA8CL and WA6VGS (Area Coordinator Development); W9CY (10 years as NCS); N4HY (For QUIKTRAK).

### Net Operations Realigned

Net Manager W8GQW has announced the suspension of the 15 Meter International Net on Sundays. According to Wray the decline in band conditions made the 15 meter frequency untenable; essentially useless. The 20 meter net continues at 1900 UTC on 14.282 MHz Sundays. The Southwest Pacific Net switched from 10 meters to 15 meters last autumn when conditions declined there. W6SP and W7FF report moderately usable conditions on the trans-equatorial path to ZL-VK.

The reduction in HF service will be offset by an increase in satellite bulletins and nets. WA2LQQ now transmits bulletins weekly on AO-10 SSB H2 (14.962 MHz). He will be joined soon by W6CA and W8GQW on Mode B. Mode L bulletin service will begin shortly. In addition, advanced voice processing techniques using the latest in ACSSB will provide a notable improvement in bulletin quality beginning in a few weeks.
**Project OSCAR - ACCSSB**  
**Level I Combrand Offered**  
by WB6JNN

A set of Printed Circuit Boards is available through Project OSCAR to provide ACCSSB Level 1 through OSCAR 10. These boards provide both compression and equalization during transmission and de-equalization with expansion during reception.

By using ACCSSB Level 1, a net increase of 10-20 dB in Signal-to-Noise performance is achieved with signal levels normally encountered via OSCAR 10. This processing will not improve signals that are already too weak to copy by experienced operators, but it will greatly improve the copy and quality of reception of moderately weak stations.

On stations 8-12 dB above the noise level this improvement is about 5-15 dB...increasing with increasing incoming SNR. Signals arriving at 12-18 dB above the noise will produce "near full quieting" when processed at both ends. Signals above 18 dB are, for all practical purposes, "full quieting".

Please note: Level 1 processing provides companding and equalization only and will not improve rapidly fading signals. We are working on a second add-on unit to provide a pilot tone for AGC purposes but this is not part of the current adapter. These second units will require the Level 1 boards, however.

**PRICES:** (Donation...) all excess to go to satellite projects

1) **LEVEL 1 ADAPTER PC BOARD** (Double sided, plated through holes, commercial grade). This includes 10 page documentation package including parts lists, schematics, layout, and parts sources with stock numbers. (TX and RX on one 3.8 x 3.5" PCB) **$15.00**

2) **LEVEL 1 ADAPTER PC BOARD SET** (As above except two 1.9 x 3.5" PC Boards for use in individual Pomona 2902 die-cast boxes or equivalent. Allows separate TX/RX functions for individual radios). **$15.00**

3) **EXTRA BOARDS (1) OR SETS (2).** **$10.00**

4) **EXTRA DOCUMENTATION PACKAGE** **$1.00**

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**Orbit Predictions By KA9Q**

**Satellite: OSCAR-10**  
**Catalog number:** 14129  
**Launch time:** 05112.616698093  
**Apr 23 14:18:27.152 1985 UTC**  
**Element set:** 169  
**Inclination:** 28.1537 deg  
**RA of node:** 142.1372 deg  
**Eccentricity:** 0.377141  
**Arg of periapsis:** 18.5944 deg  
**Mean anomaly:** 358.7839 deg  
**Mean motion:** 2.0385671 rev/day  
**Decay rate:** 5e-08 rev/day  
**Rev:** 1399  
**Semi-major axis:** 26105.415 km  
**Anom period:** 695515763 min  
**Apogee:** 353325686 km  
**Perigee:** 4131.502 km  
**Ref perigee:** 26696.1660841  
**Apr 23 14:30:47.766 1985 UTC**  
**Transate freq:** 581.0047 MHz  
**Incl:** 1  
**Beacon:** 145.8100 MHz

**Satellite: OSCAR-11**  
**Catalog number:** 14781  
**Launch time:** 05104.61668284  
**Apr 14 14:40:49.343 1985 UTC**  
**Element set:** 63  
**Inclination:** 98.1983 deg  
**RA of node:** 171.2312 deg  
**Eccentricity:** 0.0014823  
**Arg of periapsis:** 293.2678 deg  
**Mean anomaly:** 14.6159910 rev/day  
**Mean motion:** 2.03607 rev/day  
**Rev:** 573  
**Semi-major axis:** 12706.072 km  
**Anom period:** 984297686 min  
**Apogee:** 712.131 km  
**Perigee:** 691.215 km  
**Ref perigee:** 26606.624366161  
**Apr 14 14:59:04.843 1985 UTC**  
**Beacon:** 145.8260 MHz

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Short Bursts

- In ASR 102, we omitted the address to which to write for info on ACSSB Level 1 kits. The address is: Project OSCAR, ACSSB-1, 15 Valdez Lane, Watsonville, CA 95076. Please include an SASE. Tks and sri for address omission.
- We're saddened to learn of the passing of a friend of many of us, Fentin Martin, KH6OD, after a long illness. Details not available except the end came in hospital approximately 16 May.
- It is appearing more and more likely that the Arsene satellite of the French group, RACE, will be present when the Ariane 4 #1 takes Phase 3C into orbit next summer. Word from F3HK, quoted by G3IOR, has it that kick motor problems have delayed progress to the point that schedule slippage is inevitable. RACE will be seeking a launch on Ariane 4 #2 or later according to these sources. Launch could come in Autumn 1986. Also scrapped due to schedule constraints will be the 10 GHz beacon experiment. Present plans call for a Mode B and a Mode S transponder.
- Next Ham-In-Space mission will include Tony England, W8ORE, with a launch date tentatively pegged at 15 July 85. The primary downlink frequency will be 145.55 MHz. Schools and clubs which wish to schedule QSOs should contact ARRL HQ ASAP. Tony says much of his time will be occupied on science efforts but that he will be operating as much as possible. Shuttle Challenger is due for a 7 day mission landing at Edwards AFB on 22 July. Also aboard is astronaut-ham John-David Bartoe, W4NTZ, who may also get in some operating time. The SSTV and the 2 meter transceiver used by W5LFL will be along for communications.
- Phyllis Zwirko, XYL of K1HTV, formerly AMSAT VP-Ops, has made a small AMSAT flag for Tony England to carry along with him to orbit next July.
- Gerd Schrick, WB8BFM, has taken over the operation of the publication, “UHF Compendium” formerly by Karl Weiner et al. Gerd states parts 1 and 2 are available in a single bound volume for $20. Write him for info at 4741 Harlou Drive, Dayton, OH 45432.
- Paul Beeman, KA2MUM, New York City Area Coordinator, will be operating from Saint Martin from May 23 through May 29th. Frequencies will be 145.940 SSB and 145.885 CW. QSL via K2PWG. Thanks WA6VGS and N4IFD.

- The Isle of Mann DXpedition netted 603 QSOs including 38 states and 41 countries according to G3IOR.
- The RS satellites (5, 7 and 8) are doing well now that they're back in full sunlight, says UA3CR. RS-5 and 8 will be in transponder mode while RS-7 will be in robot until about 10 June. At that time a new operating schedule will be implemented to counter a new series of eclipses.
- AMSAT HQ is asking for donations of copies of old ORBIT magazines for binding into special edition volumes. If you have any back issue in good condition, please mail them to Martha at HQ ASAP. AMSAT, 850 Sligo Ave, Silver Spring, MD 20910.

AMSAT President WA2LQQ making a presentation at Dayton, '85.
New AO-10 Schedule
Provides Bonus Operating Time

A new AO-10 operating schedule went into effect 7 May. The change was announced on the AO-10 general beacon by command station ZL1AOX. Ian says the schedule is as follows:

<table>
<thead>
<tr>
<th>Mode</th>
<th>MA Start</th>
<th>MA End</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>032</td>
<td>119</td>
</tr>
<tr>
<td>L</td>
<td>120</td>
<td>136</td>
</tr>
<tr>
<td>B</td>
<td>137</td>
<td>220</td>
</tr>
<tr>
<td>Off</td>
<td>221</td>
<td>031</td>
</tr>
</tbody>
</table>

The addition of 20 MA counts (almost a full hour) to the Mode B operating time was undertaken as an experiment to make the most of the excellent operating conditions now present. With sun angle very good, the attitude of the spacecraft has been aligned such that the Z-axis is aligned with the line of apsides. That means the Z-axis is at 180 degrees in the Bahn coordinate system and that the 23 cm helix points at the geo-center when AO-10 is at apogee.

The current schedule will be in effect for as long as conditions allow; probably not later than late June or early July at the latest. Analysts predict a major series of eclipses combined with dismal sun angles later this summer and fall. Cutbacks in operating time and reorientation of the satellite will be necessary they say.

Meanwhile, the next several weeks should see some of the best operating time ever on AO-10; perhaps the best so far in its life. AO-10 will be two years old 16 Jun 85; a few weeks hence.

Accident Claims Active AMSAT Member

AMSAT Life Member Bill Cooley, WB2YIK, has died in an automobile accident in suburban Binghamton, N.Y., according to long-time acquaintance Andy Deskur, KA1M. The accident occurred at approximately 11:45 PM EDT on Friday evening, 10 May. He was 35 years old and a bachelor.

According to KA1M, WB2YIK was spending the weekend at his mountaintop retreat near Binghamton where an elaborate ham shack was Bill's home away from home. According to reports he was on the way into town on a mountain road to buy some groceries when, apparently, the car he was driving skidded on some gravel, slid into a gully and struck a tree. He died in the car which was totally destroyed. There were no passengers in the vehicle.

Bill Cooley had been an ardent AMSAT member active on the satellites beginning with AO-6. Recently he had begun the enormous task of filling the shoes of Kaz Deskur, K2ZRO, in the Binghamton area regarding AMSAT presentations and satellite demonstrations in the New York and Pennsylvania vicinity. K2ZRO became a silent key just over a year ago. WB2YIK was a member of the Kopernik Society in Binghamton and was instrumental in the planning and implementation of the K2ZRO Memorial OSCAR Satellite Station at the Observatory. Observatory Director Jay Sarton, said Bill's passing left a large gap in the volunteer staff at the observatory.

Bill Cooley, WB2YIK, at the dedication of the K2ZRO memorial station at the Kopernik Observatory in 1984. WB2YIK became a silent key recently (see story).

Bill was with the engineering department of a major cable TV concern. He is survived by his parents and a sister and both grandmothers. He had one niece. A licensed amateur for 22 of his 35 years, he was a regular at the AMSAT Annual Meetings. On May 14 he was buried in Brooklyn, Pennsylvania, with his cherished AMSAT callsign badge.

KA1M, WA2LQJ

[Editor's Note: I had personally known Bill Cooley for most of the years we both were active on OSCARs. He was one of the most enthusiastic hams I have known and was a superb CW operator. He ran rings around me in CW QSOs but always took care to avoid making me look too bad at it. I vividly recall trekking to the Goddard Space Flight Center in radio caravan with Bill and Kaz (K2ZRO) for the Annual Meeting. Seems to me he was part of the early Phase IIIA Operations planning sessions held at ARRL HQ as well. Last spring after the dedication of the K2ZRO Satellite Station at the Kopernik Observatory Bill gave me a very special tour of his ham shack of which he was very proud. He had lots of equipment for everything from ATV to RTTY. Above all, however, he cherished his OSCAR QSLs and station...and his memories of how "Kay" (rather than the less familiar "Kaz", K2ZRO) had lured him into this fascinating activity years earlier. Both are now sorely missed. How fragile this silver cord. Peace.]

DXCC-Satellite Award
Now Includes AO-10 QSOs

With the recommendation of AMSAT's Board of Directors last November, the way was cleared for the addition of AO-10 QSOs for credit towards ARRL's DXCC award with satellite endorsement. Now ARRL has learned ARRL will announce shortly this change.

Many who favored the including AO-10 QSOs for credit
towards DXCC pointed to two justifications. First, they said that geography played favorites since some areas of the world, notably Europe, offered many more countries than others. Those who could reach Europe with Phase II satellites, they argued, could attain DXCC using them while others, not so favorably disposed geographically, could just sit back and dream. They thus looked towards the high-flying, broad coverage AO-10 as an equalizer in an otherwise “stacked deck.”

Those who argued against inclusion of AO-10 contacts and felt they should not count towards DXCC pointed to the arduous task DXCC represented using Phase II satellites. They felt using AO-10 made it too easy and thus undermined the significance of the DXCC award. On the other hand proponents countered that there are barely 100 countries on AO-10 regularly and so it still represents a challenge of some magnitude.

Other opponents feared runaway high-power use, a trend, they said, which would be spurred by intense competition on thebird.

Nevertheless, the AMSAT Board, having thoroughly reviewed the arguments, last November voted in favor of including AO-10 contacts in the DXCC satellite award. The majority felt the risks were justified in view of the potential for growth through new members the DXCC Satellite award would attract.

Packet Radio News

by W3IW

Having just returned from the Dayton Hamvention I want to let all know of the exciting developments in Packet Radio. Let's start by describing the new products seen there.

Heathkit: The TAPR-clone HD4040 was very prominent. I was told that Heath's initial production run of 4040's was 500 units and represented a 3 month sales forecast — since their catalog came out earlier in April, they had delivered about 450 units, and had only 50 for sale at Dayton. The 50 were sold out before the weekend was over. Heath showed their new add-on status indicator box (which will also work with TAPR units, since the TAPR TNC-I and HD4040 are identical, and which will work with AEAA units if the parallel port chip is installed for the same reason) — this little 2” cube indicates connect status, buffer status and even beeps when someone connects with you. One Heathkit rep told me he is trying to get Heath to make their metal cabinets available for those TAPR owners that still are using a cardboard box or piece of plywood.

Kantronics: Kantronics showed their new “Packet Communicator” TNC. This 2”x6”x8” box looks like a smartmodem and lists for $350 (available with discounts) — pictures can be seen in the most recent amateur magazines. The inners have something like 7 chips, and uses a 6803 processor. The code is adapted from TAPR's TNC-I code with several changes. The low-level routines that generate HDLC format and NRZI data are done in software rather than using a hardware HDLC controller chip. The async link to the user's terminal makes use of the UART built into the 6803; since everything is interrupt driven, this software approach does not seem to suffer from the ills of the GLB — time.

However, the software HDLC generation seems to be the reason that the maximum baud rate “on-the-air” is 1200 (supported speeds are 300, 400, 600 and 1200 baud). Since the high-level code is a clone of TAPR's, a TAPR user can step up to a Kantronics unit and operate it with complete familiarity. The Kantronics unit has a built-in modem using the single-chip Am 7910 “world” modem which offers both 103A (for HF use) and 202A (for VHF use at 1200 baud). It uses a 5-pin DIN connector for the radio interface, and operates from an external +12 VDC supply thru a 3.5 mm standard power connector. Kantronics advertisement promises special packet terminal (“Pac-Term”) software for many popular computers in the near future; since the Kantronics user interface is identical to TAPR/Heath/AEA, it would seem to me that this software should be usable with with any of the TAPR-based TNC's.

HAL: The main-line RTTY manufacturer from Illinois introduced their TAPR-clone (intended primarily for commercial applications) in a beautiful 3.5” rack-mounted cabinet and priced at about $1000.

TAPR TNC-II: The non-profit TAPR group made the big hit of the show by introducing their new TNC-II (sometimes called “tiny-TNC”) controller. Physically, it looks almost identical to the new Kantronics unit (not surprising, since the aluminum extrusion used as a cabinet comes from the same manufacturer that supplies Kantronics) except that it is slightly longer (about 9”); interface connections are also essentially identical to the Kantronics, including a 5-pin DIN plug for the radio interface.

TAPR's new gem employs a Z80 cpu (hardware designed by AD71) with the TNC software written in native Z80 assembly code (by N2WX); the operating software consumes about 12k bytes of ROM space and the user interface is essentially identical to the older TNC-I (a.k.a. Heath HD4040, a.k.a. AEAA KT-1). Memory on the TNC-1 consists of 3 byte-wide sockets with the RAM being CMOS with battery back-up (replacing the NOVRAM on TNC-I). HDLC generation uses one half of a Z80-SIO chip, and the async terminal uses the other half. The NR21 encoding/decoding and clock recovery is done with a DPLL implemented as a finite-state-machine with a 2716 EPROM and LS373 byte-wide latches. The modem is a carbon copy of the X22211/X22206 design in TNC-I; The TNC-II also uses the same 20-pin external modem connector. Power requirements are +12 VDC only, with negative voltages for the RS232 terminal interface being derived from a small on-board DC/DC converter (a la the AEA KT-1). The power consumption is < 3 watts when NMOS chips are used and falls to about 1.5 watts when the board is populated with CMOS logic.

It is my understanding that the functional differences from TNC-I are as follows:
- The support of VADGC V.1 protocol has been dropped.
- TNC-I's NOVRAM had two “banks” which could contain different set-up parameters; TNC-II has only one “bank” in its battery powered CMOS RAM.
- TNC-I had an initial “autobaud” routine for setting the terminal baud rate during cold restarts; TNC-II's terminal baud rate is set with a dip rocker switch on the rear panel.
- TNC-I had up to 16 possible HDLC baud rates selectable under software control, while TNC-2 has 8 baud rates set by rocker switches (unless an external clock is provided).
TNC-II's maximum baud rate is 9600 baud with the internal baud rate clock (although 56 kbaud should be possible with an external clock).
- The parallel I/O port (usually not used except by status indicators like the new Heath box mentioned earlier) is not supported. However, front panels LED's on TNC-II show "connected" and "TNC has unacknowledged packets" status functions.
- TNC-II firmware supports AX.25 Rev.2 specifications. Rev.2 firmware for TNC-I won't be available 'till summer.
- A number of new functions have been added, which will be described in later reports after I get my hands on a real, live TNC-II.

TAPR indicates that the initial production batch of 300 units will be available sometime this summer. So far, about 8 units have been fabricated from a "Beta" test batch of 25; the other 17 "Beta" units will be making it into the field in early May. In the MAPRC area there will be two of the initial test units — WB4JFI to test compliance with AX.25 Rev.2 and W3JWI to test compatibility with applications like W0RLI PBB's and suitability for certain AMSAT/PPCSAT related tasks. TAPR will not take orders for the TNC-II until it is ready to make the initial production run of 300 units.

Oh yes — VERY IMPORTANT — The price announced for TNC-11 is $185 (in kit form) including the cabinet!

K9NG 9600 Baud Modems: Steve Goode gave another presentation on his 9600 baud hardware at one of the Dayton forums and his prototypes were running in the TAPR booth. TAPR has produced artwork for the modem boards and the initial verification batch of 5 boards will be available for Steve to evaluate next week. After PCB verification, an initial batch of about 100 boards will be made (presumably in June) to act as a "seed" for network tests elsewhere. The K9NG design assumes a radio with direct FM capability (i.e. a varactor in the xtal oscillator) on xmit, a rcvr with about 12 kHz bandwidth (typical FM radio) with a direct connection to the discriminator output. The interface to the TNC is via a ribbon cable to the 20 pin dip header "external modem" connector on TNC-I, TNC-II, AEA or HD4040 TNC's.

AMSAT Videotape Library
Current Tapes Available

#1 OSCAR The Satellite You Can Use — A narrated slide program outlining the history of amateur satellites. Also includes a silent film of the attempts to launch the Phase III-A satellite. (VHS and Beta II)
#2 Orbital Simulation Tape — A computer simulation of the earth as it would appear from OSCAR 10. Lasts only about one minute. (VHS only)
#3 Amateur Radio’s Newest Frontier — The original ARRL tape of the W5LFL STS-9 flight in December 1983. (VHS only)

Tapes 4 through 8 were produced at the 1983 AMSAT annual meeting.
#4a OSCAR 10 — Its design technology and construction by Jan King.
#4b The Mode L Transponder by Jan King, 01:49 (VHS only)
#5a OSCAR 10 operations and ground station requirements by Doug Loughmiller.
#5b Map based on tracking systems for OSCAR 10 by Marty Davidoff.
#5c Personal computer based orbital predictions and tracking programs by Bob Diersing, 01:42 (VHS only)
#6a Independent Space Project Committee by Ron Molz.
#6b The Solar Sail Project by John Champa.
#6c The Amateur Space Telescope by Jesse Eichenlau.
#6d Amateur Satellite Programs Worldwide Activities by Tom Clark. 02:03 (VHS only)
#7a Packet Communications: PACSAT, UoSAT B
#7b Circularly polarized antennas by Marty Davidoff, 01:49 (VHS only)
#8a Analysis of engineering problems facing OSCAR 10 by Phil Karn.
#8b Spacecraft Technology Status: Panel Discussion by Jan King, Richard Daniel, and Phil Karn. 02:00 (VHS only)
#9 Integration and Launch of OSCAR 10 — 30 minute program showing scenes of development and launch of OSCAR 10. (VHS)

Tapes 10 through 13 are from the 1984 Second Annual Radio Amateur Satellite Symposium. All are VHS only.
#10 Introduction; Advanced Gateway Concept, Al Dayton; JAS-1, Harry Yonedo JAIANG; Project Companion — Amplitude Companioed Sideband, Paul Rinaldo W4RI & Jim Eagleson.
#11 Computers and Satellites, Robert Diersing N5AH; Finn Steenstrup Memorial Presentation, Vern Riperella WA2LQQ; Solar Sail Project, Mark Bergham, Robert Staehle, & Chauncey Uphoff.
#12 PACSAT Forum, Harold Price NK6K, Wally Lindstruth WA6JPR, Rick Fleeter WABVQ, Phil Karn K9AQ, & Martin Sweigart G3YJO; Satellite Economics, Tom Clark W3JWI; Ham in Space Activities, Bill Tynan W3XO.
#13 Phase IV and Future Projects, Vern Riperella WA2LQQ.
#14 The UoSAT-2/OSCAR 11 Story. A brief account of the development and launch of the bird. With musical accompaniment. (VHS only)

Tapes are available for a fee of $6.00 per tape. A check for this amount plus a second deposit check for $25.00 should be mailed. The latter will be returned when the tape is received in good condition. Tapes may be kept by the user for a period of 3 weeks from the time of delivery. All correspondence regarding the tapes should be sent to 1627 36th Ave., Ct., Greeley, CO 80634.
FCC Readies 'OK' On U.S. Mode L Operations

News from two sources indicated the long-awaited break in the U.S. Mode L logjam was at hand. At pretime FCC Special Services Division Chief, Ray Kowalski, told ARRL an announcement was to be made on Tuesday, June 18.

In a related discussion, ARRL Counsel Chris Imlay, N3AKD, told ARRL a temporary authorization for Extra Class licensee-only access was already out. He noted document DC-119 as the authority.

