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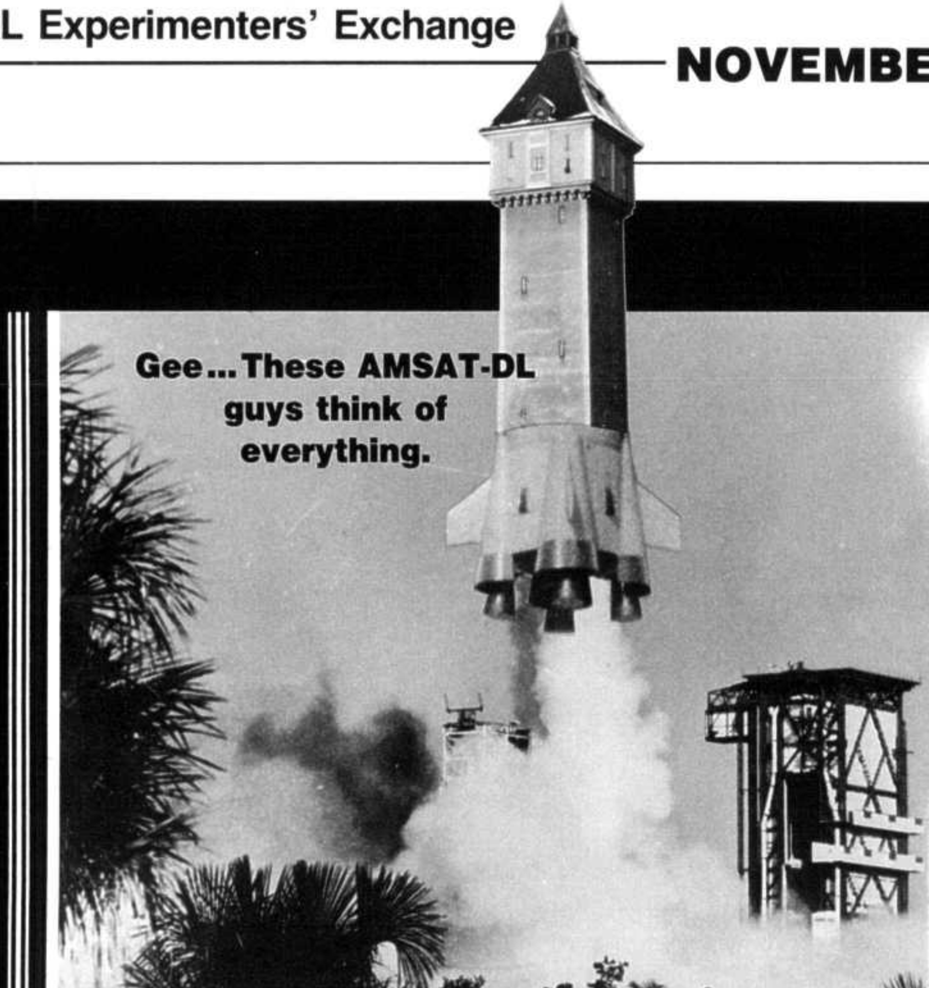
ARRL Experimenters' Exchange

NOVEMBER 1990



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COLUMNS

NOVEMBER 1990 QEX ADVERTISING INDEX

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Purposes of *QEX*:

1) provide a medium for the exchange of ideas and information between Amateur Radio experimenters
2) document advanced technical work in the Amateur Radio field
3) support efforts to advance the state of the Amateur Radio art.

All correspondence concerning *QEX* should be addressed to the American Radio Relay League, 225 Main Street, Newington, CT 06111 USA. Envelopes containing manuscripts and correspondence for publication in *QEX* should be marked: Editor, *QEX*.

Both theoretical and practical technical articles are welcomed. Manuscripts should be typed and double spaced. Please use the standard ARRL abbreviations found in recent editions of *The ARRL Handbook*. Photos should be glossy, black-and-white positive prints of good definition and contrast, and should be the same size or larger than the size that is to appear in *QEX*.

Empirically Speaking . . .

Amateur Radio Experimenting—It's One World

The Amateur Radio space program has long been an international activity with amateurs of many countries contributing to the design and construction of amateur satellites. The amateur satellites launched in 1990, alone, look like a mini United Nations: Two British, two American, one Brazilian and one Argentine amateur satellites were launched on a French Ariane V-35 rocket from Kourou, French Guiana, on January 21, and a Japanese amateur satellite was launched on February 7.

Amateur packet radio started in Canada in the late 1970s. American amateurs made numerous technical contributions since 1980, and packet has been truly international since 1981. Many valuable innovations are now coming not only from North America but from Europe and the Pacific.

Microwave experimenters are similarly dispersed throughout the globe, and at least the more serious ones have been aware of what their opposite numbers have been doing overseas.

You may have noticed that *QEX* has been carrying construction articles translated from the journals of European, and occasionally Japanese, Amateur Radio magazines. Translations amount to another step in bringing this information to you and we have several translators who do a fine job for us. Since ARRL HQ gets copies of the journals of IARU member-societies, we are in a good position to notice interesting technical articles and republish them for *QEX* readers. Occasionally, this causes some problems identifying foreign parts, which has been the subject of correspondence published in *QEX*. Then again, it is possible to order parts from overseas suppliers, and perhaps we could do a better job of exchanging information on sources and the details of international purchasing.

It has become clear that *QEX* has an international following, not just from subscribers but readers of pass-along copies and photocopying—see our copyright notice on page 1. As an international exchange, however, *QEX* could use more regular and timely information about Amateur Radio experimentation in Europe and the Pacific. Several attempts have been made in private correspondence to line up Contributing Editors (or columnists) in these two areas without much luck. So, it seems the next natural step is to go public and see who's willing to contribute fresh material to *QEX* on a regular basis. We presently pay $35/page for regular articles and more, depending on experience and the difficulty of the material, to Contributing Editors.

What format? One approach would be to devote a column to Europe and another to the Pacific, written by separate Contributing Editors. Another would be to have a page or so each month as an international column. A third alternative would be to simply include such information in the Correspondence column or as stand-alone technical articles.

If you live in Europe or the Pacific and would like to serve your fellow experimenters by regular contributions to *QEX*, please let us know. The prime requisite is that you are in touch with the experimenters in your part of the world and can report on what they are doing. If your English is a bit rusty, the *QEX* editorial staff can do the polishing.—*W4RI*

The Safari-4: A High-Integration, 4-Band QRP Transceiver—*Part 2 of 3*

By Wayne Burdick, N6KR
446 Mt Hope Street, Unit 9
North Attleboro, MA 02760

[Continued from October issue.]

Circuit Details

Transverters (Z6-Z9)

Fig 5 shows the transverter schematic. At upper left is the first receive mixer, which gets its RF input directly from the transmitter output network. C1 and RFC1 are series-resonant at the RF input frequency to reduce the loss of RF limiter D1/D2.

Like the 8.8-MHz IF input, a band-pass filter is used at the input to mixer U1. Broadband transformer T2 provides a low-impedance IF output at 8.8 MHz.

The conversion oscillator, Q1, has two different output points to help isolate the first receive mixer from transmit-mode transients. The junction of C8/C9 drives the receive mixer, while Q1's collector output drives the transmit mixer, U2.