WARC-79 authorized use of 1260-1270 MHz earth-to-space but due to an administrative oversight, the enabling authority was never enacted. AMSAT and ARRL have been working to clear general Mode L use on AO-10 since the oversight was discovered in Autumn 1984. Although U.S. access to Mode L was never absolutely denied, neither was there clear authority for use. All parties attending the matter agreed the oversight would be cleared by appropriate administrative action. Nevertheless, absence of clear authority threw a wet blanket on Mode L growth until now. With the issue now out of question, Mode L growth is expected to increase. Phase IIIC will have a Mode JL transponder aboard and growth in users of AO-10 is seen as preceding a general migration to Mode L over the life of the two satellites. Indeed, according to Engineering VP, Jan King, W3GEY, Mode L will become increasingly popular by decade's end. Already the follow-on Mode S is making its debut on Phase III.

ARRL Foundation Matching Fund Donors Rewarded With Special Pins

AMSAT HQ announces that for a limited time only, special, distinctive pins will be awarded to donors of $20 or more to the ARRL Foundation Phase IIIC fund. The pins are gold plated and measure approximately 3/4" by 1 3/8". They are an absolutely unique way of saying you care enough to send Phase IIIC into orbit (by supporting the matching fund). Each $20 donated to the matching fund yields $40 towards Phase IIIC. Send to AMSAT, C/O ARRL Foundation Matching Fund, P.O. Box 27, Washington, D.C. 20044.

Arturo Carou, LU1AH, of Buenos Aires recently got the ARRL Foundation matching fund drive off to a rousing start with a very generous $1000 donation! Mucho gracias mi amigo!

When sending in your check for $20 or more, please indicate you wish to receive the special pins. They are available in very limited numbers on a first come, first served basis. When they are gone, that's all. Don't be disappointed. Send today and help Phase IIIC with its four fabulous transponders make it to orbit next year on time.

Teleconference Net Airs To Rave Reviews

In what observers are calling the "best of the lot", seven AMSAT leaders teamed on Friday evening, June 14, to fill the airwaves over North America with AMSAT's story. Two hundred and fifty repeaters were linked in the North American Teleconference Radio Net for over two hours. AMSAT panelists W6SP, K8OCL, NK6K, W3IW, W3GEY and W3XO addressed various aspects of the Radio Amateur Space Program. Panel moderator WA2LQQ organized the panel of experts as they detailed their areas of specialty and then fielded questions from the listening audience.

Estimates of listenership ranged upwards from 10,000. Coverage extended across the U.S. and Canada. The Midway Amateur Radio Club again sponsored the NTRN. The Darome Connection of Minneapolis supplied the technical control facilities.

Real-time transmission on AO-10 was not possible because the satellite was not in view at the time.

Lead-off panelist W6SP gave an overview of what there is to do on satellites today, K8OCL then discussed the basics and how to get started especially on a budget. Next, NK6K enticed many with news of up-coming packet radio satellite activity including PACSAT, JAS-1 and the RUDAK experiment on Phase IIIC (See article in this issue.). Then W3IW gave a splendid description of why objects stay in orbit and why some orbits are better than others for communication. W3GEY told of future projects including Phase IIIC and Phase IV. He mentioned the need for more user feedback on the types of communications facilities that should be provided in the future. W3XO discussed the Space Shuttle 51F mission now scheduled for 12 July 85. He described the types of equipment and communications
that could be expected. Finally, W6SP spoke on some of the several awards that may be garnered using today's satellites.

A special feature of the NTRN was a pre-recorded interview with candidate "Teachernaut" Jeannine Duane, WB2MBW. Jeannine is an AMSAT Member and teacher who would like to become the first citizen in space (See ASR 102).

Many who listened said it was the fastest 2 hour program they could remember.

Meanwhile, sources of audio recordings of the event were being solicited. The primary recording facility in California had difficulty with the result that the recording is only marginally usable. AMSAT needs a good-to-excellent grade tape recording to dub for distribution to those who were unable to hear the net in real-time. Please contact WA2LQQ at P.O. Box 177, Warwick, N.Y. 10990, if you can help in this connection. AMSAT plans to offer copies of the tape at nominal cost for club presentations and similar education/indoctrination purposes.

The next NTRN will be on Friday, 13 Sept. 85 and will feature Paul Rinaldo, W4RI, Editor of QST and Publications Manager at ARRL. Paul will speak on ACSSB. Paul is one of the founders of Project Companion, a joint project of Project OSCAR, AMSAT and ARRL. WB6JNN of Project OSCAR and WA2LQQ of AMSAT are the team leaders in their respective organizations. Project Companion has the primary objective of introducing and proliferating ACSSB techniques in the Amateur Radio and Amateur Satellite services.

South American Pair Tops ZRO-Runs With Z7's!

With two ZRO-Memorial Technical Achievement Award test runs now complete, a pair of South American stations lead the way with top rated scores of Z7 or 21 dB below the beacon. Several dozen others have scored Z6, 18 dB down.

The leaders so far are Mike Harris, VP8NO, Falkland Islands and Rubens Murillo Marques, PY2MSG, Sao Paulo, Brazil. Both earned their outstanding Z7 rating on the 24 May 85 ZRO-Test run. No one has yet attained the fabled Z8 rating. Theory predicts the Mode B transponder noise floor should be about 21 dB below the beacon. Given the amplitude error at the source of 1 dB or less, both Z7 stations were probably copying the test signal with less than a 1 dB signal-to-noise ratio. Several very well-equipped 2 meter EME stations including K1WHS and K6MYC will be stalking the Z8 phantom when the next test occurs at 0815 UTC, 30 June 85.

Further runs after the 30 June event will have to await autumn when the eclipse season has past and the sun-angle has moderated. Poor sun-angle requires re-orientation of the satellite which in turn provides pointing angle advantages to some and disadvantages to others. Thus the next test after the 30 June edition will likely occur in late September or early October.

Certificates and endorsements were on-schedule and due to be mailed out the first week of July.

The complete list of qualifiers as of 18 June 85 was as follows:

Z7: VP8NO, PY2MSG
Z6: WA5NOM, W3KH, WA5PCN, K2GLS, W9YCV, W6MSG, WD9EQP, N6KDY, W3OEJ, WA1MBA, WD4FAB, WB4OSS, VE5XU, W8GUS, N9HR, N2BKT, W5U, K9NO, K9OPO, W8GQW, KA9NAH, WA3WBU, LU8EBH.
Z5: KY7J, KS8Z, N5ECC, WD4AHZ, K8RSP, K8BEJ, WA1AYT, K6GLC, WA5ZIB.
Z4: N1CHM, VE7EFF.
Z3: W6HDO.

VP8NO was using a single crossed yagi with 6 elements in each plane phased for RHCP. His pre-amp was a BF981 device mast-mounted with gain set by output attenuator to 8 dB. His receiver was a Microwave Modules MMC 144/28 feeding a Racial RA217 with 200 Hz filter. A very nominal arrangement indeed. Some see Mike’s quiet QTH as his major ace-in-the-hole.

On the other hand, PY2MSG believes in lots of aluminum in the air. His array of 4 homebrew 16 element boomer fed a GaAsFET pre-amp (device unspecified) and a TS-700A receiver. Rubens (PY2MSG) signed his entry as Rubens Murillo Marques, PhD. Do you suppose he “doctored” his pre-amp a bit? Like in liquid N2?

Austere AO-10 Sked Reflects Eclipse Risks

AO-10 spacecraft controllers have determined an operating schedule for the critical eclipse period which begins in August. The schedule will be as follows according to VE1SAT.

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<tr>
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The new schedule goes into effect 1 Aug. 85 and will remain in effect for a planned 4 weeks ending on/about 1 Sept. 85. The current schedule will remain in effect until 1 Aug.

Several key attitude adjustments will be necessary to assure spacecraft survival during this very critical period. Beginning 3 June 85 the Bahn longitude will be adjusted in a series of maneuvers. By 3 June the Bahn longitude will be set at 190 degrees. During the first week of July, the longitude will be further increased incrementally until by 1 Aug. the s/c will be at 230 degrees and 15 degrees of latitude (either + or - TBD). In a fast flip over, the longitude will be returned to the 140 to 150 range by 1 Sept. 85.

VE1SAT indicated the worst case eclipse will occupy the window MA 70 - 130. The intervals 30 - 70 and 130 - 189 are recharge periods. According to analysis by KA9Q as well as VE1SAT and others, there are severe thermal constraints during August as well as the obvious electrical budget constraints imposed by the eclipses. Part of the reason for the extensive maneuvering is to reduce the very real threat of freezing the batteries during a long eclipse.

While the dynamics are well-understood and the risk is under control, all involved including VP-Eng. W3GZY indicate the upcoming episode poses the most serious threat to AO-10 experienced so far and perhaps during its design life. AO-10 was 2 years old 16 June 85.
Stop Press: FCC authorizes Mode L for Techs and up; deletes Extra Class only constraint.

Satellite Bulletin Schedule

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Short Bursts

- AMSAT Life Member Don Wallace, W6AM, has died of a stroke at the age of 86. One of the world's most famous hams, Don had played host to a group of AMSAT visitors late last year. (See ASR 94/95). The end came on 25 May in a Long Beach hospital. He suffered a stroke while playing cards at a club the day before. He had been the world's top DXer for 30 years with 366 countries confirmed. His famous rhombic farm had seen thousands of awed hams attend his regularly scheduled open house occasions. He will be missed.
- According to 4X4GL, the leader of the AMSAT Israel organization, 4X6MF, Steve, has died. Details to follow.
- As noted in ASR 103, contacts on AO-10 as well as other OSCARs will now count towards the Satellite DXCC award. The Satellite DXCC Certificate is a one-time-only award. Applicants must submit ARRL forms CD 164 and CD 253 for credit. These forms are available from ARRL HQ for a business sized SASE with 39 cents postage affixed.
- New Area Coordinator appointments have been announced by Chief Area Coordinator WA6VG5. The new appointees are: Dick Beers, WD9IC, replacing W9JUV who, at his request, becomes assistant to WD9IC. Howard Zierman, WA3GOV, has been appointed Area Coordinator for Eastern Pennsylvania. Dave Lewis, KL7ETZ, has been appointed Assistant Area Coordinator for Southeast Alaska. Keith Pugh, WS1U, and Rusty Reeve, KTSU, have been appointed Assistant Area Coordinators for North Texas. Congratulations to the new appointees!
- HC1BI plans a DXpedition to Galapagos, HC8, 19 to 24 Aug. AO-10 operations are definitely a part of Bene's plans.
- Watch for ZK1XE from 30 July to 3 Aug. on 145.900 SSB.
- AO-10 will be in a special schedule to support a demonstration by UA3CR on 29 June 85. The demo station will be signing 2P. Watch for them after perigee on 29 June between 1600 and 1700UTC. Contacts are cordially invited by UA3CR.
- A related EME event will be run from R2P on 29 June from 1700 to 1800 UTC. Calling frequencies will be 144.010 to 144.012 MHz and 432.010 to 432.012 MHz.
- AMSAT HQ reminds members that nominations for Director are due not later than 31 July 85.
- Also, papers for the AMSAT Technical Journal are due not later than 1 Aug. 85.
- VK6AQ will be operating AO-10 from Antarctica until November.
- W3GHE and WA2LQQ addressed a group of foreign students of the U.S. Technical Training Institute at ARRL HQ on 6 June 85. The invitation to talk on the Amateur Satellite Service came from Dick Baldwin, W1RU, ARRL International Affairs Vice President.

RS-8 Failure Imminent

RS-8 is showing end-of-life signs according to veteran satellite operators. Spacecraft controllers in the USSR have said the satellite is not responding to commands well while operators have noticed various malfunction symptoms. These symptoms include intermittent passband operation and possibly anomalous telemetry. RS8 was launched in salvo fashion with RS-3, 4, 5, 6 and 7 on 17 Dec. 81. Only RS-5 and 7 are in full working order now. RS-6 succumbed earlier this Spring while all others in the salvo have ceased operation. Occasional reports suggest RS-1 may be sending anomalous telemetry. RS-1, launched 26 Oct. 78, apparently ceased functioning reliably (predictably) in May 1980.

According to G31OR, Russian controllers began seeing serious RS-8 malfunction symptoms on or about 4 June 85. W0CA reported similar observations on 9 June 85.

The failure of RS-8 would leave RS-5 and 7 as well as AO-10 and UO-9 and 11 as the remaining operating OSCARs.

Shuttle Launch Scheduled For 12 July

The 12 July 85 launch of Tony England, W0ORE, aboard Space Shuttle Challenger at 2030 UTC 12 July 85 will mark the second Ham-In-Space mission. Tony will fly mission 51F in a 232 nautical mile orbit inclined 50 degrees. The higher inclination gives listeners in the northern states and provinces a shot a hearing the astronaut directly on his downlink of 145.55 MHz.

The Shuttle will land at Edwards AFB, California after a scheduled seven day flight.

Voice and SSTV modes are planned both using FM on 145.55. The earlier-planned 10 meter transmissions had to be scrubbed because of antenna restrictions.

Meanwhile, it was learned that President Reagan may attempt to communicate with W0ORE via 2 meters in conjunction with the Young Astronauts Program (YAP), a Private Sector Initiative of the White House. AMSAT and ARRL officials recently met with YAP to discuss in preliminary, general terms how Amateur Radio and the Amateur Space Program could work in tandem to challenge today's youth.

The Goddard Amateur Radio Club again plans to retransmit Shuttle audio on the amateur bands. Frequencies cited were as follows:
3860 kHz SSB (evenings/night)
7185 kHz SSB (days)
14295 kHz SSB (continuous)
21390 kHz SSB (conditions permitting)
147.45 MHz FM (continuous)
The JPL Amateur Radio Club plans to operate on 224.040 and 145.460 MHz serving Los Angeles and Pasadena. The Marshall Space Flight Center will transmit on 145.430 MHz serving greater Huntsville.

The NASA/Ames facility near San Francisco will offer Shuttle audio on 145.580 MHz.

(Tks, ARRL Letter)
AMSAT DL Specifications  
Mode L Packet System

The Phase 3C satellite may carry up to four transponders as mentioned previously in these pages (see ASR #6/89). A "standard" Mode B transponder will be joined by a novel Mode JL transponder. Besides the possible Mode S transponder too, a fourth transponder has also been proposed. The fourth transponder would be a Mode L packet transponder as proposed by AMSAT DL.

During the weekend of February 15 through 17, AMSAT DL hosted a formal meeting to finalize the packet payload for TEC. The experiment has been named RUDAK for "Regenerativer Umsetzer fuer Digital Amateur Kommunikation." Roughly translated, that's an Amateur Radio digipeeter.

The following data have been published by AMSAT DL to elaborate on the project. The paper has previously been published in the Fourth ARRL Amateur Radio Computer Networking Conference proceedings (Mar 85) and in AMSAT Journal, the official magazine of AMSAT DL, in its March/April 1985 issue, number 27/28. We are grateful to Herr Werner Haas, DJ8KQ, AMSAT DL Vice President, for the excellent translation from the German.

Attending were:
Hans Peter Kuhlen DK9YQ Project Manager RUDAK project
Peter Guegler DJ2OS Project Manager RUDAK project
Heinz Moelkielen DL3AH Ground Systems Manager RUDAK project
Werner Haas DJ8KQ Vice President AMSAT-DL e.V.
Karl Meineker DJ4ZC President AMSAT-DL e.V.

A. General

After a brief review of the performance and capabilities of existing packet systems, the board set the objectives for RUDAK payload as follows:

1. Compatibility of the system with the present AX.25 standard and the existing Packet Radio boards (e.g. TAPR).
2. Regular Amateur communication equipment should be used without the need of modification or intrusion.
3. To moderate to small antennas should be sufficient for low bit error rates.

Relating to point three, the board agreed on the nominal performance parameters as detailed in Annex A. With these in mind, the second point was analysed in great detail with particular reference to link-performance and modulation techniques available with the payload as follows:

a. Link budget calculations require efficient techniques for the downlink which today can only be achieved using (transparent) SSB equipment with demodulation at baseband (audio). This limits the practical achievable data rate to 1200 bits/s (RSK) or lower (BPSK); a performance better than 12 dB Eb/No can be expected.

b. The uplink could employ standard FM-equipment for straight FSK modulation. Experiments by DB2OS showed that 2400 bits/s (biphase) can be handled by standard equipment without problems. It remains to be investigated if 4800 bits/s (NRZ) also can be handled if special measures are necessary to eliminate the influence of the DC-component (e.g. scrambling for spectrum shaping). Higher data rates cannot be achieved with standard radios. Technical papers reviewed indicated that a discriminator type of demodulator 17 dB Eb/No are necessary for 2400 bits/s and about 25 dB for 4800 bits/s (FM-threshold). The meeting concluded that also BPSK for the uplink is viable without intrusion into equipment by using a high-power passive BPSK modulator between transmitter and antenna or between exciters. The approach imposes no restriction on the data rate and yields also a better than 12 dB Eb/No performance. The resulting spectrum needs to be investigated and bandwidth limiting measures may turn out to be necessary. The board concluded that in view of the long viability of the satellite no significant on board storage would be employed. The uplink using essentially ALOHA signalling should have about six times the capacity of the downlink. On board storage should be sufficient to buffer about ten times the packet differential between downlink and uplink (6-7 Kbyte).

c. Presently there is no suitable ISO-layer 3 network devoted to packet data. Thus the payload initially should emulate the existing digipeeter function as defined in the AX.25 version 2.0.1084. If a more sophisticated level 3 protocol becomes available, the SIC will be upgradable.

B. Design decisions taken by the board

1. The board agreed on the following main features as design guidelines for the RUDAK experiment:

   - Nominal amateur equipment as defined by Annex A requires the selection of the following data rates and modulation techniques:
     - Uplink: 2400 bits/s differential binary phase PSK (±90 deg)
     - Downlink: 400 bits/s differential binary phase PSK (±90 deg)
   - "Bulletin Board" i.e. cyclic repetition of information packets containing updated Satellite status (telemetry)
   - Information packets (Repeater data and present position)
   - Uplink packet format set to be used by Packet Radio stations wishing access to RUDAK to eliminate unnecessary trial and error experimentation.
   - RUDAK programmes will be resident entirely in RAM facilitating software updates to be executed by AMSAT control stations via the regular P-C commands.

2. Packet first-in-first-out (FIFO) buffer (6-7Kbyte) plus additional storage consistent with available memory to be used.


4. The original RUDAK design constraints (power 5 W, mass 5 kg, mass 5 kg) were reviewed. It was concluded that only a large single module (300 cm X 200 cm X 40 mm) would be sufficient for the digital part of the experiment. The board was made aware that for a continuation of the RUDAK project a considerably lower power consumption than 5 W would be desirable. If this turns out to be impractical, the availability of a station by mode with memory retention should be investigated. The transmitter and receiver of RUDAK will be built and integrated into the L-transponder by the group building the transponder.

5. A work assignment and schedule has been agreed upon consistent with the AMSAT P-C-C launch and the Mode L-transponder.

6. The board elected Herr. Kuhlen, DK9YQ, to compile the full RUDAK specification for definition of hardware and software requirements including the interfaces to the "Integrated Housekeeping Unit" (IHU) and the Mode L-transponder.

7. Offers of participation to interested AMSAT groups will be released after availability of the full specification set.

8. Development of a compatible ground MODEM and its early publication will be initiated in parallel with the space segment development.

Annex A. (Link assumptions and calculations)

Both Mode B and Mode L link-scenarios have been investigated. Mode B finally was rejected because the expected downlink performance in the 2m-band was considered unsatisfactory in Japan and European metropolitan areas. Also the lack of suitable spectrum space in the 2m-band, the bulk and the cost required the 2m antenna and the fact, that the U-transponder exists already, entered into the decision. For the sake of completeness, the links are also presented for Mode L.

Ground station assumptions:

Mode B: Receiving (2-m)  
Gant: +9 dB  
Tx: 1000 W  
Gb: +10 dB  
P-Tx: 50 W  
mode: +27 dB  
Mode L: Receiving (70 cm)  
Gant: +10 dB  
Tx: 1000 W  
Gb: +15 dB  
P-Tx: 12 W  
mode: +26 dB  

All links are to be designed with 7 dB margin to cover the less than perfect equipment to be expected in the amateur environment.

Mode B links: (for reference only)

   Downlink
   P-Tx: 5 dB (3W)
   Gant: S/C
   link: +16 dB
   margin
   received power
   ground Rx: +16 dB
   Var 400 b/s
   +17 dB

Mode B uplink (Assuming 2400 Bit/s FSK)

   Gant: 10 dB
   P-Tx: 50 W
   link: +17 dB
   margin
   received power
   at S/C
   Pn (500K, 2400 b/s)
   +7 dB
   Var 400 b/s
   +3 dB
   0 dB

Mode L links (selected for RUDAK)

   Downlink
   P-Tx/S/C (5W)
   Gant: -7 dB
   link: -9 dB
   margin
   received power
   at S/C
   +15 dB
   Pn (500K, 2400 b/s)
   +7 dB
   Var 400 b/s
   +17 dB

   Uplink
   P-Tx ground (12 W)
   Gant: +11 dB
   link: +7 dB
   margin
   Gant/S/C
   +13 dB
   Power at S/C Rx
   +15 dB
   Var 2400 b/s
   0 dB

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Challenger Ready; Hams Poised
For H.I.S. #2!

At press time the space shuttle Challenger was ready for its 12 July launch while tens of thousands of hams the world over checked and rechecked their two-meter equipment for the second-ever Ham-In-Space mission: the flight of Tony England, WØORE and John-David Bartoe, WA4NYZ.

Continuous operation of the 2 meter SSSV downlink, interspersed with CW IDs, were to serve as a beacon for tracking. Otherwise, a very modest operating schedule was contemplated; this required because of the rigorous work schedule for both astronaut-hams.

In this ASR are stories on various aspects of the H.I.S. story:

- The STS 51F mission of WØORE and WA4NYZ
- A possible follow-up mission this October by two German astronauts
- Tracking a University of Iowa experimental satellite released by 51F which uses a 400 MHz telemetry frequency
- Two hams are among 10 finalists in telemarathon competition
- Other H.I.S. Astronauts wait in the wings

Plan: “Operate As Work Schedule Permits”

Planning for the Ham-In-Space aspects of the 51F mission indicates a modest operating schedule dictated by the constraints inherent in an ambitious work schedule. This is the word from NASA spokesman Chuck Biggs, KC5RG, as well as Tony England, WØORE. Several dozen coordinated contacts with radio clubs and various youth groups were to have been arranged on confidentially held coordination frequencies. WØORE has indicated his desire to maximize the youth interface on this mission as well as lower the level of intense QRM attending the W5FL mission.

But while the total voice operating time was limited, the 51F mission will be on the ham airwaves nearly continuously thanks to several improvements in 51F compared to W5FL’s STS-9 mission 2 years ago. This time, thanks to some excellent ground work by the Amateurs at the Johnson Space Center and other NASA centers, the WØORE radiostations will be on the shuttle power busses. Thus they will not have to rely on battery power as did Owen Garriott on his pioneering effort, the first Ham-In-Space in November-December, 1983.

For this mission Amateur Radio SSSV will make its debut in space. The video will be converted from the NASA fast-scan video on-board Columbia. Those on the ground with SSSV will be served a unique treat as the SSSV signals use the primary downlink frequency of 145.55 MHz. The SSSV will be interspersed with a MFM CW ID every few minutes. These signals will provide a handy beacon for those on the ground to track. Signals should be strong enough to copy on an HT when the Shuttle is even a few degrees above the horizon and at a range of several hundred miles.

The voice operating schedule was not fixed at press time. According to WØORE, he will announce through Shuttle communications channels when he plans to operate. The announcements will be made one orbit ahead of time according to Tony’s plan. The Shuttle audio will be carried live on a number of specially authorized stations around the nation. Primary among these will be the continuous operation of the Goddard Amateur Radio Club from the Goddard Space Flight Center, Greenbelt, Maryland. As previously reported in these pages, the Goddard club’s call, WA3NAN, will be heard on a number of frequencies as follows: 14.295 MHz (continuous); 7.185 MHz days; 3.860 MHz evenings and nights. (See ASR 104 for additional frequencies and club operations.)
A number of frequencies have been announced for up-links despite the desire of certain mission planners to restrict access to the frequencies to facilitate the coordinated contacts. According to Westlink, if an open operating period is declared by WBOR, you should call him on 144.91, 144.97, 145.03, 145.63, or 145.69 MHz. Do NOT call on 145.55 MHz; that's HIS transmit frequency and he is not equipped to hear you there anyway!

**University Plasma Package**

**On 51F Signals at 400 MHz**

The University of Iowa Amateur Radio Club is planning a special event station during the STS 51F shuttle flight to commemorate the second mission of the Plasma Diagnostics Package, PDP. The PDP is one of the science experiments carried by Spacelab 2 and was built by the Physics and Astronomy Department of the University of Iowa. The PDP is an independent spacecraft which is to be released by the shuttle for a free flight lasting several days. During this free flight it will make sensitive measurements on the ionospheric plasma and later be retrieved by the mechanical manipulator arm, stowed in the cargo bay and returned to earth with the shuttle. Details of the special event station are found in July QST, page 80.

The PDP has its own telemetry transmitter operating on 400.68 MHz with wideband PSK during its free flight period. Power output is about one watt so it should be easily heard from its low earth orbit (LEO). The University of Iowa Amateur Radio Club will QSL to any station reporting telemetry and or reception reports of PDP. Since the PDP will be flying close to Shuttle, the same tracking data provide for 51F will suffice for PDP.

Although the telemetry signal is a PSK subcarrier, there will also be an audio channel which will carry the output from a VLF receiver on PDP. This receiver was designed to detect whistlers and other "strange" VLF emissions that cannot be heard from the ground including plasma wave emissions that may be stimulated by the electron gun that will also be carried by the Shuttle. It should be possible to hear these sounds on an FM receiver tuned to 400.68 MHz.

QSLs may be sent to: University of Iowa Amateur Radio Club, 4900 Engineering Building, Iowa City, IA 52242. (Thanks N8FGV)

**Martha S., Office Manager, In Hospital**

Martha Saragovitz, AMSAT's Office Manager and Corporate Secretary, entered Columbia Hospital for Women in Washington, D.C. 7 July for major surgery. According to OM John Shew, N4QQ, Martha underwent surgery on Monday afternoon, 8 July. The approximately one hour procedure was termed a complete success. The patient was said to have come through surgery well and was recovering Monday evening according to Shew.

Ms. Saragovitz was expected to remain in the hospital for up to a week with a subsequent extended convalescence at her parents residence in Washington. Get-well greetings may be sent to AMSAT HQ (850 Sligo Avenue, Silver Spring, MD, 20910) or to the Saragovitz-Shew residence (9620 Sutherland Rd., Silver Spring, MD, 20901). A handsome bouquet was sent to her room by AMSAT on behalf of members.

Meanwhile, the AMSAT HQ office will remain open throughout the convalescence with a temporary gal Friday, Norma, holding things together. A special task force comprising K8OCL, WA6VGS, N4FD and WA2LQQ were standing by at telephone distance to aid Norma in fielding the occasional unusual question or request.

Martha has been an AMSAT employee since 1978. The former school teacher was spotlighted in ASR #13, August 10, 1981.
Short Bursts

- The ZRO-Memorial Station Engineering Award test run of 30 June and the special re-run of 3 July have yielded a bumper crop of super stations reporting the superior Z7 rating denoting successful copy at a level 21 dB below the Mode B beacon. Complete list of top finishers next time. The next on-the-air test will be in late September or early October when better pointing angles return to AO-10. South Africa AMSAT has expressed an interest in performing the ZRO tests for Region 1 and discussions are now proceeding in that direction. Volunteers for a Region 3 effort are sought according to WA2LQQ.

- After a scare, RS-8 seems to have returned to normal operation. It may have recovered or it may be a last gasp. Better watch this bird closely for signs.

- Rumors in Europe say the birth of ISKRA-3 is near. Prior ISKRA's, built by the Moscow Aviation Institute, were manually launched by ejection out the hatch of a Salyut space station. Sources indicate a 15 to 10 meter narrowband transponder is likely. RS-9 and RS-10 are due for launch late this year or early next year.

- Phase IIIC spacecraft is now scheduled for launch less than 11 months hence. Mid-June 86 is ESA's schedule. The launcher is an Ariane 4. Four transponders will be aboard: B, JL, L RUDAK (digital) and S.

- AMSAT is about to sign a contract with the Solar Energy Research Institute, SERI, in Golden, Colorado for a facility in which to integrate Phase IIIC. A strong team is now functioning in the Boulder area under VP W3GEY. The Phase IIIC spacecraft recently arrived in Boulder having been shipped from Washington. W4PUJ had been doing some machine work on the spacecraft on his pool table in Virginia home until last week.

- JAS-1 launch has slipped 6 months until August 86.

soon. Meanwhile, another bumper crop of Area Coordinators (AC) and Assistant Area Coordinators (AAC) has been announced: Harry Searles, KL7IHX, AAC for Alaska; Jim Roop, K0BI and Wendell Broome, KBOO, both AACs for Michigan; Jim Elder, KA0OQ, AAC for Missouri; Col. John Clowe, W4ZPG and George Norton, W4EEE, both AACs for Georgia; John Ellison, KA8TSR, AAC for West Virginia. Congratulations and thanks to the new appointees.

PSK Demod Kit Proves Workable

Radiokit of Greenville, N.H. tells ASR the G3RUH PSK demodulator kits are selling well and that the earlier suspected problems have been resolved (ASR 102). Specifically, WA6YBT found that his problem with the unit was not the fault of the kit but rather with a poorly regulated power supply. He says a zener stabilized supply cured the problem. WA2KDL had problems traced to a solder bridge under an IC attributable to solder wicking up the plated-through holes. W6KAG built the unit from the article in Ham Radio magazine earlier this year and has had no problems.

Yet to become widely available is a software handler program to buffer and analyze the data. The PSK demod takes in 400 baud AO-10 telemetry and outputs 1200 baud data in compliance with RS-232C serial interface standard. W8PN had developed a fine s/w handler for the Atari 400. Now ASR learns from I8CVS that Dom has developed a s/w handler for the TRS-80. Contact him for details. Bob Wilson of Radiokit will be pleased to answer your questions on the G3RUH PSK kit. He says nearly 150 units have been sold. Contact him at Radiokit, P.O. Box 411, Greenville, N.H., 03048; 603-878-1033.

W3TMZ has also volunteered to act as a source of technical information on these units. Will this kit unlock the secret of AO-10's telemetry? Tune in and find out for yourself.
Two Hams Among Teachernaut Finalists

According to ARRL HQ, two hams are among the ten finalists competing to be the first citizen in space; the first teachernaut. All are practicing teachers responding to President Reagan's initiative to have a teacher as the first citizen in space. (See ASR #102).

The finalists cited to ASR were: David Marquart, WA7QKD, of Boise Idaho and William Townsend, WB1CRB, of Bar Harbor, Maine. There is some question about Townsend, however, as he did not appear on a list published by Aviation Week magazine, an authoritative industry source. The discrepancy was not resolved at press time.

AMSAT member Jeannine Duane, WB2MBW, of New Jersey who was also a candidate and one of 114 semi-finalists did not make the cut to the final ten.

More Astronaut-Hams Wait Their Turns

A number of U.S. and foreign astronauts are thought to be licensed amateurs or intent on obtaining their licenses prior to spaceflight in order to join the Ham-In-Space team, the ultimate ultimate DXpedition!

One already on-line and scheduled for flight is AMSAT member Dr. Ron Parise, WA4SIR, of Silver Spring, Maryland. As detailed in ASR #81 and #82 last year, Ron is due to fly in March 86, November 86 and July 87 on the three ASTRO mission.

Ron was notified of his selection in June of last year and has been in preparation for his flight next year ever since. He plans to have an Amateur Radio activity as part of his flight(s) as well. His proposal to NASA in this regard was recently submitted. Ron hinted it might contain some novel aspects but that he preferred to withhold details until

NASA officials had an opportunity to review and comment on the proposal.

Oktoberfest Auf der Shuttle?

Two German radio amateurs may be carrying a ham station aboard Flight 61-A this October.

The news was first reported in July 73 Magazine. It has since been confirmed through NASA/JS by Roy Neal, K6DUE of NBC News. According to the story, Dr. Ernst Medderschmid, DG2KM and Dr. Reinhard Furter, DD6CF, will be on board Shuttle Columbia for the Spacelab - D1 operation and hope to engage in cross-band, OSCAR transponder-type operation.

The equipment was reportedly built by the European electronics concern Robert Bosch Company. The radio is said to be capable of four 2 meter and eight 70cm channels. In addition to two-way FM QSOs whenever the astronauts are available, automatic logging equipment is planned for recording all received calls when they are busy with other Spacelab duties. The Bosch built package will also have a 1 watt 70cm beacon for determining when the shuttle is within your communications range.

The equipment to be carried by the two German astronauts appears to be designed for cross-band rather than in-band operation. A typical Mode B or Mode J station would appear required to permit QSOs. (Mode B is 70 cm up, 2 m down; Mode J is 2 m up and 70 cm down.)

Also scheduled to be on board Flight 61-A is Dutch astronaut Wubbo Ockels, who early last year had announced his intention to obtain a license and become the first European amateur to operate from space. Since his initial announcement, however, no further details have been provided. (Courtesy Westlink)
Shuttle 51F Operating Opportunities Announced

NASA, AMSAT and ARRL have announced tentative operating opportunities for the mission of Tony England, WØORE, and John-David Bartoe, W4NYZ. As previously detailed, actual voice operating time for the astronauts will be quite limited due to the heavy "official" workload. This is reflected in the schedule below with the majority of transmissions being SSTV scan converted images from the NASA on-board video. This will be the first occasion on which SSTV has originated on a shuttle.

The majority of voice transmissions will be with previously scheduled clubs and youth groups. This arrangement is in accord with the express wishes of Tony England so as to make the most efficient use of the limited operating time available.

The downlink frequency will be 145.55 MHz. If an open operating period is declared, you may attempt to QSO with the shuttle on 144.91, 144.97, 145.03 or 145.63 MHz. Listen to W3ANN on the frequencies listed in ASR 105 for late breaking news on the operation.

The following data is courtesy of NASA spokesperson Chuck Biggs, KC5RG.

New Attitude, Antenna and Schedule
Mark August Operations

As previously announced, a radical attitude has been set on AO-10 to counter the negative effects of the most severe series of eclipses AO-10 has yet experienced. At press time the attitude had attained 230 degrees of longitude and -10 degrees of latitude in the Bahn coordinate system. This unusual orientation was calculated to be the best balance between electrical, thermal and operating requirements. The attitude will be essentially unchanged until late August or early September when the series of eclipse ends.

In conjunction with the attitude setting for August, Command Station ZL1AOX announced on July 13 that the 2 meter omni antenna had been selected for use for the first time since the early post-launch period. The omni will be in use from MA 35 to MA 80 on an experimental basis, according to ZL1AOX.

The omni antenna is on the satellite's Z-axis and was designed to have a uniform torus pattern in the x-y (spin) plane.

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**ST51F Amateur Radio Opportunities**

**Launch: July 29, 19:23 UTC**

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NOTES:
1. UTC day is day of the month of August.
2. This is revision B.
3. Offset from prior launch schedule (12 Jul 85, 20:30 UTC) to current planned launch (29 Jul 85, 19:23 UTC): 16 days, 22 hours, 53 minutes.
4. MET is Mission Elapsed Time.
plane of the spacecraft. However, it is suspected that the 2 meter omni antenna may have sustained some damage in the post-deployment incident although this has never been confirmed positively. Initial observations made with the omni showed a deep null but it was uncertain what this indicated about the condition of the 2 meter omni antenna.

The 2 meter antennas on AO-10 consist of the high gain array and the 2 meter omni. The high gain array is three two-element beam antennas, each driven element and a director, phased to produce RHCP with about 8 dB gain. Because of the present attitude of AO-10, the 2 meter high gain beam substantially misses the earth during part of the orbit. Thus the omni will be used during this period to evaluate the results.

It is easy to tell when the omni is in use since the fade rate is one third of that resulting from the high gain array. The spin rate of AO-10 is now about 30 rpm. Since the high gain array displays three distinct nulls per revolution, fades are heard every 2/3 second when the high gain array is in use. On the other hand, a fade rate of one every 2 seconds indicates the omni is in use. The fade depth observed with the omni was quite deep according to recent observations. Also of note is the fact the omni produces linear polarization.

Based on an analysis of results of these omni tests, spacecraft controllers may opt to use the omni during the perigee period after the new schedule goes into effect.

The new AO-10 operating schedule was due to go into effect on August 1. As previously described, this austere schedule was designed to make the best of a rather dismal period; the worst AO-10 has experienced to date. The schedule will, however, offer some interesting opportunities to study the effects around perigee since the Mode B transponder will be on during perigee. The new operating schedule to be in use throughout the month of August is:

| Off | MA 030 - 189 |
| L   | MA 190 - 026 |
| B   | MA 207 - 029 |

The MA or Mean Anomaly clock ticks off 2.73 minute-long counts beginning at perigee with 0. Each orbit is divided into 256 equal parts. Since an orbit is 699.512262 minutes long, each MA tick is 699.512262/256 = 2.732470 minutes.

**Final AMPTE Glow, Artificial Comet, Termed Success**

A man-made comet launched over the Pacific Ocean was visible from Texas to Peru, and scientists called the experiment a success July 18 despite a fire that destroyed a NASA observation plane on the ground.

The creation of the artificial comet 74,000 miles above the ocean was the last in a $78 million, international series of eight experiments designed to study how Earth’s magnetic field is affected by the solar wind, an electrically charged gas that speeds from the sun at nearly 1 million mph.

“The theoreticians are having a ball with the data,” project manager Gilbert Ousley said in a telephone interview from the Washington headquarters of the National Aeronautics and Space Administration.

“Some very good observations were made of the comet,” said Johns Hopkins University researcher Richard McEntire, in a telephone interview from Baltimore.

A West German satellite released two canisters of the metallic element barium at 8:50 p.m. PDT Jul 18 from a point high above the Pacific off Tahiti. At 9 p.m. PDT, the canisters released the barium, which glowed as it was energized by solar wind, forming the artificial comet.

The man-made comet — the second ever launched — measured about 250 miles in diameter and sprouted a tail 4,500 miles long, somewhat smaller than the first man-made comet, which was created last Dec. 27 but wasn’t visible to most ground observers because of cloudy weather, Ousley said.

He said four crew members and 15 scientists from NASA’s Ames Research Center in Mountain View, Calif., escaped without injury as NASA’s four-engine Convair 990 flying observatory blew a tire and then caught fire as it rolled down the runway at March Air Force Base, 65 miles east of downtown Los Angeles.

The fire was allowed to burn itself out, destroying the equipment-laden plane, which was used as a model in the design of the space shuttle.

The comet was seen by scientists aboard an Argentine Boeing 707 flying off the coast of Mexico, Ousley said. It also was observed by scientists on the ground at Kitt Peak National Observatory near Tucson, Ariz., McDonald Observatory in west Texas, Mount Palomar Observatory east of San Diego and an Observatory near Arequipa, Peru.

It also was seen by amateur astronomers in Phoenix, Ariz., who said “it began as a light green color, then turned red, persisted for several minutes and developed a very visible tail,” which dissipated a few minutes later, Ousley said.

The artificial comets Wednesday night and last December were part of a joint American-West German-British study named AMPTE, for Active Magnetospheric Particle Tracer Explorers. In addition to the two comet-creating barium releases, the project involved six other releases of lithium and barium from the West German satellite since last September, which weren’t intended to form artificial comets.

The interaction between solar wind and Earth’s magnetic field causes Earth’s Northern and Southern Lights and can disrupt communications on Earth and electronics aboard spacecraft.

The project involved three satellites — one from each nation launched from Cape Canaveral on Aug. 16, 1984. The West German satellite released the chemicals, then joined the other two to measure the effects. Last January, however, the British lost contact with their satellite, leaving only the American and West German spacecraft to study the latest man-made comet from space.

Participating in the experiment in a major role was NASA scientist and AMSAT member Dr. Mario Acuna, L8/HHBG, an expert in geo-magnetism. Mario designed and built the magnetometers for the UoSAT spacecraft as well as the Mariner and Viking spacecraft. He works at NASA’s Goddard Space Flight Center in Greenbelt, Maryland.
Tom Clark, W3IWI, Receives Honor, Plaque

AMSAT Past President Tom Clark, W3IWI, was to receive a unique plaque honoring his tenure as AMSAT President on July 27 in Tulsa, Oklahoma. The 1985 meeting of the Central States VHF Conference is being held in Tulsa. Tom has been a member of the Central States VHF Society for many years and AMSAT President WA2LQQ determined it was a suitable site for an award to Tom inasmuch as many CSVHFS members are also AMSAT members.

The CSVHFS honored W3GEY four years ago with its prestigious Chambers Memorial Technical Achievement Award.

Tom's award salutes his several extraordinary contributions to AMSAT what may be seen to have been a watershed episode which included both the loss of Phase 3A and the remarkable comeback culminating in the success of Phase 3B.

The proclamation on the plaque reads:

The AMSAT Board of Directors, on behalf of its officers and members proclaim by these presents for all to note that:

WHEREAS

The health and prosperity of our organization depends critically on the vision, wisdom and fortitude of its leaders and

WHEREAS

The role of sound leadership is seldom understood and virtually never fully appreciated in all its multivariate guises and

WHEREAS

The intellectual acumen to invent and promulgate basic tools for all to use manifestly broadens the appeal and enjoyment for all and

WHEREAS

The courage to rise up from, shrug off and move on from the ashes of disaster, as a latter-day Phoenix, stands to symbolize strength and resolve and inspires all towards ultimate success and

WHEREAS

The endurance to bear up for protracted periods under unmitigated pressure and demands and then to lead onwards to higher levels of achievement represents the soul of a successful organization.

NOW THEREFORE

We gratefully acknowledge the unique contributions of:

DR. THOMAS A. CLARK, W3IWI
President, 1980 - 1984

And bestow upon him the title

PRESIDENT EMERITUS
This 27th day of July, 1985.

Short Bursts
- AMSAT congratulates the following new Area Coordinators (AC) and Assistant Area Coordinators (AAC): Jim Roop, KB0I, and Wendell Broome, KB0O, AACs for Michigan; Jerry Elder, KA00OQ, AAC for Missouri; Col John Clowe, W4ZPG and George E. Norton, W4EEE, AACs for Georgia; John Ellison, KB6TSR, AAC for West Virginia; Harry Searles, KL7/HH, AAC for Alaska; Paul Bocchi, K9NO, AAC for Illinois; Alfred Forte, WD4PQN, AAC for Florida.
- AMSAT is especially pleased to announce a new position and a distinguished individual to establish the function. Dr. Joseph Berman, N8ATB, has been appointed AMSAT Public Relations Specialist. Joe is Director of the Ohio University Center for Communication Management and a welcome addition to AMSAT's leadership team.
- In ASR 105 we incorrectly stated that two techarnaut candidates were hams. In fact only one was: David Marquart, WA7QKD, a finalist, was unfortunately not the techarnaut selectee.
- At least two stations are needed to join the 20 meter AMSAT International Net team. Net Manager W6BCQW has moved to Arizona and will not be on HF in the foreseeable future. N4HY is on temporary assignment in New Jersey. That leaves WD0HHU to pull the load alone. If you have a strong 20 meter signal and can devote a Sunday afternoon to doing the Net a couple of times per month at most, we need your help. A good speaking voice is helpful as is an East Coast QTH but these are not absolutes. We'll get you the bulletins if you can get them on the air. Contact WA2LQQ.
- Martha is recovering nicely after being discharged from hospital July 13. She thanks all who thoughtfully sent greetings. She hopes to return to work in 2 to 3 weeks. Meanwhile Norma, our "temp" is keeping the office running in good order.
- AMSAT is investigating the feasibility of proposing to NASA that it be one of the experimenters granted access to an advanced geosynchronous satellite transponder for two years beginning in 1989. The Advanced Communications Technology Satellite (ACTS) will be positioned over the Western Hemisphere with both scanning and fixed beams. Among the very steep challenges involved, not the least involves fielding a 30 GHz uplink and a 20 GHz downlink earth station. AMSAT has an ad hoc pre-proposal study team looking at some NASA documents to determine if a full-scale experimental proposal is feasible. A decision on the matter is expected in a few weeks.
- KA2MUM advises that QSL cards from his PJ7 and FS DXpeditions are in the mail.
- KA2MUM also advises that new documentation packages for holders of the C-64 version of N4HY's QIUKTRAK are being sent now.
- W7HR has adapted N4HY's QIUKTRAK for the Macintosh. Beta-level tests will proceed with a field-test team during August.
- A major Western Hemisphere radio organization has been granted permission by ARRL and K2UBC to translate a Spanish language version of the Satellite Experimenters Handbook.
- A facility dedication and kick-off meeting was to be held in combination with a Phase 3C working meeting at the Colorado AMSAT OSCAR Spacecraft Laboratory in Golden on Sunday, 28 July. AMSAT President W2LQQ was scheduled to be on hand to present the Colorado Center of Excellence its Charter. About 20 members of the team were expected to be on hand.

- AMSAT’s Video Tape Librarian Roger Johnson, WB6BGA, will soon be taking on new responsibilities in connection with his medical practice and will consequently be unable to continue in his librarian role. AMSAT therefore is seeking a competent replacement. Domestic U.S. interested candidates may contact W2LQQ.

- No AO-10 Mode B bulletins will be scheduled until some experience in working with the eclipse schedule is obtained.

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**Orbit Predictions**

By KA9Q

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Space Shuttle Ham Activity
Spurs Radio, Space Interest

Planners, observers and participants in the highly successful Amateur Radio experiment performed by Tony England, W6ORE, and others aboard Challenger are virtually unanimous in their acclamation of the event. Tens of thousands listened to various radio stations to hear live Shuttle audio via NASA communication channels. Other thousands heard Tony and even Mission Commander Gordon “Gordo” Fullerton on 2-meter FM Amateur Radio frequencies. Still more tens of thousands watched the skies during evening passes to discern the bright man-made comet whiz across the sky from horizon to horizon in what seemed just a few seconds even if it was several minutes on most passes. Millions watching news broadcasts and reading newspapers were aware that Amateur Radio was a part of this shuttle mission. And a few fortunate clubs and individuals actually made contact with the shuttle via 2-meters. All this on the second-ever ham-in-space episode.

Liftoff was from Cape Canaveral at 21:00 UTC on July 29. The launch had been postponed from July 12 because of a balky computer. It was due to launch at 19:23 on July 29 but further minor problems forced the delay until 21:00.

AMSAT President, Vern “Rip” Riportella, (left) WA2LQQ, presents AMSAT proclamation plaque to President Emeritus Dr. Tom Clark, W3IWI, at the Central States VHF Society Conference in Tulsa, OK 27 July 85.

If the mission was to be judged by its first five minutes, it would have seemed like a big zero (or worse) was about to be hatched. Yet after the problems encountered in liftoff (probably just faulty sensors) were overcome, the business of flying the most ambitious space science mission in history got into full swing. When the first 2-meter SSB signals were heard on orbit 47, the word spread quickly that the operation was under way. W6ORE began keeping QSO skeds with club stations and youth groups around the country. Video was exchanged with the JPL club in Pasadena, WA6VIA, the Johnson Space Center Club in Houston, W5RRR, and the Goddard Space Flight Center in Greenbelt, WA3NAN. Later open-field QSOs were sought by the astronaut and thousands responded with a deluge of rf.

Among AMSAT members known to have successfully QSO’d Tony were W2RS and K2OJ (both in N.J.) and KB1Z in Colorado.

Tracking the shuttle would have been difficult had it not been for the timely Kepler data updates provided by NASA’s Public Affairs officer at JSC, Chuck Biggs, KC5RG. Most of the pre-mission planning data went by the boards since as a result of the launch anomaly they never attained the full 387 km altitude planned. Rather they hovered in the 300 km range throughout the mission. The ground track maps distributed widely by AMSAT were mostly relegated to souvenir status as a result. Nevertheless, most persons found the shuttle with little difficulty. If they didn’t have their
own tracking computer and software, most knew how to obtain the information by inquiring on local repeaters. The folks at W3NAN did their usual fantastic job at keeping the world in touch with the shuttle. Similarly, W1AW bulletins were especially closely monitored for late-breaking shuttle news during the eight-day mission.

The inevitable comparison between the WBORE and W5LFL missions was often made during the flight. The consensus was strong that we had learned a good lesson from the occasional abuses of the LFL flight and that the present situation was far superior in terms of organization and minimal disruption/confusion.

Grumbling about the lack of open QSO time was minimal and virtually absent during the last couple of days when many passes included voice QSOs. Contacts were made throughout the world by WBORE. Clubs and individuals in England, Israel and elsewhere got through in fine shape. At the request of BRAMSAT, the Brasil AMSAT organization, a request was made for Tony to leave his SSTV beacon on at all times that voice communications were not on so South American Amateurs could be assured of hearing the signals. This was graciously accomplished by Tony.

NASA has requested Amateurs to help set the stage for the next ham-in-space mission by supplying NASA with documentary evidence of the positive effect the WBORE activity had on the community. Newspaper clippings, photographs and other technology-related material should be sent to ASR, Editorial Office, P.O. Box 177, Warwick, N.Y., 10990. We'll make sure it gets into the right hands at NASA to assure we get another ham-in-space flight soon.

AMSAT and ARRL congratulate all those who took part in the planning and execution of this superb mission. It has taken us a long, long way down the road towards greater space-awareness in Amateur Radio and has helped manifestly to tell Amateur Radio's positive story to the public at large. Special note goes to Bill Tynan, W3XO, AMSAT's VP-Manned Spaceflight, for lending his expertise to the effort.

**New AO-10 Operating Schedule In Effect**

As anticipated, the new restricted-use operating schedule was put into effect by command station ZL1AOX early this month. The exact cutoff date was slipped from August 1 to August 5 to allow a few extra days for repositioning the satellite. The new schedule is:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>040 - 189</td>
</tr>
<tr>
<td>Mode L</td>
<td>190 - 206</td>
</tr>
<tr>
<td>Mode B</td>
<td>207 - 039</td>
</tr>
</tbody>
</table>

The ten extra counts of Mode B time (as compared to the previously announced cutoff of 29) is an experiment according to ZL1AOX. It will be carried at this extended level for as long as battery condition allows, said Ian Ashley, ZL1AOX.

Also changing with the new schedule is the use of the 2 meter omni antenna. Its use now extends from MA 45 to 184. This increase likely reflects the results of experiments last month to evaluate the effectiveness of the omni compared to the high gain array during portions of the orbit when the latter is severely off-pointed. This schedule and antenna protocol will likely remain in effect until early September according to AMSAT officials. Once the eclipse period is passed, normally excellent operating conditions are expected to return. The period of October and November should be some of the best experienced to date. Also, with the latitude of apogee progressing further south, new DX vistas will be opening every day.

**Colorado Group to Host Annual Meeting, Space Symposium**

In a surprise change of direction, it will be Colorado, not Texas that hosts the AMSAT Annual Meeting and Third Annual Space Symposium for 1985. This announcement was made Tuesday, August 6 when it became clear the option to hold the meetings in Texas was no longer open.

The meetings have been firmly scheduled for the Denver-Boulder area with The Space Symposium and Annual Meeting on Saturday, November 9. The Autumn Board of Directors meeting will be held in the same vicinity on Sunday, November 10.

After last year's highly successful meeting in Los Angeles, an ad hoc group representing the North Texas area said it would be interested in holding the 1985 meeting in their area. They submitted a proposal to AMSAT and hoped to have an answer from the Board during its Spring meeting in Dayton. However, a group from South Texas appeared on the scene to compete for the right to hold the meeting in the Houston area.

A request for proposal was issued to both groups so each would have a common set of requirements against which to bid. However, both groups "no bid" after the process pushed a turn-on date beyond that they could accommodate they said.

Enter the Colorado group. Getting wind of the Texas "no bid" situation, groups from three new cities eagerly stepped forward to ask to hold the meeting in its area. In the end, however, it was evidence of teamwork and depth that convinced AMSAT to hold the meeting in Colorado for 1985.

Molly Hardman, N3CHZ, has been named to head up the Project Committee as General Chairperson. Molly said she will be naming other managers soon to handle programs, prizes, accommodations, transportation and all the sundry issues which need to be addressed. Upwards of 200 are expected to attend this year's meeting.

Ms. Hardman issued a call for papers for the Third Annual Space Symposium. She asked that a letter of intent be forwarded to her at her home address: Molly Hardman, N3CHZ, 3994 Promontory Ct., Boulder, CO, 80301. Molly will pass the letters on to the programs chairperson when one is named.

Announcements will be made regarding hotel accommodations and group airline discounts as they are firm.

**Short Bursts**

- AMSAT is pleased to announce the following Area Coordinator (AC) and Assistant Area Coordinator (AAC) appointments. Bob Myers, KB4AKQ, AAC for South Carolina; Hank
Fitz, WB4URU, AAC for Florida; Millard Croll, AAC for Pennsylvania. Meanwhile, Ohio AAC Eric Rosenberg, WA6YBT, has moved to Harrisburg, PA, and has been reassigned as AAC for PA. Congratulations to all the new and re-nwed A-Team members!

- John Champa, K8OCL, is wondering aloud if anyone is interested in Shuttle 51F mission patches. John says they could be made available for $5 a crack. Let him know your interest please. A SASE always helps. Write: John Champa, K8OCL, 7800 Hartwell Street, Dearborn, MI, 48126.
- The RS satellites have been off because of eclipses according to PA0DLO who quotes UA3CR. PA0DLO also states that ISKRA 4 will not be launched this year but rather early 1986. There will be no transponder aboard according to this report. A beacon is possible but no frequency has yet been specified.
- Ed Steeb, WA2RDE, of Buffalo, N.Y. will be heading up a new project to keep track of callsign prefixes that appear on AO-10. The list will provide a fair reckoning of how many countries are on or have been on AO-10. The RDE DX tally will be published here periodically.
- On a related note, Don Knollinger, WB8ZTV, will be heading up a Gateway Project team soon. His main function will be to organize gateway activities and to promote interesting and useful events through them.
- The Central States VHF Society has presented AMSAT with a $400 donation symbolic of its enthusiastic support of the Amateur Space Program. CSVHFS President Charlie Calhoun, WØRRY, presented the check to AMSAT President Vern Ripportella, WA2LQQ, at the CSVHFS Conference Banquet in Tulsa on July 27.

**TAPR TNC 2 Available Soon**

Tucson Amateur Packet Radio is pleased to announce the availability of the new TAPR TNC 2. In field testing since January, it is now ready for you!

Effective Monday, August 19th, the TAPR Office will be accepting orders and, for the first week, will have extended hours (9 AM until 9 PM Pacific Daylight Time - 12 NOON until 12 MIDNITE for you Easterners). (These extended hours are possible through the participation of volunteers, some of whom are travelling to Tucson from all over the country to assist you in obtaining a TNC 2.)

280 TNC 2 kits will be ready for shipment on or about August 19th. All parts are in hand (and boxed!) EXCEPT

a) the manual, which is at the printers and is expected back on the 16th, and

b) the cabinet end plates, which will ship to TAPR on or before the 10th of September. The first units will be shipped WITHOUT the cabinet end plates; the end plates will be sent to TNC 2 owners as soon as TAPR receives them.

The price for TNC 2 is $185 plus $10 S & H. A credit card order incurs a 3% surcharge (that's what the bank charges us) for a total of $200.85. Arizona residents must add tax, of course.

To order your TNC 2 kit, follow these simple rules:

1) Call the TAPR Office at (602) 746-1166

2) Have the following information available
   * Your Name
   * Your UPS shipping address (no PO Boxes, please)
   * A DAYTIME telephone number at which you can be reached
   * Your VISA or MasterCard number and expiration date

3) Two shipping labels (one for the TNC 2, one for the cabinet end plates) will be filled out WHILE YOU ARE ON THE PHONE.

4) Your credit card slip will be made out and read back to you.

5) You will be assigned a sequential order number. Number 101 means you will be shipped the 101st TNC 2 kit.

Due to limited supply and expected large demand, only one kit per person and one kit per call may be ordered. After Office hours, an automatic answering machine will be connected to the telephone line. IT WILL NOT RECORD MESSAGES! It will, however, advise of the day’s order status and shipping status by order number. Thus, in less than a minute, you can find out if your order was shipped, if any orders are still being taken for the following day, and how many TNC 2s are still available.

We hope this procedure minimizes any inconvenience to you, and we will do our best to ensure that no orders are misplaced.

IF OUR SUPPLIERS DON’T SLIP IN THEIR SHIPMENTS TO US, an additional 300 kits will be available in mid-September. If you require multiple units, or miss out on the 280 set for August, you may order against the September shipments. Thus, after the initial 280 units, it will be “business as usual.”

Thank you for your continued support of TAPR and The Packet Radio Revolution! (For more details on what is in the TNC2, see your August QST on the cover and in the NK6K article — W3JW!).

Jim McKim, W4ICY (left) and Byron Lindsey, W4BIW in the AMSAT booth at the Atlanta Hamfest July 6. Banner was made by John Clove, W4ZPG and his XYL Margie. W3XO and W4DAQ were on hand to help out.
Tom Larson, N1CHM, To Manage AMSAT Video Library

Tom Larson, N1CHM, of Dover, Massachusetts will be picking up responsibility for the AMSAT Video Tape Library. It was announced recently. He will assume the manager's job upon the retirement of Roger Johnson, WB0GAI, from that post at the end of August. Roger is taking on new professional responsibilities in connection with his medical practice and asked to be replaced. Tom responded with just the right credentials and was appointed last week to the post.

Tom is the owner of an audio-visual production company in Boston. He says he will alert members to borrowing procedures and address in the near future. Until 31 August, however, members may continue to borrow tapes from the library using the Greeley Colorado address of WB0GAI.

Congratulations and thanks to Tom Larson, N1CHM, on his new assignment!

Director Nominees Number Seven

AMSAT has announced the nominees for Director. The nomination period closed on July 31. The nominees are:

John Browning, W6SP* Rancho Palos Verdes, CA.
Gordon Hardman, KE3D Boulder, CO.
Jan King, W3GEY* Boulder, CO.
Julian Macassey, N6ARE Pasadena, CA.
Andy MacAllister, WAZ5ZB Pearland, TX.
Harold Price, NK6K Redondo Beach, CA.
Paul Roemer, KG6LC Manchester, N.H.

Two Directors opted to not seek reelection: John Henry, VE2VQ and John Pronko, W6XN. This guarantees at least two new Directors on the Board this time, the first time that has occurred in many years. Election ballots will be mailed from AMSAT HQ in the next few weeks to all current members.

*Incumbent

Orbit Predictions By KA9Q

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<th>OSCAR-11</th>
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<th>Satellite</th>
<th>RSS-5</th>
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<td>713.846 km</td>
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<td>145.8256 MHz</td>
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<td>145.8256 MHz</td>
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</tbody>
</table>

Amateur Satellite Report is published and mailed First Class bi-weekly for the Radio Amateur Satellite Corporation. The purpose is to enhance communications about the Amateur Radio Satellite Program. Subscription rates for the United States, Canada, and Mexico are $22.00. Foreign is $30.00. The rate covers 26 issues (typically one year). Send check or money order in U.S. funds (drawn on U.S. banks only) to "Satellite Report," 221 Long Swamp Road, Wolcott, CT 06716. Information contained herein may be quoted without permission provided credit is given to Amateur Satellite Report, Wolcott, CT 06716. Amateur Satellite Report is Copyright Protected and duplication of this publication in any way including by the photocopy process or by electronic means (computer data banks, etc.) is not permitted under any circumstances. Amateur Satellite Report is endorsed by the ARRL as the special interest newsletter serving the Amateur Radio Satellite Community. The editorial opinions expressed are not necessarily those of the ARRL.
Autumn Operating Schedule Previewed

A new AO-10 operating schedule will be put into effect during the first week of September according to ZL1AOX. The new schedule will mark the end of the severe eclipses experienced during August. The new schedule (final details pending) will be in effect for about 5 weeks until mid-October when a "normal" schedule will be implemented.

A preliminary estimate of the new schedule was given by ZL1AOX as follows:

<table>
<thead>
<tr>
<th>PRELIMINARY ESTIMATE</th>
<th>B</th>
<th>040 - 189</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule Beginning</td>
<td>L</td>
<td>190 - 206</td>
</tr>
<tr>
<td>on or about 5 Sep 85</td>
<td>B</td>
<td>207 - 220</td>
</tr>
<tr>
<td>Off</td>
<td></td>
<td>221 - 039</td>
</tr>
</tbody>
</table>

Estimated Attitude: 230 longitude, -15 latitude

<table>
<thead>
<tr>
<th>PRELIMINARY ESTIMATE</th>
<th>B</th>
<th>040 - 119</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule Beginning</td>
<td>L</td>
<td>120 - 136</td>
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<tr>
<td>on or about 15 Oct 85</td>
<td>B</td>
<td>137 - 220</td>
</tr>
<tr>
<td>Off</td>
<td></td>
<td>221 - 039</td>
</tr>
</tbody>
</table>

Estimated Attitude: 210 longitude, -10 latitude
at first; then
190 longitude, 15 latitude with further refinements expected later.

ZL1AOX emphasized that these are PRELIMINARY estimates and further work needs to be accomplished to refine the plan. The actual schedule implemented may resemble but probably will not be exactly the ones cited above. ZL1AOX is working with VE1SAT and DJ4ZC to check and refine the plan for the AO-10 operating schedule.

For latest developments, listen to the RTTY and/or CW bulletins on 145.810, the Mode B General Beacon or 436.040, the Mode L Engineering Beacon.

OSCARs 24 and 30 Launched; Not AMSAT's

The U.S. Navy launched two satellites into low polar orbits in early August. The satellites are named OSCAR 24 and OSCAR 30 (objects 15935 and 15936 respectively). These are not Amateur Radio satellites and are not related to AMSAT OSCARs. The Navy has previously called some of its satellites OSCAR. In addition, the Advanced Research Projects Agency (ARPA) of the U.S. government announced plans about two years ago for an experimental space-to-submarine satellite system also using the name OSCAR. AMSAT does not hold any copyright or trademark rights on the name.

AMSAT To Meet In Colorado

The Third Annual Space Symposium and the AMSAT Annual Meeting have been tentatively set for Vail, Colorado according to Project Leader Molly Hardman, N3CHZ. AMSAT was in the final stages of negotiations with the Westin Hotel in Vail at presstime.

While a few details need to be finalized with the hotel, it would appear Saturday, 9 Nov. 85 will find hundreds of satellite folks descending on this famous ski resort in the Colorado Rocky Mountains. Plans call for the Space Symposium to be an all-day affair with featured papers presented by experts from around the world. A call for papers has been issued by Ms. Hardman. Letters of intent and/or abstracts are appropriate. Molly’s address is 3994 Promontory Ct., Boulder, CO 80301.

On the evening of 9 November AMSAT will hold its Annual Meeting and Awards Banquet. A truck load of prizes will be awarded as well. Topping the list of prizes awarded will be the fabulous new ICOM 1271A all-mode 1.2 GHz transceiver donated by ICOM of Bellevue, Washington.

The new Directors will be announced and introduced as well at the Annual Meeting and various officers will make presentations.

The Autumn Board of Director’s meeting will be held in Vail on Sunday, 10 November.


## European Spacelab-Shuttle Mission Includes Ham-In-Space

Three European Radio Amateurs will be aboard the space shuttle this November and they plan to operate the third ham-in-space project. Two Germans and one Dutch astronaut will fly along with the European Spacelab D1 mission tentatively scheduled for 7 November.

Dr. Ernst Messerschmidt, DG2KM, Dr. Reinhardt Furrer, DD6CF of the Federal Republic of Germany and Dr. Wubbo Ockels (callsign unknown) of Netherlands will be aboard Spacelab D1. They will operate under the callsign DP0SL (Spacelab) using a Mode B type transponder built by the German Bosch Company. (See ASR 105, July 9, 1985).

The transponder was tested during a five-hour flight aboard a German aircraft piloted by the two German Astronauts Saturday, 17 Aug. Launched at 0908 UTC, the flight included several hundred contacts with hams across northern Europe. Flying under the call DF0LRK/AM, the flight was believed to be the first authorized German aeronautical mobile ham operation.

According to C31OR, the operational frequencies are similar to a Mode B transponder. The frequencies are:

<table>
<thead>
<tr>
<th>Uplinks</th>
<th>Downlinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>437.125 MHz</td>
<td>145.450 MHz</td>
</tr>
<tr>
<td>437.175</td>
<td>145.475</td>
</tr>
<tr>
<td>437.225</td>
<td>145.550</td>
</tr>
<tr>
<td>437.275</td>
<td>145.575</td>
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<tr>
<td>437.325</td>
<td></td>
</tr>
<tr>
<td>437.375</td>
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</tbody>
</table>

It is believed each uplink and downlink can be independently selected. FM operation is the preferred mode. Operational plans for the November flight have not been announced.

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## Changes in Operations and New Services Department Announced

AMSAT Headquarters recently announced the following re-organization within the Operations directorate. Appointed Acting Vice President for Operations (VP-O) is Julian Macassey, N6ARE, of Pasadena, California. Julian replaces John Champa, K8OCL, in the role of Acting VP-O. Julian has been active in Southern California for many years and has been responsible for thousands of dollars in fund raising through his orbital prediction program. He is active on AO-10, is an Electrical Engineer and consultant.

Stepping into the new position of Assistant Vice President for Operations (AVP-O) for Field Operations is Mike Crisler, N4IFD, of Miami, Florida. Mike will oversee the function of over 100 Area Coordinators and staff and play a key role in planning and supporting hamfest and conventions across the nation. Mike is active on AO-10 and recently operated maritime mobile on AO-10 from Bermuda.

Rick Dittmer, WH6AMX, of Honolulu continues in the AVP-O/Spacecraft Operations role and Jim McKim, W8CY continues as AVP-O/Administration.

Jack Somers, WA6VGS, of Los Angeles has been promoted to AVP-Public Affairs reporting to the Executive Vice President, John Champa, K8OCL. This is a new position. Jack had been Chief Area Coordinator. He joins Joe Ber- man, N8ATB, in the Public Affairs department.

A new position has been established in recognition of the important role Member Services plays in the satisfaction of members. The new slot is the Vice President for Member Services (VP-MS). Doug Loughmiller, KO5I, of Paris Texas has been named to fill the position. Doug has recently returned to active status having returned to Texas and re-established his station. He had been VP-O until a year ago when he moved East. Doug was recently married and he and his wife Jane expect to attend the Annual Meeting and
The Phase 3C Team

Phase 3C team in Colorado pose for photo in Boulder 28 July. They had just received their Center of Excellence charter from President WA2LQQ (left to right): WD9HHU, KE3D, WA2VO, W3GEY, AABILWA2VSL, WB9RLY, WB9QDL, Regina Henriksly, KORZ, W1XE, NF8U.

Space Symposium in Vail.

The new VP-MS function will have at least a five separate AMSAT agencies and bureaus to oversee. Included are AMSAT Nets (Net Manager W6GQW); QSL Bureau (WBBOTH, Manager); Videotape Library, (N1CHM, Manager); AMSAT Software Exchange (N4HY, Manager); AMSAT DX Bureau (WA2RDE, Manager). In addition, two new bureaus are in the offing. An Awards Program Manager will be named shortly as will a AMSAT Boutique Manager. The former will oversee the development and functioning of AMSAT’s various operating and administrative and coordinate with other award-issuing organizations. The latter will help develop various AMSAT memorabilia, tokens and premiums such as special AMSAT jewelry, leisure wear, flags, etc.

Other projects starting up in the very near future include a Twenty-Fifth Anniversary Celebration Project to commemorate 25 years of OSCARs. (1986 is the 25th anniversary of OSCAR-1). Also, a 1986 AMSAT Yearbook is planned.

Short Bursts

• The first mobile-to-mobile operation using AO-10 has recently been reported by G3IOR. According to Pat, G4CUO worked G3PXT using AO-10 at 1600 UTC on 19 August. The frequency of the SSB QSO was 145.957 MHz. Both were using less than 10 watts ERP and exchanged 5 by 6 reports. Others joining in were W4BE and WA2RDE.
• Press clippings, photographs and other documentary matter relating to the recent 51F ham-in-space mission of W9ORE are requested by NASA and AMSAT to support efforts for further, more ambitious missions in the future. Please send to WA2LQQ, P.O. Box 177, Warwick, NY 10990.
• The Autumn Mode B Bulletin schedule on AO-10 will commence September 15. The season begins with a bulletin session at 0200 UTC on that date. Further schedules will be announced as the AO-10 operating schedule is firmed up.
• The next series of ZRO Engineering Award tests will commence in late September or early October as the new schedule allows.
• Nominees for Director are: KG6LC, N6ARE, NK6K, WA5ZIB, W6SP, W3GEY, VE2VQ and KE3D. Ballots will be sent soon. Please mail back promptly.
• In five days of order-taking by telephone ending 23 August, TAPR had sold 600 TNC-2 boards. (See 107, August 12, 1985). Earlier in the week the telephone traffic was sufficient to seriously impair the Tucson commercial telephone trunks.
• The RS satellites have returned to service. However, RS-8 appears to be in trouble as it emerges from its recent series of eclipses. The Russian controllers are reported to be having trouble keeping it turned on. Battery problems and radiation damage are the prime suspects. RS-5 and 7 are doing well with RS-7 pulling robot duty recently. All three Russkies should be on regularly until about 1 Oct. 85.
• Publication of the AMSAT Technical Journal has been postponed. It had been planned to issue the Journal in December. It is now anticipated to be issued in early 1986 with papers presented at the Third Annual Space Symposium in Vail, Colorado, included.
• The Society for the Promotion of Amateur Radio Communications (SPARC) will hold its 1st Annual swapmeet and packet exhibit on October 19 at the Lee County Fairgrounds on US 431 just north of the US 29 Junction in Opelika, Alabama. Times are from 10:00 am to 5:00 PM. Spaces $5.00 per vehicle in advance, $7.00 at the gate. $1.00 gate donation. Free parking. Packet, ACSSB demonstrations conducted by Robert "Bob" McGwier, N4HY. Refreshments available. Reservations contact: Ray P.O. Box 2423, Opelika, AL 36803-2423. Information call Ray 105/745-2838, Gene 205/821-8010, Danny 205/745-7455. Talk in on 147.06/66.

ASR Mini-Tutorial #2

The second in a series of compact explanations to puzzles encountered in the fascinating world of Amateur satellites and Amateur space activities. This time we examine the relation between nodal period and anomalistic period.

When all OSCARS were in circular orbits, we learned about orbital periods. They were easy to measure. The period was simply the time between two successive north-going or south-going equator crossings. For convenience, we said that the north-going passage or ascending portion of the orbit would form the reference. So our definition of period was simply the time interval between two successive ascending nodes, that is, equator crossings on a northbound trek. This became known as the nodal period. For AMSAT-OSCAR 8 it is about 103 minutes; for RS5 it’s about 120 minutes.

Recently, with the advent of AMSAT-OSCAR 10, we’ve been exposed to the complicating influence of another variable in orbit geometry: varying height above the earth. This comes about by design. We desired an elliptical orbit to provide the best coverage possible with a single satellite.
With the elliptical orbit, however, comes a new, different kind of period. Sure, the elliptical or Molniya orbit has a nodal period, but with Molniya orbits and other elliptical orbits it just makes more sense to keep track of them using a different reference. That reference is the time between successive perigees. We call it the anomalous period. We could just as well have established the time interval between successive apogees but for various reasons AMSAT uses the perigee reference scheme.

The anomalous period is what is provided in the AO-10 orbital predictions provided here in ASR. Ever wonder about the relation between nodal period and anomalous period? We did and so we asked Dr. Martin Davidoff, K2UBC, to help us understand the difference. Marty is the author of the very popular “Satellite Experimenters’ Handbook”, an ARRL publication available at AMSAT HQ.

Step-by-step Procedure for Calculating Nodal Period from Currently Published Orbital Element Sets

Prepared by: M. Davidoff, K2UBC, 12 June 1985

METHOD

Step 1. Add “Mean Motion” (see latest orbital element set) to Wo “rate of change of argument of perigee in revolutions per day” (see Table !).

Step 2. Take inverse of result of Step 1. You now have nodal period in units of days per orbit.

Step 3. Multiply previous answer by 1440 minutes per day. Result is nodal period in minutes per orbit.

EXAMPLE: OSCAR 11

Step 1. 14.61956704 + (−0.008681) = 14.6108860
Step 2. 1/(14.6108860) = 0.06844212
Step 3. (0.06844212) (1440) = 98.55665 minutes/orbit

NOTE

Results will be slightly more accurate (at least one additional significant digit) if you calculate “rate of change of argument of perigee” directly from latest set of orbital elements. See Satellite Experimenters’ Handbook page 8-8, Eq. 8.12. Results for nodal period should only be trusted to 5 or 6 significant digits due to approximations inherent in model.

---

**TABLE 1. All calculations based on orbital element sets listed in ASR No. 4, May-June 1985.**

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Anomalous period (minutes)</th>
<th>Wo (deg/day)</th>
<th>Wo (rev/day)</th>
<th>Nodal period (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSCAR 9</td>
<td>94.294556</td>
<td>-3.513</td>
<td>-0.009758</td>
<td>94.35485</td>
</tr>
<tr>
<td>OSCAR 10</td>
<td>699.510692</td>
<td>0.2628</td>
<td>0.0007300</td>
<td>699.26272</td>
</tr>
<tr>
<td>OSCAR 11</td>
<td>98.498129</td>
<td>-3.125</td>
<td>-0.008681</td>
<td>98.55665</td>
</tr>
<tr>
<td>RS-5</td>
<td>119.497145</td>
<td>-2.050</td>
<td>-0.005693</td>
<td>119.55363</td>
</tr>
<tr>
<td>RS-7</td>
<td>119.137036</td>
<td>-2.064</td>
<td>-0.005734</td>
<td>119.19358</td>
</tr>
<tr>
<td>RS-8</td>
<td>119.705456</td>
<td>-2.041</td>
<td>-0.005670</td>
<td>119.76191</td>
</tr>
<tr>
<td>NOAA-7</td>
<td>101.900326</td>
<td>-2.813</td>
<td>0.007815</td>
<td>101.95671</td>
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<tr>
<td>NOAA-9</td>
<td>102.028893</td>
<td>-2.818</td>
<td>0.007827</td>
<td>102.08560</td>
</tr>
</tbody>
</table>

---

**Project OSCAR Donates $1,000 For Phase 3C**

Project OSCAR has once again supported a major spacecraft construction project. In a recent letter to AMSAT President WA2LQQ, Project OSCAR President Dr. John Pronko, W6XN, writes:

“Dear Rip:

As President of Project OSCAR Inc. I am pleased to announce that the sale of the Project OSCAR Orbital Predictions has, as in past years, been a successful fund raiser. In addition to the proceeds from the sale of those calendars which Project OSCAR has donated to AMSAT and were (or will be) sold at various ham fests and conventions, a check made out to AMSAT for $1000.00 is enclosed. Project OSCAR will leave it to the officers of AMSAT to decide how the donation could best be used to enhance the effectiveness of the amateur radio satellite program.

Sincerely,

John G. Pronko, W6XN
President of Project OSCAR Inc.
P.O.B. 1136
Los Altos, CA 94022”

---

Amateur Satellite Report is published and mailed First Class bi-weekly for the Radio Amateur Satellite Corporation. The purpose is to enhance communications about the Amateur Radio Satellite Program. Subscription rates for the United States, Canada, and Mexico are $22.00; Foreign is $30.00. The rate covers 26 issues (typically one year). Send check or money order in U.S. funds (drawn on U.S. banks only) to “Satellite Report,” 221 Long Swamp Road, Wolcott, CT 06716. Information contained herein may be quoted without permission provided credit is given to Amateur Satellite Report, Wolcott, CT 06716. Amateur Satellite Report is Copyright Protected and duplication of this publication in any way including by the photocopy process or by electronic means (computer data banks, etc.) is not permitted under any circumstances. Amateur Satellite Report is endorsed by the ARRL as the special interest newsletter serving the Amateur Radio Satellite Community. The editorial opinions expressed are not necessarily those of the ARRL.
New Post-Eclipse Schedule Implemented On AO-10

As expected, a new transponder operating schedule was put into effect in early November (See ASR #108). However, after less than a week’s experience with the new sked, it became apparent to satellite command stations that more battery charge time was required. Thus a revised, interim schedule was put into effect on 8 Sep by command station ZL1AOX.

The new schedule is as follows:

<table>
<thead>
<tr>
<th>Mode</th>
<th>040 - 105</th>
<th>106 - 121</th>
<th>122 - 189</th>
<th>190 - 206</th>
<th>207 - 220</th>
<th>221 - 039</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Off</td>
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<tr>
<td>Mode B</td>
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<tr>
<td>Mode L</td>
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<tr>
<td>Mode B</td>
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<td></td>
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<tr>
<td>Off</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

The omni antenna is now in use from 045 to 060.
The extra off period (106 to 121) was inserted on 8 Sep to increase the overall charging time compared to the preliminary schedule discussed previously.

This schedule will remain in place for at least a few weeks. As soon as possible, a further change will be made to increase operating times.

The objective attitude for the current epoch is 200 degrees longitude and -30 latitude. With changes coming frequently during this transition period, operators would do well to monitor the bulletins on the general beacon of Mode B, 145.810 MHz, for latest developments.

Short Bursts
- Richard Ensigin of Dearborn Michigan has been named AMSAT Science Education Advisor. Richard directs a planetarium in the Dearborn Heights area of Michigan. Congratulations to this new volunteer!
- New 2-meter nets starting up include one in Derry, NH. Under the leadership of KG6LC, this Thursday evening net will meet at 9 PM on the Derry, 146.85 MHz repeater. N1DBB is backup NCS. Also, in the Chicago area, remember to tune in the AMSAT Net on Wednesday evenings on 147.285. NCS W9JIC or K9NO are on hand to answer your questions and help you out. Net meets at 7:30 PM. The repeater requires a 1B PL tone to access.
- The Midwest Space Development Conference will be held at Miami University in Oxford, OH 27-29 September. Phone 216-282-6329 or write, Midwest Space Development Conference, 2720 West 40th Street, Lorain, OH, 44053.
- AMSAT has received an intriguing proposal to team on specific space development and spacecraft projects from the L5 Society. The L5 Society is a medium-size space activist organization based in Tucson, AZ. L5 is interested in participating in a spacecraft development program such as Phase 3C and would lend its space education and promotional expertise to AMSAT. A Memorandum of Agreement between the organizations is now under study.
- Continental Satellite of Clackamas, Oregon, makes parabolic dishes of various sizes (up to 30 feet) for commercial users and consumers alike. President Dan Berge, WA7BU, and Randy Steggemeyer, W7HR, have recently told ASR that a special package of components for their excellent 5 meter (16 foot) dish is now available to amateurs at a very substantial discount. Contact Dan or Randy at 503-656-2774.
- Make reservations early at the Westin Hotel at Vail for the Third Annual Space Symposium and AMSAT Annual Meeting Nov. 9. AMSAT has a block of rooms and a special discount applies if you sign up early. Call 303-476-7111.

Top prize at the November 9 Annual Meeting and Awards Banquet will be this fabulous new ICOM 1271A all-mode 23cm transceiver. The meeting is slated for Vail, Colorado, in conjunction with the Third Annual Space Symposium.
Sidereal Time Calculations For The “W3IWI” Orbit Program

by Dr. Tom Clark, W3IWI

The orbital prediction program I wrote a few years ago which was published in ORBIT magazine has been translated by a number of collaborators and made available through the AMSAT Software Exchange. Most of the ASE versions have a table of sidereal times at 00:00 on January 0 of each year which “expires” at the end of 1985. This AMSAT Technical Note will update this table for the entire period 1978-1999 using a more precise formulation than was used in the original program.

Recently the International Astronomical Union (IAU) adopted new astrometric constants for the based on the Julian day epoch Jan.0.0, 2000 (usually called “J2000”) to replace the previously used Besselian year 1950 (called B1950) constants. These calculations make use of the complete J2000 sidereal time series as published in the American Ephemeris and Nautical Almanac. Table 1 gives the J2000 Greenwich Mean Sidereal Times (GMST) for January 0.0 of each year. The BASIC program (written in Microsoft BASICA and run on an IBM-PC clone running MSDOS) which performed these calculations is given in Table 2. This program also includes a set of calendar utilities (to relate calendar day/day of year/day of the week/elapsed days since 1978.0) which may prove useful to others.

### TABLE 1

<table>
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<tr>
<th>Year</th>
<th>GMST</th>
<th>1978</th>
<th>0.27584815</th>
<th>89</th>
<th>0.27676777</th>
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<td>79</td>
<td>0.27518504</td>
<td>90</td>
<td>0.27610467</td>
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<tr>
<td>80</td>
<td>0.27452194</td>
<td>91</td>
<td>0.27544157</td>
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<td></td>
</tr>
<tr>
<td>81</td>
<td>0.27659675</td>
<td>92</td>
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<td></td>
<td></td>
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<tr>
<td>82</td>
<td>0.27593365</td>
<td>93</td>
<td>0.27685328</td>
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<td>83</td>
<td>0.27527055</td>
<td>94</td>
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<tr>
<td>84</td>
<td>0.27460745</td>
<td>95</td>
<td>0.27352708</td>
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<tr>
<td>85</td>
<td>0.27668226</td>
<td>96</td>
<td>0.27486399</td>
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<tr>
<td>86</td>
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<td>97</td>
<td>0.27693880</td>
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<td>87</td>
<td>0.27535606</td>
<td>98</td>
<td>0.27627570</td>
<td></td>
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<tr>
<td>88</td>
<td>0.27469296</td>
<td>99</td>
<td>0.27561260</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Editor’s Note: ASR has received an excellent similar Sidereal Time analysis and table of values from Dr. Jack Cavanagh, KB4XF. Jack’s values differ insignificantly from Tom’s given above. We appreciate the fine work of both these experts. Where would we be without their work?]

### Silicon Solutions Introduces New Tracking Software

Visitors to the First Annual Space Symposium at the Applied Physics Laboratory in Maryland in 1982 saw on display a valuable new purpose computer built by Dick Allen, W5SXD, and Joseph Bijou, WB5CCJ, of Sugarland, TX. Now Dick and Joe have formed Silicon Solutions in Houston,
TX and introduced a very impressive pair of programs for the professional satellite analyst and advanced amateur alike.

Much of the number crunching accomplished in hardware in the prototype has been allocated to fast software processes in their new programs. Called GrafiTrak and Silicon Ephemeris, these two programs provide capabilities never even closely approximated before on microcomputers. Only on large mainframes could the stunning graphics and fast, complex number crunching be accomplished. Running on an IBM PC or clone with the math co-processor, these programs have astonished virtually everyone who has viewed them. ASR will present a special product review on these programs soon. In the mean time, if you can't wait, check out the ad for Silicon Solutions in September QST, page 100 and/or call them at 713-661-8727.

**ESA Loses Ariane Launcher, Two Satellites; Insurance Industry Teeters**

ESA, the European Space Agency, lost an Ariane launcher to a failure on 12 Sep. Details were sketchy at press time but early reports suggested a third stage failure and a subsequent destruct command by the range safety officer when the seriously off-course launcher threatened a populated area. Two major satellites were aboard. This was the third failure of the Ariane in 15 launches and ended a string of 9 successful launches.

The battered space insurance industry, shuddering under the weight of losses in the hundreds of millions of dollars may virtually collapse with these latest losses. Last week the Syncom 4 satellite launched by shuttle mission 511 only the week before suffered a total loss of its UHF transponder for unknown reasons. Insurance premiums had zoomed to nearly 20% recently if a carrier could be found. Industry sources now expect even higher rates if any insurance can be obtained at all.

**DARC Spacelab Ham-In-Space Mission Details**

The German Amateur Radio Club, DARC, will fly a Ham-In-Space mission aboard the space shuttle this autumn as reported previously in these pages. Flying aboard Spacelab Mission D1, two German and one Dutch astronaut ham will use an FM, Mode B type transponder to communicate with hams around the world. The following details were recently supplied AMSAT by DARC via ARRL. The following is an excerpt from the DARC 5 Jul 85 document by the DARC working group comprising DL5MH, DL2MDE, DH1BAS, DCO8V and DF5KJ.

During the 7-day Spacelab Mission D1 in October 1985, the science astronauts R. Furrer, DD6CF and E. Messerschmid, DG2KM [and Dr. Wubbo Ockels, PE1LFO] will operate a ham radio station, located in the Spacelab on board the Space Shuttle Columbia. The call sign of this station will be DPOS.

This ham activity is planned to start on mission day 3 and to last until about 12 hours before landing. Therefore, about 5 days may be available, with which the astronauts can be active as radio amateurs within their [free time]. Exact information on possible contact times for interested ground stations depends on mission parameters and will be given in due time. As a rough guess, 6 shuttle passes with a maximum of 12 minutes of possible contact time may be expected per day.

This ham radio activity will be focused on Europe. However, it is intended to attempt contacts also in other parts of the world, as far as mission parameters, attitude of the spacecraft for instance, permit such attempts.

Calls of responding ground stations will be recorded on tape, evaluated after the end of the mission and confirmed with special QSL card by the DARC.

In times of no voice communication of the astronauts, the rig may operate as a recording beacon, i.e. an automatic CQ call will be transmitted, followed by a one minute period, in which the receiver records incoming calls on tape. This cycle is automatically repeated. Calls identified on tape will also be confirmed by DARC.

Finally, the transmitter may be operated as a normal beacon, i.e. continuous transmission with inserted callsign, but without receiving periods. This mode may be used for VHF wave propagation measurements.

**TECHNICAL INFORMATION:**

### 2.1 Equipment on board

The ham-rig on board the Spacelab consists of the following items: VHF/UHF Transceiver, Antenna, DC/DC Converter, Various cables, Headset Container with 10 micro-cassettes

#### 2.1.1 VHF/UHF Transceiver

The VHF/UHF transceiver is a special development, designed and constructed by BOSCH/Germany according to the D1-mission specifications, and using components out of the normal mobile transceiver program of BOSCH.

RF power output of this transceiver is 10 watts. This output is reduced to 1 watt for automatic (beacon) operation. Frequency range of transmitter: 144 to 146 MHz, modulation: F3e (FM).

The receiver is a double-superheterodyne receiver, frequency range 430 to 440 MHz, sensitivity for 5+ N= -12dB is 0.45 microvolts.

Selection of operating frequencies is provided by a ROM, programmed for 4 VHF transmitting frequencies and 6 UHF receiving frequencies within a 25 kHz channel spacing.

The transceiver is provided with a built-in micro-cassette recorder.

#### 2.1.2 Antenna

The antenna has been designed and constructed by a group of radio amateurs at the antenna labs of the University of Bremen. This special antenna, to be mounted outside the Spacelab, is an aluminum whip antenna with a length of approximately 50 cm. It shows quarter-wave resonance for VHF and 5/8 λ for resonance for UHF.

#### 2.1.3 DC/DC Converter

Electrical power (28 volts DC) is applied to the transceiver from the Spacelab utility power lines via a DC/DC Converter, to provide line isolation from ground.

#### 2.1.4 Headset

For audio input and output, a lightweight headset from SIEMENS is used. It contains an earplug and a microphone with preamplifier, power for the latter being taken from the transceiver.
2.2 Equipment necessary for ground stations

To operate the Spacelab ham radio station, normal VHF and UHF amateur equipment is sufficient, if this equipment is capable of FM, split frequency operation on the frequencies given in the table in annex 5.1. It is recommended to use circular polarized antennas, adjustable in horizontal and vertical direction. The maximum velocity, necessary to follow the Spacelab's orbit is approximately 1.5 degrees per second. At least for receiving, manual control of the antennas is sufficient, since only low gain antennas (gain 3 dB) are required to receive the signals of the Spacelab ham radio station.

An effective radiated power (ERP) of 10 dBW is recommended for contacts with Spacelab. This means, for instance, that a 70cm-transmiter with 10 watts of power output combined with a 10dB gain antenna will be a good choice.

3. OPERATION

3.1 Installation on board Spacelab

Installation of the ham radio rig on board Spacelab is planned for mission day 2. The equipment will be unstowed from its dedicated storage container, and mounted at rack 12. Cabling will be accomplished between the antenna feedthru in the aft vent plate of Spacelab and the transceiver antenna connector, between transceiver and DC/DC-Converter, and from DC/DC Converter to the utility power outlet on rack 10 or 8. Connecting the headset and inserting a micro-cassette into the recorder complete the installation procedure.

3.2 Testing

Testing of the ham radio rig is planned for mission day 3. The astronauts will call service stations in Germany in order to receive operational reports. These operational reports will exclusively be given by the German service stations DF0VW (Oberpaffenholzen), DF0LK (Cologne) and DK0UP (Bremen).

After successful contact reports from these service stations, the test procedure is completed.

3.3 Normal Operation

For normal operation, the astronauts can use either one of the following operating modes:

1. **Ham rig "OFF"**
2. Beacon-operation with inserted callsign, no receive.
3. Beacon-operaton with automatic recording of incoming calls. In this mode, the transceiver transmits a CQ call in Morse Code (F2): “CQ de DP0VSL record on tape K”, followed by one minute receiving with automatic recording of calls on tape. Calls have to be made in 3e (FM voice).
4. Two-way voice QSO operation in F3e.

Selection of transmitting and receiving frequencies is exclusively with the astronauts. Frequencies and operating modes will be chosen by them according to the actual situation.

The normal channel-pair will be 3/3 (145.575 MHz transmit / 145.275 receive). However, in case of strong pile-up the astronauts will change their receiving frequency without notice. In such cases, ground stations have to choose one out of six uplink frequencies with equal contact likelihood, and the pile-up for the astronauts, as a consequence, will be reduced by a factor of 6.

For operational information between the astronaut-radio amateurs and ground amateurs, exclusively the 3 service stations will be used. For this kind of traffic, special procedures have been implemented.

4. INFORMATION SERVICE

Prior to the mission, all necessary information will be published in Germany in the CQ-DL magazine and the “DL-Rundschreiben”. Such information items are, for instance

- Modifications of the operating concept, according to the latest knowledge about the mission.
- Information on the correct way to communicate with the amateurs aboard the Spacelab ("Codex of procedure").
- Expected contact times, according to the latest information on the project.

During the mission, the service stations in Oberpaffenholzen and Cologne will on 80m and 2m, and in Bremen on 2m issue daily information on the mission. The content of these transmissions will be the same, except for the orbit data, which are corresponding to the locations of the respective stations. Examples for the content:

- Forecast of expected contact times for the next day.
- Orbit data hereto for Oberpaffenholzen, Cologne and Bremen.
- Other matters of special interest, concerning operation.

These transmissions (duration ca. 15 min.) will be followed by confirmation traffic. Confirming stations will be supplied with the special QSL card.

The transmissions of the service stations will be multiplied by selected, additional stations, in order to obtain an as complete as possible coverage of Germany and neighbor countries even on the 2m band. Up to today, no information service has been planned for outside Europe. However, it is intended to provide information on 20m. Proposals are welcome.

5. ANNEX

5.1 Technical Data of the Rig

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ham Radio TX</td>
<td>Bosch D1</td>
</tr>
<tr>
<td>Channel frequencies</td>
<td>see table</td>
<td></td>
</tr>
<tr>
<td>Channel spacing</td>
<td>25 kHz</td>
<td></td>
</tr>
<tr>
<td>Frequency deviation (kHz)</td>
<td>6.2 (voice)</td>
<td></td>
</tr>
<tr>
<td>Modulation frequency, voice</td>
<td>3.0 (beacon)</td>
<td></td>
</tr>
<tr>
<td>Modulation frequency, beacon</td>
<td>1 kHz</td>
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</tr>
<tr>
<td>RF power output, voice</td>
<td>10.0 watts</td>
<td></td>
</tr>
<tr>
<td>RF power output, beacon</td>
<td>1.0 watts</td>
<td></td>
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<table>
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<th>Receiver</th>
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<th>Type</th>
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<td></td>
<td>Ham Radio RX</td>
<td>Bosch D1</td>
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<tr>
<td>Channel frequencies</td>
<td>see table</td>
<td></td>
</tr>
<tr>
<td>Channel spacing</td>
<td>25 kHz</td>
<td></td>
</tr>
<tr>
<td>Sensitivity (µV)</td>
<td>0.45 for S+N/N = 12 dB</td>
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Table of frequencies

<table>
<thead>
<tr>
<th>Transmit</th>
<th>Receive</th>
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<tr>
<td>Channel 0</td>
<td>145.450 MHz</td>
<td>437.125 MHz</td>
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<tr>
<td>Channel 1</td>
<td>145.475 MHz</td>
<td>437.175 MHz</td>
</tr>
<tr>
<td>Channel 2</td>
<td>145.500 MHz</td>
<td>437.225 MHz</td>
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<td>Channel 3</td>
<td>145.575 MHz</td>
<td>437.275 MHz</td>
</tr>
<tr>
<td>Channel 4</td>
<td>-</td>
<td>437.325 MHz</td>
</tr>
<tr>
<td>Channel 5</td>
<td>-</td>
<td>437.375 MHz</td>
</tr>
</tbody>
</table>

Selection of transmit and receive frequencies is separately. There are no dedicated frequency-pairs, except for channels 3/3 (normal operation without pile-up).
Geo-Synchronous Satellite System
In Early Planning Stages

Progress is being made on several fronts towards a geo-synchronous Amateur Radio satellite capability according to AMSAT officials. The geo-synchronous satellites, often called Phase 4 satellites, have been the subject of keen interest recently as a result of several unrelated developments according to AMSAT President Vern Ripportella, WA2LQQ.

These developments were said to be threefold. First was the recent National Aeronautics and Space Administration (NASA) announcement of its Advanced Communications Technology Satellite (ACTS) Program and the suggestion that it could conceivably include Amateur Radio interfaces. Second, it was recently learned by AMSAT Vice President for Engineering, Jan King, W3GEY, that there is a possibility of AMSAT flying its own transponder(s) aboard the ACTS spacecraft. Third, Arianespace has told AMSAT it is currently developing a so-called "piggy-back" pricing policy for small payloads on its Ariane 4 launcher. Thus, according to these officials, there are three avenues to a Phase 4 system currently under active study.

Several months ago in an article appearing in a popular trade publication, Mobile Radio Technology, the possibility of Amateur Radio participation in ACTS was aired. Many sharp-eyed AMSAT members read the article and found the concept intriguing. Following up on the initial article, AMSAT President WA2LQQ contacted the NASA Lewis Research Center, the cognizant NASA center and obtained a series of documents detailing the technical and schedule aspects of ACTS. WA2LQQ sent copies of these documents to two dozen AMSAT technical leaders around the world for evaluation. The ad hoc AMSAT ACTS study group suggested ACTS was in fact out of reach of AMSAT. The group thought the 30/20 GHz uplink/downlink combination and the very high speed digital switching involved would tax our technical resources beyond the project's worth. While no one was willing to say "impossible", several pointed to other projects and suggested that all available resources would have to be devoted to ACTS at the expense of most other development activities. The cost in these terms, the group seemed to say, would be too high.

On the other hand, a number of the AMSAT ad hoc ACTS study group suggested that ACTS offered an excellent possibility for gateway access to a geo-synchronous spacecraft. With a few nodes around the country, the dream of a high-speed voice data or digital data network might easily be realized the group said. AMSAT is seeking individuals to work on a proposal to this effect and has dubbed this access to
the geo-synchronous capability the P4A1 option (Phase 4A, option 1).

Based on a suggestion by Butch Mason, W6KAG, to place AMSAT's own transponders aboard ACTS rather than rely
on the SHF/EHF ACTS systems, W3GEY learned from senior
ACTS Program officials that there is a slim possibility that
this could be achieved. The NASA official did point out
some major technical risk areas and pointed as well to a
growing schedule risk. The launch is currently slated for
fourth quarter, 1988, according to W3GEY.

Nevertheless, according to W3GEY, he heard nothing
from NASA or the prime ACTS contractor, RCA Astro, that
sounded like an absolute "No". Rather, reports W3GEY,
he heard cautious encouragement. A preliminary concept
would place a Mode L and a Mode S transponder aboard
the ACTS payload. AMSAT's transponders would advantage
themselves of conditioned power, station keeping and ther-
mal control provided by the host. AMSAT would provide
transponders, control and its own antennas. The antennas
on ACTS appear unsuitable for any antennas AMSAT might
use.

King emphasized to ASR that the key incentive for includ-
ing AMSAT aboard ACTS, barring any fundamental technical
constraints, was for NASA to perceive a positive technical
innovation and/or public service aspect to any such proposition. Thus, AMSAT is now soliciting concrete
suggestions as to how Amateurs might benefit society either
directly through communications services or indirectly
through technological innovation in connection with ACTS.
King advises to be mindful of the nature of ACTS, that is,
it is a communications technology experiment. An ACTS
proposal team is to collect ideas and codify them in the form
of a formal proposal to NASA.

According to preliminary concepts discussed by W3GEY
and WA2LQQ, three types of service might be provided by
the Mode L and S transponders. First would be a Mode L
linear transponder similar to that on AO-10 and Phase 3C.
Second would be a packet radio repeater or perhaps even
drop packet switch. Finally, a third service might include a capability
to both link selected terrestrial repeaters and group
address repeaters for bulletins, training, educational mate-
rials and, of course, emergency communications on a
hemispheric basis. Given the opportunity, AMSAT might
also propose a more ambitious C-Band trans-
ponder as well.

The suggestion by Mason, W6KAG, was made based on
his examination of the NASA ACTS documents and on his
independent contacts in the space industry. It was W6KAG
who established there might be payload accommodations
suitable for AMSAT's interests. The idea of placing an
Amateur Radio transponder aboard a commercial or sci-
ientific geo-synchronous spacecraft has been discussed by AM-
SAT for nearly a decade and builds on the SYNCART
(Synchronous Amateur Radio Transponder) concept of AM-
SAT Canada and Project OSCAR. More recently, a proposal
was made by Cablesat General of Florida and its President,
Ray Kassis, WA4OHK, to place a C-band Amateur Radio
transponder aboard a proposed commercial spacecraft. The
FCC recently eliminated Cablesat from competition for the
orbital slot in which Cablesat was to place its satellite.

AMSAT will be working this possible Phase 4 option as
its P4A2 option. Concepts for use may be sent to AMSAT
President WA2LQQ, P.O. Box 177, Warwick, NY 10990.
Similarly, individuals interested in writing portions of AM-
SAT's proposal to NASA or in participating in a proposal
team should contact WA2LQQ by mail at the same address.

A third avenue to a geo-synchronous system could be a
two satellite system launched by an Ariane 4. Ariane-space
is known to be working on a low-cost, "piggy-back" sys-

tem which seems ideally suited to carry an AMSAT payload
to a geo-synchronous transfer ellipse. A two-satellite sys-
tem with one placed over the equator at 47 degrees west
and another over 148 degrees west would provide coverage
for virtually all of North America to Western Europe
and most of Africa on the eastern satellite (AMSTAR East)
and most of North America to the Pacific basin including
New Zealand, Eastern Australia and Japan on the western
satellite (AMSTAR West). Further tradeoffs could be made
in coverage and a terrestrial relay might be invoked to al-
low double-hop communications such that Australia, for in-
stance, could work England. (See figures). AMSAT is
working this option as P4A3. Engineering VP W3GEY and
President WA2LQQ are planning to discuss these options
at the Space Symposium and Annual General Meeting on
November 9 in Vail, Colorado, and the following day with
AMSAT's Directors. Comments and suggestions are
solicited.

Within the last two years, discussions have addressed var-
ious Phase 4 ensembles including up to 6 satellites placed
in pairs to provide globe-girdling coverage. A geo-
synchronous drifter, which would move above the equa-
tor and make a complete orbit in about a month has also
been discussed on the basis of a minimum "full-coverage"
system which is time-shared. It would be continuously avail-
able to any non-polar QTH about 10 days per month.

However, neither AMSAT's officers nor its Directors are
precisely certain what is in the greater interest of its mem-
bers and the Amateur radio community for future projects.
The view from AMSAT DL is that a follow-on to Phase 3C
next summer should naturally be Phase 3D, a 1.2 scale
version of Phase 3C with a super power Mode L transponder
 aboard (in the 200 to 300 watt class). Meanwhile, JAS-1
will be launched next summer as well. AMSAT UK and SA AM-
SAT are both interested in satellite projects with the latter
now supporting the Mode S transponder project of Phase 3C.
Gargantuan 2 Meter Array
Sprouts in Texas

What must certainly be the largest 2 meter yagi array in the world has recently been pressed into service in Manvel, Texas by Dave Blashcke, W5UN. (See photos.) Dave writes:

"A new 2 meter EME array has been completed at W5UN which is capable of communicating with average sized stations equipped for 2 meter cw operation. The new array consists of 32 special KLM 17LBX antennas (31 foot boom) which were optimized for EME work. The "H" frame on which the antennas are mounted consists of 8 forty foot high crossarms mounted on a 97 foot long boom. Each crossarm holds four of the antennas. The entire array is supported by two 30 foot tall masts. One of the masts is fixed but rotatable. The other mast travels on a mobile platform (actually a 1947 Ford pickup truck chassis) around the fixed mast. The entire array occupies 115,000 cubic feet and requires approximately one acre of land to rotate 360 degrees.

"Performance tests tend to confirm the predicted 3.75 degree "E" plane beamwidth and the predicted 6.5 degree "H" plane beamwidth. Calculated gain exceeds 31 dBi. Return echoes from an unmodified IC-251 feeding a single yagi pointed at the moon are being heard at W5UN. Sun noise is measured at 13 to 14 dB above the noise and Cassiopeia A is 10 dB above the noise.

"It should be possible for stations with a single yagi to hear W5UN off the moon. Transmissions are made regularly on 144.008 MHz shortly after moonrise and when the moon is in a northerly declination. Stations feeding a single yagi with 160 watts or more should easily make contact with W5UN. W5UN is open for skeds. Write to W5UN or check into the EME net which meets every Saturday and Sunday at 1700 UTC on 14.345 MHz."

Write Dave Blashcke, W5UN, 9102 Kings Drive, Manvel, TX 77578.

Is this the world's largest 2 M yagi array? Comprising 32 long-boom yagis designed by K6MYC, the array is owned and operated by W5UN. (See story.)

AGM Banquet Prize List

At press time the following prizes were pledged to AM-SAT for the Annual General Meeting Banquet in Vail Colorado November 9.

<table>
<thead>
<tr>
<th>Prize</th>
<th>Donor</th>
</tr>
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<tr>
<td>GRAND PRIZE ICOM IC-1271A</td>
<td>ICOM America</td>
</tr>
<tr>
<td>all-mode 1.3 GHz Xcvr; see ASR #109</td>
<td></td>
</tr>
<tr>
<td>ARR Model SP-144VSG</td>
<td>Advanced Receiver Research</td>
</tr>
<tr>
<td>in-line GaAsFET preamp</td>
<td></td>
</tr>
<tr>
<td>Alinco model ALM-203T</td>
<td>Alinco</td>
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<tr>
<td>2 meter FM HT</td>
<td>Encomm</td>
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<tr>
<td>Ken-Pro model KR-5600</td>
<td>Encomm</td>
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<td>dual axis rotor system</td>
<td>AEA</td>
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<tr>
<td>Welz Model SP-450</td>
<td>Henry Radio</td>
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<tr>
<td>UHF power meter</td>
<td>Lunar Electronics</td>
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<tr>
<td>AEA 2 meter Isopole antenna</td>
<td>Lunar Electronics</td>
</tr>
<tr>
<td>Landwehr 2 meter mast mounted</td>
<td>KLM</td>
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<tr>
<td>GaAsFET preamp</td>
<td>KLM</td>
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<tr>
<td>Lunar model 2m4-40P 2 meter</td>
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<td>ARRL</td>
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<tr>
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<td>KLM model 145-22C</td>
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<tr>
<td>2 meter crossed yagi</td>
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<tr>
<td>Lunar model PAI 144B 2 meter</td>
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<td>preamp</td>
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<td>ARRL Antenna Book</td>
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AO-10 DX Country Count Rising

According to newly-appointed DX Bureau Manager Ed Steeb, WA2RDE, the DX country count heard and/or worked on AO-10 is reaching truly impressive numbers. Here is Ed's latest tally.

<table>
<thead>
<tr>
<th>Zs</th>
<th>Manual Log</th>
<th>CW/ST</th>
<th>CQ/B</th>
<th>RTTY</th>
<th>Phone</th>
<th>Packet</th>
<th>Internet</th>
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Mode L Experiments To Support Phase 4 Concepts

AMSAT President Vern "Rip" Riporella has announced a new series of experiments on AO-10 Mode L which promise to illustrate the functional capability of future satellite systems for bulletin transmission via satellite. As a bonus, the experiments may yield valuable engineering data on the merits of ACSSB techniques compared to FM.

There are several facets to the experiment to be performed over the next year or so on AO-10, Mode L. As explained to ASR recently, the unique window of opportunity for these experiments derives from the partial malfunction of the Mode L transponder.

As reported earlier in ASR, AMSAT engineers have determined that the defect reducing the usefulness of AO-10 Mode L is attributable to the failure of a bias regulator transistor in the Mode L power amplifier. The amplifier is operating in a non-linear regime and with light loading provides very little downlink for a given uplink. However, there is some self-biasing of the amplifier stage. Consequently, with a number of strong signals in the receiver's passband, the transponder exhibits a somewhat more linear response and makes getting through the transponder easier for low power stations. The increased performance is seen clearly when the RTTY telemetry replaces the PSK telemetry on 436.040 MHz at quarter hour intervals for 5 minute episodes. The downlink signals normally come up a dB or so when the RTTY is on.

The result is that it takes about 10 dB more uplink power than expected to have a reasonable downlink signal-to-noise ratio. Whereas Mode L was designed to provide about a 10 dB S/N ratio with an uplink in the 2 kW EIRP region it presently takes about 20 kW EIRP for the same S/N.

WA2LQQ described the window of opportunity this way.

"Originally we were delighted to have Mode L as a safety valve for Mode B overflow. But we recognized the inertia represented by existing equipment, station capabilities and operating as well as technical practice. We felt that when anticipated heavy Mode B traffic (as we now occasionally see on weekends) made Mode B less desirable, we would increase the ratio of Mode L to Mode B operating time gradually to provide added incentive for Mode L user migration.

"However, we now have a real counter-force to Mode L migration incentives which makes it less viable. Currently it takes too much power for most to move to Mode L. The result is the desired Mode L migration will probably occur at a higher Mode B 'annoyance threshold' than earlier anticipated and most likely the flow will not reach full strength until Phase 3C is well-established.

"Consequently the overall philosophy of Mode L use has been perturbed. Instead of scores of low power users distributed regularly across the vast Mode L expanse (800 kHz), we have but a handful of higher-power users rattling around in this huge passband much as a string quartet in a vacant Wembley Stadium; barely able to find each other if they didn't know where to meet! This suggests to me an opportunity for meaningful experiments which can in some measure compensate for the otherwise diminished usefulness of Mode L and, indeed, set the stage for the flawlessness performance of Mode L on Phase 3C next summer.

"Previously we would have been constrained by available downlink power and the legitimate desire to share power more or less equally among all users present. But it's evident by usage patterns that most cannot field sufficient power to result in usable downlinks. So why not take an alternative approach?

"Since available downlink power is no longer a major constraint, let us do some experiments to see what a modest Mode L Receive Only (RO) station might hear from a very strong Mode L uplink. Then we might try linking this downlink into terrestrial repeater networks as a demonstration of possible future capabilities of Phase 4 Mode L and Mode S. Concurrent Mode L users will benefit (up to a point we'll have to determine) from the linearization of the Mode L amplifier resulting from the strong bulletin station. Since spectrum is no longer a major constraint, we might try FM bulletins as well as SSB. How well will ACSSB compare to FM both objectively and subjectively? Can similar S/N be realized? These are the types of answers and results I hope we can obtain from the impending series of experiments on Mode L.
"Finally, I sense that given the balance of negatives impeding migration from Mode B to Mode L, it may take the addition of a notable positive attraction to catalyze upward mode mobility. Perhaps the planned noise-free, spin modulation-free bulletins and other "premium communication services" planned for Mode L will add the positive note required to offset the balance of negatives between B and L."

Initial Mode L experiments from WA2LQQ are planned for late October with late November targeted for regular Mode L bulletin service. Bulletins on Mode L will be scheduled as often as conditions and convenient times will allow. The ZRO Memorial Technical Achievement Award will open its Mode L series of tests in November as well.

The new experimental Mode L station at WA2LQQ has been under development since Spring. John Beanland, G3BVU, proprietor of Spectrum International in Concord, Massachusetts donated a Microwave Modules 1269 MHz transmit converter for the effort. Chip Angle, N6CA, of Angle Linear volunteered to build a 2C39 amplifier in support of Mode L experiments. Dan Burge, WA7BJU of Continental Satellite was kind enough to develop special packages and price breakouts in response to a perceived need for more Mode L equipment support. Continental Satellite builds dish antennas for the TVRO and cable business. Mike Staal, K6MYC, formerly of KLM and now a consultant and free-lance designer designed a new type of feed for the Mode L dish. Jim Eagleson, WB6JNN of Project OSCAR is building a Level I ACSSB unit for the tests. Jim's participation is a continuation of the on-going Project Companion which has the objective of bringing ACSSB techniques to the Amateur Radio bands.

The experimental high-power Mode L station at WA2LQQ is almost ready to air. The WA2LQQ Mode L station will have sufficient reserve to counter marginal satellite pointing angles. At full bore the 18 foot dish and 2C39 amplifier could provide upwards of 350 kW EIRP if needed. Experiments will indicate what levels are required for optimum use by all and what, if any, effects these operations will have on battery charge/discharge rates.

Meanwhile "Project Uplink" has been initiated to concentrate efforts for evaluating direct satellite to repeater linking. Bulletins transmitted over AO-10 Mode L will be interconnected to selected repeaters to determine the efficacy of this mode. The experimental FM transmissions will carry various types of Amateur Radio bulletin information. AMSAT bulletins as well as occasional training and educational material may be provided depending on initial results. The ARRL has expressed a preliminary interest in these experiments and may participate with bulletins of general interest.

Plans for Project Uplink call for perhaps a dozen special portable Mode L RO stations to be placed on short-term loan to repeater organizations and clubs for hamfests and conventions. The portable LRO stations would comprise a 70 cm crossed yagi with about 10 or 11 dBi gain. The yagi would break down to two easily assembled half booms each about 36" long. A 70 cm GaAsFET preamp with a noise figure in the vicinity of 0.7 to 0.8 dB and a gain of 17 to 20 dB would be included. A receive converter which would convert 436 MHz to the 2 meter band would also be part of the kit. The choice of the 2 meter i-f is a touchy one. Since 2 meter FM HTs are proliferate, it's an easy path to recover baseband audio to pump into the repeater. But what if the repeater has a 2 meter output? Will it interfere with the 2 meter output of the receive converter? Experiment may be necessary here as well.

Jay Rusgrove, W1VD, of Advanced Receiver Research as well as John Beanland, G3BVU, of Spectrum International have expressed an interest in Project Uplink and may be invited to supply equipment for the experimental kits. Meanwhile, AMSAT is soliciting help from individuals who, on the one hand, would like to help assemble the kits, and on the other hand, would like to help Project Uplink "connect" with the repeater community for these experiments. In both cases, interested individuals should contact AMSAT President WA2LQQ at P.O. Box 177, Warwick, NY 10990. Mark your correspondence attention Project Uplink.

WA4SIR Selected To Fly Shuttle Next March

Dr. Ron Parise, WA4SIR, has been selected by NASA to fly the ASTRO 1 space shuttle mission in March, 1986. Ron is an AMSAT member and was formerly AMSAT's UoSAT Science Advisor.

Ron was notified of his selection as a Payload Specialist on 11 June 84 after having applied in September 1983. (See ASR #81, July 2, 1984). Formerly an employee of the Systems Sciences Division of Computer Sciences Corporation, he is an astronomer with a PhD from the University of Florida.

The selection for ASTRO 1 means a nominal liftoff aboard mission 61E of 06 Mar. 86, according to Ron. Dr. Parise designed and will operate some of the unique astronomical instruments aboard ASTRO 1. The Ritchie-Chretien ultraviolet telescope may glimpse Halley's comet.

A proposal to place a packet radio Terminal Node Controller (TNC) aboard the flight is being composed by a group

Sarge (left) and Syl display their Hams-In-Space T-Shirts. These folks are Martha Saragovitz' parents.
in the Washington, D.C. area as reported by Dr. Tom Clark, W3WI. Tom says that some hardware is now coming together and that the plan calls for a special version of the Tucson Area Packet Radio (TAPR) TNC-2 to be aboard. A team of about a dozen individuals is supporting the proposal which all admit has a very short "fuse".

The flight of WA4SIR probably will mark the fourth Ham-In-Space Mission aboard the shuttle. W5LFL and W6ORE have already flown their pathfinder missions. The German and Dutch astronauts aboard Spacelab D1 are due to fly their mission later this month. WA4SIR will fly next March while Owen Garriott, W5LFL, may get his second Ham-In-Space mission next autumn. Planners at the Johnson Space Center are already talking about novel approaches to the challenge of a further follow-on.

Meanwhile Dr. Parise can expect at least one further flight aboard either ASTRO 2 or 3.

**Short Bursts**

- AMSAT congratulates Harold Price, NK6K, on another fine article on PACSAT, this one appearing in the September edition of Personal Communications.
- AMSAT Congratulates Ed Henderson, N8BOD, on his new AMSAT advertisement artwork. The new ads will be appearing in several Amateur Radio magazines and newsletters soon.
- AMSAT congratulates Assistant Vice President Mike Crisler, N4IFD, for a fine job leading the AMSAT's presence at the ARRL National Convention in Louisville. Supporting were W8PGP and W3XO et al.
- AMSAT congratulates Bill Tynan, W3XO, AMSAT Vice President for Manned Space Flight, for his having accepted the return of AMSAT's flag from astronaut Tony England, W6ORE, at the ARRL National Convention. The flag, fabricated by Phyllis Zwirko, XYL of K1HTV, flew with the ARRL flag aboard shuttle STS-51F and Tony, W6ORE, during the second Ham-In-Space mission recently.
- AMSAT congratulates Dick Burgraf, W8PGP and Bob Rogers, W8JLE on their fine job in manning the AMSAT booth at the Cincinnati Hamfest September 15.
- AMSAT congratulates Alan Clark, WD5IKD, on his fine job of representing AMSAT at the recent Mississippi Gulf Coast Hamfest, Oct. 5-6 in Biloxi, MS.
- AMSAT congratulates the University of Surrey on the occasion of the fourth anniversary of the launch of UoSAT-1 aka UO-9, October 7!
- Publisher Doug Bornstein, WA2JTC, reports advertisers are showing renewed interest in AMSAT's Satellite Journal magazine. Issue #5 is in the mail. Issue #6 is targeted for early November.
- Time is running out if you have not made reservations at the Westin Hotel in Vail and you plan to attend the Space Symposium and Annual Meeting November 9. Check out the fabulous prize list elsewhere in this issue. Don't delay further if you expect to get the discounted room rates. Call ASAP 303-476-7111 to make your reservations.
- New Video Tape Librarian is Tom Larson, N1CHM. He will send you a copy of the library list and operating procedures in return for a SASE. Mail to Tom Larson, N1CHM, AMSAT Video Tape Library, 85 Main Street, Dover, MA 02030. Tom and Roger Johnson, WB0GAI will be taping the Space Symposium at Vail and the proceedings will be in the library soon thereafter.
- Jeff Kelly, KT2K, has edited the W6ORE audio tapes down to the bare minimum eliminating the dead-air time. AMSAT plans to transmit these on the air in the near future. Watch for announcements regarding time and frequency. A special tape of just the SSTV audio is also available.
- The Second San Francisco OSCAR Users Meeting will be held October 20 9:30 AM to 5 PM at the Villa Hotel in San Mateo, California. Special guest speakers include W6SP, K6MYC, WB6MLC, K6FO and WB6GFJ. Contact WB6GFJ for details. Topics will include AMSAT policy, satellite antennas, packet radio on OSCAR, getting started on OSCAR and San Francisco Activity review.
- The new AMSAT-ARRL-NASA T-shirts are available at AMSAT HQ for a $15 donation. These lovely light blue quality shirts are emblazoned with a striking illustration of space shuttle mission 51F, the mission of W6ORE. Featured is SAREX, the Shuttle Amateur Radio Experiment and the AMSAT, ARRL and NASA logos. Available in s, m, l and xl. Please specify. AMSAT, 850 Sligo Ave., Silver Spring, MD 20910. 301-589-6062.
- Bob Diersig, N5AHD, has developed a new program for decoding UoSAT telemetry. It will be available through the AMSAT Software Exchange soon.
- The Young Astronauts Program (YAP) is seeking hams around the country who can perform live space communications demonstrations for youngsters in the 6 to 14 age bracket. Demonstrations of OSCAR communications and EME QSOs are particularly relevant. Contact ARRL Washington Office, Bill Lazzaro, N2CF at 202-429-9748.
- Articles are solicited for AMSAT Satellite Journal. If you have a topic you believe warrants an article, why not write up a synopsis or abstract and mail it off for possible use.

Dick Burgraf, W8PGP and Joe Berman, N8ATB manned this AMSAT booth at the Columbus, Ohio Hamfest on June 2.
Mail to ASJ Editor Harold Winard, KB2M, P.O. Box 575, Wharton, NJ 07885.

- The next ZRO Memorial Test session will be on Sunday, October 20 at 0315 UTC. Downlink frequency will be 145.840 MHz.
- A possible AO-10 operating schedule change may be implemented in conjunction with an anticipated attitude change on or about 22 October. Watch the beacon frequencies, 145.810 and 436.040 MHz, for details and schedules.
- AMSAT has obtained a collection of rare OSCAR memorabilia including some classic OSCAR posters. These early OSCAR years posters are available in limited quantities for a mere $5.00 donation and a minimum 30 inch mailing tube. Send the tube and your donation to AMSAT HQ for your classic OSCAR poster.
- The long-heralded AMSAT Phase 3 Operations Manual is in the final editing stages according to K8OCL and W6SP. Printing is anticipated by year’s end. Project OSCAR is considering undertaking the printing project in a manner similar to their production of the Project OSCAR orbit prediction books.
- AMSAT is looking for ideas on ways to celebrate the 25th Anniversary of OSCAR 1’s launch next year. A special series of commemorative events is being planned for next year but we need your suggestions too. A special 25th anniversary yearbook with lots of features on past and current OSCAR operations and operators is planned. Want to be a part? Let us know soon!

**ESA Launches Halley Probe**

The European Space Agency launched its Giotto spacecraft, Europe’s first interplanetary probe, on July 2. It is to sail to a 1986 rendezvous with the famed Halley’s Comet. The launch from Kourou Space Center on the north coast of South America, scheduled for 8:13 a.m. (7:13 a.m. EDT,) was delayed by nine minutes, but appeared to go off without a hitch.

Fifteen minutes after the launching, Giotto, separating from Ariane, was thrust into what is called a parking orbit, ESA said. The satellite’s onboard motor was due to kick it into space on its fourth orbit of the Earth.

If all goes well, Giotto, being carried into space by ESA’s Ariane rocket, is to approach within 310 miles of the dust-shrouded nucleus of the comet and photograph, measure and gather data on its components.

But despite special shielding, scientists say the dust around the comet may destroy Giotto within hours of the scheduled March 13, 1986, rendezvous.

ESA has called the expedition one of the few “missions left in the solar system where major surprises can still be expected.”

The launch is the 14th for Ariane, whose 11 previous successes have made it competitive with the U.S. space shuttle for satellite launchings.

The spacecraft is named after the 14th-century Florentine painter Giott di Bondone, who saw Halley’s comet in 1301 and portrayed it as the Star of Bethlehem in a painting of the birth of Jesus Christ.

The comet was named after British astronomer Edmond Halley, who studied it in 1607 and predicted its 76-year cycle. It was observed in Rome in 87 B.C., when Julius Caesar was 14, and astronomers say it probably is the same comet recorded by Chinese astronomers in 1057 B.C.

ESA has spent the equivalent of $106 million on Giotto including development of the spacecraft and the cost of the Ariane launcher. Federal budget cuts kept NASA from mounting a probe of Halley, the most famous of the comets. More than 200 scientists from 87 institutions in all the ESA nations are taking part in the project.

The Giotto craft will carry 10 separate experiment packages to study the comet. Cameras will take color photographs of features on the nucleus; sensors aim to capture dust finer than smoke particles; and six different experiments will study the interaction of the solar wind and the comet’s atmosphere.

Other instruments will identify the chemical and isotope composition of the comet’s halo. European scientists expect to be able to identify the molecules from which the nucleus is made.

ESA is particularly excited about the mobile multicolor camera on board, computer controlled to lock on to the nucleus as it approaches and follow it through 180 degrees, looking back after flyby.

“Beside the fascination of seeing the nucleus of a comet for the first time,” said an ESA spokesman, the pictures should show if just a few “hot spots” on its surface create the dust and gas jets seen in the coma or aura.

**Decoding OSCAR 10 Telemetry**

*by Julian Macassey, N6ARE*

Two stations in the Los Angeles area are using the G3RUH telemetry decoder in novel ways. One station is taking the “Low Tech” approach and another station is taking the “High Tech” approach.

Butch Mason W6KAC, is decoding his telemetry with the G3RUH decoder and feeding it into his Kaypro computer. Butch has written a d-Base II routine to align the telemetry data and store it so he can compare telemetry parameters over time.

Chris Wachs, WA2KDL, has taken the “Low Tech” route in the best amateur tradition. Lacking a computer, he records the raw PSK feed direct from his receiver into a cassette recorder. In parallel he runs the decoder watching the carrier lock and clock lock signals to ensure he has the receiver properly tuned. Chris then feeds the audio from the tape into his dumb terminal to read the M and Y blocks.

For better utilization, Chris feeds the audio into his dumb terminal then into his TAPR TNC. His signal is copied by Julian Macassey, N6ARE who formats the ASCII text from the M and Y blocks using Wordstar.

Julian loads the edited ASCII onto the local packet bulletin board for the use of the local AMSAT members.

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Short Bursts

- The QSL address for the DP9SL ham-in-space mission is:
  DARC DP9SL Activity
  Postfach 1155
  Lindnalle 6, D3507
  Baunatal 1
  Federal Republic of Germany
- The operating schedule of AO-10 will remain unchanged for the present. Battery condition is stable and favorable. Watch the AO-10 beacon for early word on any changes in the operating schedule contemplated.
- RS-5 and RS-7 will continue in eclipse through early December. The eclipses have caused the operating schedule of both these satellites to be sharply curtailed and largely unpredictable. The eclipse series for RS-5 ends December 14 while that for RS-7 ends December 11. Meanwhile, RS-8 continues to be in serious condition and may not return to service.
- The next North American Teleconference Radio Net (TRN) will be held at 0100 UTC on December 13. Featured speaker will be Paul Rinaldo, W4RI, QST Editor. Paul will speak on ACSSB and its potential and applications for Amateur Radio and satellites.
- AO-10 engineers and controllers have noted an increase in the quantity of errors being processed and corrected in the satellite computer known as the Integrated Housekeeping Unit or IHU. The situation is being closely monitored and is not presently a source of major concern. A so-called “hard-error” as contrasted to a “soft-error” is one that is constant and may indicate a cosmic ray impact in memory. The software used is designed to accommodate these types of “hits” and no serious consequences are expected if the number of errors detected remains reasonably constant.
- JAMSAT has donated $5,000 to AMSAT for the Phase 3C project. JAMSAT’s President Harry Yoneda, JATANG, presented the check to AMSAT at the Annual Meeting November 9. Harry is also an AMSAT Director.

New RS Satellites Expected Soon

Usually reliable sources in Europe predict the launch of RS-9 and RS-10 early in 1986. February is most-often cited as the likely time frame according to G3IOR who quotes UA3CR. Both satellites will be placed in a low earth orbit similar to all prior RS’s, that is, a polar orbit with a period approximating 120 minutes so as to approach synchronization. RS-9 has been experiencing some test difficulties, but, if these diversions are overcome, it will be launched together with RS-10. RS-10, on the other hand, is said to be in excellent condition within its test regime, and should soon be shipped to the launch facility for integration with the launcher.

RS-9 will be quite similar to RS-1 and 2 with a Mode A transponder only. The big surprise is RS-10 which will probably carry 3 transponders. In addition to the now-traditional RS Mode A transponder, RS-10 is reported to include both a Mode K and Mode T transponder. Mode K, previously used on an ISKRA satellite launched from Salyut, uses 15 meters up and produces a 10 meter downlink. Mode T is a new Mode not previously used in any oscillator. It will use 15 meters up to produce a 2 meter downlink. A 2 meter beacon will be placed at 145.557 MHz while a 70 cm beacon’s frequency remains undetermined pending licensing arrangements.

Meanwhile, reports are circulating that a Progress refueling mission to Salyut 7 in January will include ISKRA 4. ISKRA 4 was, like prior ISKRAs, built at the Moscow Aviation Institute. It will contain a Mode K transponder. Its 92 minute orbit will likely survive a month or two before re-entering. However, the launch of ISKRA-4 may be postponed due to the recent emergency return of the Cosmonauts to earth. One of the Cosmonauts aboard Salyut 7 became seriously ill last week and the entire three-man crew returned to the Soviet Union. Recovery was uneventful. The effect on missions next year is not established at this juncture.

Vail Meeting Summary

The Third Annual Space Symposium, the AMSAT Annual General Meeting and the Autumn Board of Directors’ meeting took place the weekend of November 9 and 10 is snowy Vail, Colorado high in the Rocky Mountains.

The Space Symposium was Saturday. Speakers included W3WI (SAREX-2 and packet radio linking); N6ARE and K8OCL (AROTB balloon-borne transponder experiments);
WB6JNN (ACSSB and gateway links); N4HY (predicting AO-10 eclipses); JA2PKI et al (JAS-1); Richard Ensign (Young Astronaut Program); Bob Blackledge (L5 Society); DJ4ZC (Phase 3-D concept); KE3D (patch antennas); W3GEY (Phase 4 concepts); NK6K (PACSAT); W3GEY (Mode S). The technical presentations were followed by a question and answer session from the floor. The SAREX-2 proposal was formally handed over from AMSAT/ARRL to NASA at the Symposium.

Saturday evening the Annual Meeting began with a lively and entertaining introduction of all guests. About 100 banquet guests were on hand, President WA2LQQ presented his report to the members on the state of AMSAT. He reported AMSAT is solvent, growing and is vibrant with over a dozen technical and operations projects under way. He stated the key to future vitality was to broaden our appeal through accessible projects and information services. The results of the Board of Directors’ election were then announced. The results were reported as follows:

W3GEY 1310
W6SP 1103
VE2VQ 901
NK6K 786
KE3D 699
WA5ZIB 652
KG6LC 487
N6ARE 400

Total ballots cast: 1650 (Tallied by M. Saragovitz)

Awards were then given to nearly two dozen individuals. The key awards were made to:

W3WI for his fundamental orbital tracking algorithms. DJ4ZC for his design and implementation of HELAPS. W3GEY for than a decade of technical leadership. Martha S. for outstanding dedication in member service. WB6JNN for technical innovation in developing ACSSB. N4IFD as the Outstanding Area Coordinator for 1985. Other awards went to: N3CHZ, W6XN, NK6K, WA5ZIB, WB8OTH, N6TE, DWKN, N4HY, WB0GAI, WA6VGS, WB0CY, W4BIW, W8PGP, W6KAG, WB6GFJ.

The banquet prizes were then awarded. Winner of the ICM-1271A 24 cm transceiver Grand Prize was Art Feller, KB4ZJ. The Alinco 2 meter HT was won by W4DAQ. Over $2,000 in prizes had been donated and were all claimed at the banquet.

On Sunday the Board met in an all-day session. Major actions of the Board included:

1. Election of Officers: W6SP, Chairman of the Board; M. Saragovitz Secretary to the Board; WA2LQQ, President; KBOCL, EVP; W3GEY, VP-Eng; N6ARE, VP-Ops; W3KO, VP-MSO; K9LF, VP-SP; WA2JTC, Publisher; KB4ZJ, Treas; M. Saragovitz, Dir. Admin. The concept of VP for member service was endorsed with discussions on assignee pending.
2. Declining to establish a Board of Trustees in favor of specific assignees and action officers.
3. Directing re-orientation of ASR-AMSAT relations.
4. Directing discussions with ARRL on ASJ.
5. Directing the 1986 AGM venue/time be fixed ASAP by the President.
6. Endorsing (again) an international AMSAT organization formed by the extant organizations coalescing on a self-governing, parity basis and moving to place AMSAT as a partner in the coalescence and to promoting a constitutional meeting ASAP.
7. Establishing specific study committees to study and report back within 6 months on the feasibility of a Phase 4 project.
8. Requiring that not less than 50% of member dues be allocated to space systems projects.
9. Endorsing the SAREX-2 as proposed by W3WI.
10. Endorsing increased cooperation and the drafting of a Memorandum of Agreement between AMSAT and the L5 Society in areas of mutual interest and benefit.
11. Approving in principle the budget as drafted by KB4ZJ with refinements and discrepancies to be worked out ASAP.
12. Endorsing the need to reduce inactive Life Member liabilities as an economy move.
13. Endorsing support for an emerging launch and satellite construction capability in Brazil.
14. Directing specific awards to individuals for excellent work.
15. Applauding the JAS-1 team of JARL/AMSAT/NASDA on a phenomenal effort.

QRP Emphasis Heard

AMSAT managers emphasize the need to keep AO-10 uplink transmit power levels as low as possible at all times. It is particularly irresponsible to clobber the satellite with high power when lower power levels suffice. It is poor form and not in keeping with the spirit of cooperation required in satellite use. Moreover, all users are reminded that Mondays, UTC, are QRP days, meaning that uplink power must not exceed 100 watts ERP. Please help spread the word on this important matter.

New Publication Announced

AMSAT has announced the immediate availability of a new publication aimed at both the beginner and experienced OSCAR 10 user. Titled the AMSAT Phase III Satellite Operations Manual, it explains in easily understood terms many of the intricacies of working OSCAR-10. The graphic presentations of the orbits and the definitions of terms are especially helpful. With over a dozen authors and editors, the manual has been published in conjunction with Project OSCAR. It is available now from AMSAT HQ for a $15 donation. Write AMSAT, P.O. Box 27, Washington, DC 20044.
IARU Region 3 Meets in New Zealand

A meeting of IARU Region 3 has attracted IARU Officials from around the world to the South Pacific. IARU Secretary K1ZZ and ARRL President W4RA and others attended. A special greeting from ARRL International Affairs Vice President, W1RU, was carried on AO-10’s beacon recently. It expressed the desire of IARU to preserve and conserve the recognized satellite bands as recognized by ITU and IARU.

Study Groups to Evaluate New Satellite Concepts

Concepts for the design and implementation of the next generation of OSCARs is the objective of several study committees now being formed. Over the next several months, these groups, mandated by AMSAT Board of Directors resolution, will look at possible successors to the Phase 3 generation of long-lived, multi-transponder, Molniya orbit spacecraft.

There will be four committees considering various aspects of the new generation of satellites. One group will look at technical feasibility of the spacecraft itself, another will define user requirements and estimate future capabilities. A third group will look at regulatory and legal issues in connection with inter-regional and intra-regional matters such as third party agreements. The fourth group will establish fund raising and resource development methods.

The committees will work autonomously although cross-fertilization and consultation is obviously required for a coherent plan. Operating under the leadership of a chairperson, each committee will submit its report in six months with draft reports available for review at the 4 month mark.

Qualified individuals interested in working with this program should express that interest in writing to AMSAT President WA2LQQ at P.O. Box 177, Warwick, NY 10990. Committee members will be expected to write extensively, participate in meetings and be available for consultation. A word-processing system will be an advantage but is not mandatory. Expressions of interest should be forwarded ASAP but not later than 31 Dec. 85.

MARCE Date Set

The launch of the Marshall Amateur Radio Club Experiment (MARCE) has been scheduled for 1200 UTC on December 18 from Shuttle mission 61C according to MARCE Project Coordinator Ed Stluka, W4QAU. This will be a reflight of a GAS can experiment which did not function on the first flight last year when a procedural error caused the activation of the experiment to be omitted.

Synthesized voice telemetry will report the conditions within the canister during the progress of several experiments. One part of the package is a crystal growing experiment while another will grow a radish seed.

The direct downlink frequency will be 435.033 MHz. Relay through AO-10 may be possible under very special conditions and all are encouraged to both predict these special circumstances and to attempt to observe the retransmission of MARCE telemetry via AO-10 on Special Service Channel H1, nominally 145.972 MHz. Achievement of this telemetry relay would be seen as a major achievement in the history of Amateur Satellites. The direct downlink could be as strong as 6 watts ERP and should be easily heard. However, the downlink transmissions will occur in three relatively short episodes viewable mainly from the Southern Hemisphere but including Japan. For this reason, MARCE managers and AMSAT are soliciting telemetry capture assistance from Southern Hemisphere stations especially. Support from ZS, PY, VK and ZL has been evident but more help is needed. Contact N6ARE ASAP at 475 North Daisy Avenue, Pasadena, CA 91107. Or call 818-449-7088 to offer your assistance and to receive an informative data packet.

Group To Test SAREX-2 Software

By Ralph Wallio, W0RPK

Development of the next Shuttle Amateur Radio Experiment (SAREX-2) is underway. There is a possibility of its flying with Astronaut Ron Parise, WA4SIR, aboard the Space Shuttle Columbia in March 1986. The SAREX-2 station, potentially aboard STS-61E, will be on packet radio with several new and interesting modes of operation that require extensive “beta” testing.

The Central Iowa Technical Society (CITS) is preparing to provide intensive SAREX-2 ground-based and aeronautical mobile testing environments. Beginning with the availability of special TAPR TNC-2 SAREX-2 software on December 1, CITS members will operate a ground-based test in Des Moines, IA. Initial testing will peak during the weekend of December 6-8 when local packet radio stations will coordinate their operation to create as much load on the SAREX-2 software as can be mustered.

The following Wednesday evening, December 11th, CITS members Rich Amundson, WA0IFS, Ray Knapp, WA2GTM, and Larry Vandewater, N0BK, will carry the SAREX-2 package aloft for an aeronautical mobile operation. They will “orbit” a Cessna 182 aircraft over Greenfield, IA at an altitude of 10,000 feet which should yield a 2M range of approximately 275 miles. This range will allow packet radio stations from as far away as Minneapolis-St. Paul, Chicago, St. Louis and Kansas City to help load test SAREX-2 software and a newly developed logging mechanism.

All ground-based and aeronautical testing will be held on 145.950 MHz uplink and 145.550 downlink. The aeronautical test will occur between 1900 and 2200 CST with a minimum of 2-hours at operational altitude. During the airborne test, W0RPK will chair a net on 3857 KHz to provide testing information. An ground-to-air UHF link will be maintained during the flight.

Should the December 11th operation be grounded due to weather, it will run on the following Wednesday, December 18th. Last minute information will be available on Tuesday evening AMSAT nets at 2000 and 2100 CST on 3857 KHz.
Orbit Predictions
By KA9Q

Satellite OSCAR-9
Catalog number: 12888
Epoch time: 85318.13182672
Thu Nov 14 03:18:54.148 1985 UTC
Element set: 810
Inclination: 97.64156 deg
RA of node: 309.41053 deg
Eccentricity: 0.0004245
Arg of perigee: 98.5762 deg
Mean anomaly: 261.5934 deg
Mean motion: 15.27752411 rev/day
Decay rate: 1.4636-05 rev/day
Epoch rev: 22812
Semi major axis: 6687.635 km
Anom period: 94.256810 min
Apogee: 502.941 km
Perigee: 497.119 km
Ref perigee: 2874.16501993
Thu Nov 14 03:44:40.52 1985 UTC
Beacon: 145.8250 MHz

Satellite OSCAR-10
Catalog number: 14129
Epoch time: 85314.71177612
Sun Nov 10 17:04:56.167 1985 UTC
Element set: 210
Inclination: 26.2911 deg
RA of node: 110.45006 deg
Eccentricity: 0.5975505
Arg of perigee: 60.3161 deg
Mean anomaly: 345.9124 deg
Mean motion: 2.058662672 rev/day
Decay rate: -1.1407 rev/day
Epoch rev: 11181
Semi major axis: 26105.417 km
Anom period: 609.519799 min
Apogee: 3323.744 km
Perigee: 4131.134 km
Ref perigee: 2870.73070765
Sun Nov 10 17:32:18.584 1985 UTC
Translate freq: 581.0037 MHz
Invert: 1
Beacon: 145.8100 MHz

Satellite OSCAR-11
Catalog number: 14781
Epoch time: 85307.607744287
Sun Nov 3 14:35:03.983 1985 UTC
Element set: 96
Inclination: 98.1754 deg
RA of node: 12.3807 deg
Eccentricity: 0.0013983
Arg of perigee: 214.8232 deg
Mean anomaly: 214.823 deg
Mean motion: 14.62001729 rev/day
Decay rate: 1.036-06 rev/day
Epoch rev: 8940
Semi major axis: 7061.032 km
Anom period: 98.490906 min
Apogee: 700.425 km
Perigee: 680.676 km
Ref perigee: 2864.61552454
Sun Nov 3 15:14:52.39 1985 UTC
Beacon: 145.8260 MHz

Satellite RS-5
Catalog number: 12999
Epoch time: 85319.19504031
Fri Nov 15 04:40:51.482 1985 UTC
Element set: 276
Inclination: 82.9594 deg
RA of node: 222.8750 deg
Eccentricity: 0.0009879
Arg of perigee: 112.3285 deg
Mean anomaly: 247.8832 deg
Mean motion: 12.05035369 rev/day
Decay rate: 4.06-08 rev/day
Epoch rev: 17209
Semi major axis: 8033.839 km
Anom period: 119.496755 minut
Apogee: 1681.654 km
Perigee: 1665.781 km
Ref perigee: 2875.22008443
Fri Nov 15 05:03:40.415 1985 UTC

Satellite RS-7
Catalog number: 13001
Epoch time: 85310.26803587
Wed Nov 6 06:26:03.347 1985 UTC
Element set: 223
Inclination: 82.959 deg
RA of node: 222.2098 deg
Eccentricity: 0.0022907
Arg of perigee: 62.1074 deg
Mean anomaly: 298.2312 deg
Mean motion: 12.08699330 rev/day
Decay rate: 4.06-08 rev/day
Epoch rev: 17153
Semi major axis: 8017.665 km
Anom period: 119.136308 minut
Apogee: 1674.404 km
Perigee: 1637.544 km
Ref perigee: 2866.20230129
Wed Nov 6 06:46:30.831 1985 UTC

Satellite RS-8
Catalog number: 12998
Epoch time: 85317.12073121
Wed Nov 13 02:53:49.621 1985 UTC
Element set: 346
Inclination: 82.9610 deg
RA of node: 227.0370 deg
Eccentricity: 0.00018425
Arg of perigee: 179.8646 deg
Mean anomaly: 100.2418 deg
Mean motion: 12.02947337 rev/day
Decay rate: 3.86-08 rev/day
Epoch rev: 17154
Semi major axis: 8043.187 km
Anom period: 119.705252 minut
Apogee: 1679.862 km
Perigee: 1650.223 km
Ref perigee: 2073.16222170
Wed Nov 13 03:33:35.954 1985 UTC

Note that positive longitudes are degrees east; negative is west.

OSCAR-9
Wed Nov 27 00:20:28.540 1985 UTC:
Ascending node at -108.3
Nodal period: 98.2603 min
Longitude increment: 2.638017 deg/week
Element set 98, epoch
Sun Nov 3 14:35:08.983 1985 UTC
RS-5
Wed Nov 27 01:36:58.001 1985 UTC:
Ascending node at 125.3
Nodal period: 119.53327 min
Longitude increment: 10.012933 deg/week
Element set 276, epoch
Fri Nov 15 04:40:51.482 1985 UTC
RS-7
Wed Nov 27 01:03:26.360 1985 UTC:
Ascending node at 129.2
Nodal period: 119.19294 min
Longitude increment: 29.925072 deg/week
Element set 223, epoch
Wed Nov 6 06:26:04.347 1985 UTC
RS-8
Wed Nov 27 00:14:04.369 1985 UTC:
Ascending node at 150.1
Nodal period: 119.7019 min
Longitude increment: 30.067484 deg/week
Element set 346, epoch
Wed Nov 13 02:53:49.621 1985 UTC
AO-10 IHU Memory Fault Confirmed

AMSAT engineers have confirmed earlier diagnoses that an AO-10 memory fault has developed. The fault will have no effect on operations or overall spacecraft longevity according to AMSAT officials. According to Jan King, W3GEY, AMSAT’s Engineering Vice President, the fault in the Integrated Housekeeping Unit (IHU) memory appears to have been caused by a heavy particle impact; possibly the debris of an energetic cosmic ray.

The IHU memory has been designed to accommodate both soft errors, the kind that are encountered randomly and are one-shot events, and so-called hard errors; ones which represent a physical change in hardware and are permanent. The IHU software can not only detect errors when they occur, but can automatically correct for most errors so as to avoid any serious consequences. The satellite is completely under computer control and any uncorrected software error could be devastating. The system is also designed to count the number of times the error-correcting feature has been used. This count comprises an index to the number of errors incurred. Several weeks ago engineers began to notice an increase in the number of hits experienced. It was unclear at the time whether they were due to soft errors or one of several types of hard errors.

A diagnostic software routine designed by Karl Meinzer, DJ4ZC, recently confirmed, however, that the errors are hardware-based. The fault has been identified in specific memory locations, hex 0781 and 3D81. King points out that it is quite likely the fault lies in adjacent memory cells; adjacent real estate on the silicon memory die itself. This could be due, King asserted, to either a latent manufacturing defect or the impact of a heavy particle. The area of memory affected is normally allocated to data rather than operating...
Short Bursts

- The operating schedule of AO-10 will remain unchanged for the present. Battery condition is stable and favorable. Watch the AO-10 beacon for early word on any changes in the operating schedule contemplated. The current operating schedule is:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode B</td>
<td>055-119</td>
</tr>
<tr>
<td>Mode L</td>
<td>120-136</td>
</tr>
<tr>
<td>Mode B</td>
<td>137-203</td>
</tr>
<tr>
<td>Off</td>
<td>204-239</td>
</tr>
<tr>
<td>Mode B</td>
<td>240-019</td>
</tr>
<tr>
<td>Off</td>
<td>020-054</td>
</tr>
</tbody>
</table>

An attitude maneuver was planned for 9-11 December. The transponder was to be turned off during the perigee passage for this maneuver. Target attitude was said to be about 185 degrees longitude and 0 degrees latitude but this was not finalized at press time.

- The first trial run of the Mode L portion of the ZRO-Memorial Technical Achievement Award test will be held on January 1 at 2230 UTC. The downlink will be 436.200 MHz, approximately. This will not be an official test run but just a trial to try out the equipment and procedures.
- The next Mode B ZRO-test run will be January 1 at 2330 UTC. The downlink will be 145.940 MHz.
- The next scheduled Mode B satellite bulletins will be on January 2 at 0100 UTC. The downlink will be 145.962 MHz.

Solid State Mode L Amplifier

An article by Al Ward, WB5LUA, in the December issue of QST details plans for solid state 1296 MHz amplifiers capable of up to 18 watts output. As Al points out in the article, these units will work well at 1269 MHz too. When used to drive a 2C39 amplifier, they appear just the ticket to get on AO-10 Mode L now. When Phase 3C is launched next year, these amplifiers, when coupled to a 22 or 24 dbi antenna array, will provide access to the improved Mode L on the new bird. The amplifiers described use NEC 1300 series transistors and were shown at the Central States VHF Society meeting earlier this year.
MARCE NEWS FLASH

AMSAT Seeks Reduced AO-10 Traffic During MARCE Relay Try

AMSAT managers are appealing to AMSAT OSCAR 10 users to reduce or eliminate use of the Mode B transponder during a special event later this month. For a few hours between 18 and 21 December, the Getaway Special canister MARCE will attempt to relay telemetry through AO-10 Mode B.

This is a splendid opportunity to set a new kind of precedent; one that was thought highly improbable until recently, according to AMSAT officials. It would go a long way to establishing future mission capabilities as well, ASR has been told. But since the MARCE 70 cm emissions are QRP, the load on AO-10 Mode B transponder will have to be very light in order for the QRP MARCE uplink to be heard on the AO-10, Mode B downlink. The MARCE telemetry package is using only 6 watts ERP.

The times to avoid AO-10 use are:
First Session:
18 Dec 23:40 through 19 Dec 07:30 UTC
Second Session:
19 Dec 20:10 through 20 Dec 02:45 UTC
Third Session:
20 Dec 19:00 through 21 Dec 01:00 UTC

Although MARCE will be transmitting beyond these times, due to spacecraft position and mutual visibility, these are the only times that relay through AO-10 will be possible.

AMSAT is offering two awards for MARCE telemetry capture. A Letter of Recognition will be sent to all who submit a bona fide audio cassette of the direct MARCE downlink on 435.033 MHz FM.

Moreover, a Special Technical Achievement Award certificate will be presented to anyone who submits a bona fide audio cassette of the MARCE telemetry RELAYED through AO-10. The downlink on AO-10 will be 145.972 MHz ± 13 kHz using FM.

Submit cassettes to N6ARE, 475 North Daisy Avenue, Pasadena, CA 91107. No cassettes will be returned unless return postage in full is enclosed.

Cassettes will be analyzed by AMSAT for authenticity and then forwarded to MARCE program officials for analysis.

AMSAT hopes to have most AO-10 users listening for the relayed MARCE downlink (rather than transmitting) on AO-10 during the three sessions so the load on the transponder will be very low and, if fact, facilitate this unique opportunity for all to participate in an historic event!

MARCE To Fly With Shuttle; Awards For Telemetry Offered

The launch of the Marshall Amateur Radio Club Experiment (MARCE) aboard STS-61C has been scheduled for 1200 UTC on December 18 according to MARCE Project Coordinator Ed Stluka, W4QAU.

Synthesized voice telemetry will report the conditions within the MARCE Get Away Special canister during the progress of several experiments. The direct downlink frequency will be 435.033 MHz using FM. An AMSAT Letter of Recognition will be presented to all who submit a bona fide audio cassette recording of the MARCE telemetry received by direct reception from the Shuttle.

Telemetry relay through AO-10 may be possible under very special conditions. The relayed downlink will likely be on Special Service Channel H1, 145.972 plus or minus 12.7 kHz Doppler shift according to NASA's Gil Carman, WA3NOM, of the Johnson Space Center who did much of the orbit analysis and plotting for MARCE.

Realization of telemetry relay from a Get Away Special canister to another Amateur satellite would be seen as a major achievement in the history of Amateur Satellites. AMSAT will be issuing a Special Technical Achievement Award certificate to anyone who submits a bona fide audio cassette recording of MARCE telemetry as relayed through AO-10.

Although the direct downlinks will be strong enough (6 watts ERP) to be heard well with even modest equipment, the timing of the emissions limits direct access to the Southern Hemisphere but including Japan. MARCE is powered by an internal 50 ampere hour silver zinc battery and

Ed Stluka, W4QAU — MARCE antenna installation process. Antenna must be disassembled for connection and installation on the gas canister lid.
altitude of Columbia. With the payload bay facing earth most of the time, "Satellite access will be most likely for approximately 6 minutes just before and after each earth eclipse when AO-10 is within about 18 degrees of the earth horizon" as seen from Columbia, says WA5NOM.

Four major experiments are in the GAS can. Besides the Amateur Radio portion, there is an alloy solidification experiment, a plant physiology experiment and a crystal growth experiment. A series of measurements are telemetered by radio in three separate sequences as described in the tables below.

MARCE managers and AMSAT are soliciting telemetry capture assistance from Southern Hemisphere stations especially. Contact N6ARE ASAP at 475 North Daisy Avenue, Pasadena, CA 91107. Or call 818-449-7088 to offer your assistance and to receive an informative data packet.

All submissions of cassettes for awards should be forwarded to N6ARE at the same address. Cassettes will not be returned unless return postage in full is provided.

**Special MARCE Support Data**

The preliminary Keplerian elements for 61C are as follows:

- **Set:** NASA Element Set #3
- **Epoch:** 85 352.99372106
- **Drag:** 2.5e-04
- **Inclination:** 28.6741
- **RAAN:** 95.3371
- **Eccentricity:** 0.0008376
- **Arg Perigee:** 97.4619
- **Mean Anomaly:** 70.2603
- **Mean Motion:** 15.78856556
- **Ref Ep Orbit:** 9

If the actual launch is later than planned, add the difference to the epoch and increase the RAAN by 15.04107 degrees per hour and resolve to 360 degrees.

**Detailed Direct Downlink Schedule**

**First Downlink Session: Orbits 8-14**

Tx on 30 sec/min

<table>
<thead>
<tr>
<th>UTC</th>
<th>Orbit #</th>
<th>DD/HH:MM:SS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>18/22:18:01</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>19/23:49:02</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>19/01:20:03</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>19/02:51:03</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>19/04:22:04</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>19/05:53:05</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>19/07:24:05</td>
</tr>
</tbody>
</table>

Paul Shuch, N6TX, phrases a question for AMSAT officials at the Symposium.

the transmissions are limited to conserve battery life. A half-wave dipole is mounted atop the canister and is fully exposed. The Shuttle Columbia will have its payload bay facing the earth for much of the mission so a strong signal can be expected.

However, what's **good for direct reception is poor for relay** through AO-10 since AO-10, with apogee at 35,300 km and perigee at 4100 km is always higher than the 336 km

Executive Vice President John Champa, KBOCL, tells the 1985 Space Symposium of ARTOB plans.
Second Downlink Session: Orbits 22-27

Tx on 45 sec/min

<table>
<thead>
<tr>
<th>Orbit #</th>
<th>DD/HH:MM:SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>19/19:32:11</td>
</tr>
<tr>
<td>23</td>
<td>19/21:03:11</td>
</tr>
<tr>
<td>24</td>
<td>19/22:34:12</td>
</tr>
<tr>
<td>25</td>
<td>20/00:05:12</td>
</tr>
<tr>
<td>26</td>
<td>20/01:36:13</td>
</tr>
<tr>
<td>27</td>
<td>20/03:07:14</td>
</tr>
</tbody>
</table>

Third Downlink Session: Orbits 37-42

Tx on 45 sec/min

<table>
<thead>
<tr>
<th>Orbit #</th>
<th>DD/HH:MM:SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>20/18:17:19</td>
</tr>
<tr>
<td>38</td>
<td>20/19:46:20</td>
</tr>
<tr>
<td>39</td>
<td>20/21:19:21</td>
</tr>
<tr>
<td>40</td>
<td>20/22:50:21</td>
</tr>
<tr>
<td>41</td>
<td>21/00:21:22</td>
</tr>
<tr>
<td>42</td>
<td>21/01:52:22</td>
</tr>
</tbody>
</table>

Telemetry Decoding

Telemetry will be sent in either of two formats:

Sample Data in format A:

QST QST QST FROM WA4NZD TIME 00000
STATUS 10 DATA 012 014 014 015 015 012 225
135 255 FROM WA4NZD OUT

Sample data in format B:
(Employed when alloy solidification experiment is on).

QST QST QST FROM WA4NZD TIME 00000
STATUS 10 DATA 012 014 014 015 015 012 225
135 255
STATUS 98 TIME 0000 DATA 3F 4A 3B 3C 3D
42 AF A2 FROM WA4NZD OUT

Format A and B status codes explanation.

Status word is a two digit hex number ranging from 01 to ff. The status word encodes the condition of any combination of 8 variables. Taking the arithmetic sum of the status point codes yields the transmitted code word.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Status Point</th>
<th>Voice Hex Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/D Converter failure</td>
<td>0</td>
<td>01</td>
</tr>
<tr>
<td>Canister pressure too low</td>
<td>1</td>
<td>02</td>
</tr>
<tr>
<td>Transmitter on too long</td>
<td>2</td>
<td>04</td>
</tr>
<tr>
<td>GCD &quot;B&quot; Transmitter relay off</td>
<td>3</td>
<td>08</td>
</tr>
<tr>
<td>GCD &quot;C&quot; Control relay off</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Exp #1 Over-temperature</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Exp #2 or #3 are on</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Battery voltage is too low</td>
<td>7</td>
<td>80</td>
</tr>
</tbody>
</table>
Example: Status word A1 is sent.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Voice Hex Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/D error</td>
<td>0</td>
</tr>
<tr>
<td>Exp #1 Over Temp 5</td>
<td>20</td>
</tr>
<tr>
<td>Battery V low</td>
<td>7</td>
</tr>
<tr>
<td>hex sum</td>
<td>A1</td>
</tr>
</tbody>
</table>

Format B status code explanation:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Hex Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on</td>
<td>98</td>
</tr>
<tr>
<td>Heat up</td>
<td>1E</td>
</tr>
<tr>
<td>Regulate</td>
<td>B6</td>
</tr>
<tr>
<td>Experiment</td>
<td>D9</td>
</tr>
<tr>
<td>Cool down</td>
<td>CD</td>
</tr>
<tr>
<td>Shut off</td>
<td>C8</td>
</tr>
</tbody>
</table>
Data value explanation:

Data values are obtained from the accompanying graphs. The data values encode the levels of certain measurements as follows:

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Parameter Encoded</th>
<th>Designation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oven #1 temperature</td>
<td>T1</td>
<td>Alloy solidification</td>
</tr>
<tr>
<td>2</td>
<td>Oven #2 temperature</td>
<td>T2</td>
<td>Alloy solidification</td>
</tr>
<tr>
<td>3</td>
<td>Experiment #3 temperature</td>
<td>T3</td>
<td>Plant physiology</td>
</tr>
<tr>
<td>4</td>
<td>Experiment #4 temperature</td>
<td>T4</td>
<td>Crystal growth</td>
</tr>
<tr>
<td>5</td>
<td>Container temperature</td>
<td>T5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Battery temperature</td>
<td>T6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Battery voltage</td>
<td>V1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Battery current</td>
<td>I1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Container pressure</td>
<td>P1</td>
<td></td>
</tr>
</tbody>
</table>

Command code explanation:

GCD "A" PPC "D": Turns GAS on/off
GCD "B": Radio tx power
GCD "C": Turns on experiments 1, 2, 3 and 4.

Experiments #1, 2 & 3. Exp. #2 cover is removed. MARCE low pass filter is under Exp. #1 oven.

Exp. #4 MARCE ready for gas #007 installation into the gas canister and for flight.

Experiment #4, MARCE, with new SRB battery. Electronic support assembly cover is removed.
## MARCE to AO-10 Relay Opportunities

<table>
<thead>
<tr>
<th>MARCE Downlink Session Number</th>
<th>MARCE AO-10 Relay #</th>
<th>61C Orbit #</th>
<th>Window Opens DD/HH:MM [UTC] [AO-10 MA]</th>
<th>Window Closes DD/HH:MM (UTC) [AO-10 MA]</th>
<th>Total Relay Time (Minutes)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>8</td>
<td>18/23:45 [194]</td>
<td>18/23:57 [198]</td>
<td>12</td>
<td>First xmsn</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>12</td>
<td>19/04:53 [050]</td>
<td>19/05:45 [069]</td>
<td>52</td>
<td>Mode B on at MA 137; 20:30 UTC</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>13</td>
<td>19/06:29 [085]</td>
<td>19/07:21 [104]</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>23</td>
<td>19/21:50 [166]</td>
<td>19/22:42 [185]</td>
<td>52</td>
<td>Mode B off at MA 203; 23:30 UTC</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>24</td>
<td>19/23:27 [202]</td>
<td>20/00:20 [221]</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>25</td>
<td>20/01:19 [243]</td>
<td>20/02:41 [17]</td>
<td>82</td>
<td>Mode B off at AO-10 perigee MA 137; 19:49 UTC</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>37</td>
<td>20/19:00 [119]</td>
<td>20/19:52 [138]</td>
<td>3</td>
<td>Mode B on at MA 203; 22:49 UTC</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>39</td>
<td>20/22:11 [189]</td>
<td>20/23:03 [208]</td>
<td>38</td>
<td>Mode B on at MA 204; 00:32 UTC</td>
</tr>
</tbody>
</table>

Total possible relay time: 402 Minutes; 6.7 hours

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