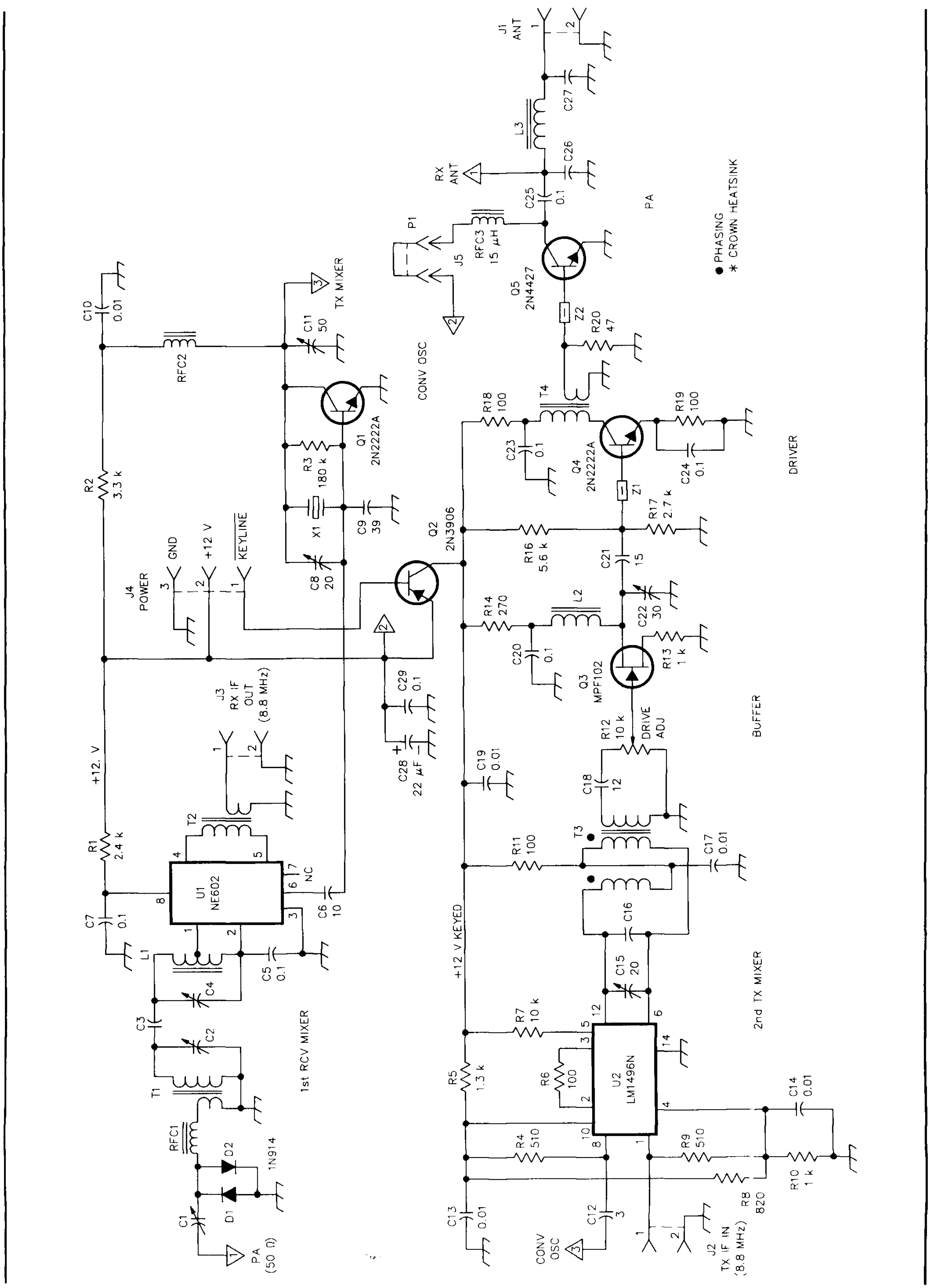
U2, an LM1496 double-balanced mixer, provides good isolation between the 8.8-MHz IF and conversion oscillator signals. C15, C16 and T3 are used in a balanced configuration that yields excellent gain and low spurious output at the difference frequency. R12 varies the amount of drive to a tuned buffer, Q3, which in turn feeds untuned driver Q4.

Q5 is a simple grounded-emitter class C output stage. A 2N4427, which is intended for 12-volt applications, was used because of its low cost. (The often-used 2N3866 is designed for a 24-volt supply, and is less

[1]Notes appear on page 9.

Fig 5—Transverter schematic (Z6-Z9). All variable capacitors are Mouser series 24AA miniature ceramic trimmers (0.2-inch lead spacing is required for use with the author's PC boards). L1 through L3 and T1 through T4 are wound on Amidon cores.

C1—40 m: 50 pF (24AA024); 20 m: 30 pF (24AA023); 10/15 m: 20 pF (24AA022).
C2, C4—40 m: 50 pF; 10/15/20 m: 30 pF.
C3—40 m: 3 pF; 10/15/20 m: 1 pF.
C8, C15—20 pF.
C11—50 pF.
C16—40 m: 47 pF; 20 m: 15 pF; 15 m: 12 pF; 10 m: not used.
C22—30 pF.
C26—40 m: 470 pF; 20 m: 220 pF; 10/15 m: 100 pF.
C27—40 m: 470 pF; 20 m: 220 pF; 10/15 m: 120 pF.
J1-J4—Made from break-off, pin-line sockets (Aries A208); use strip-line SIP headers as mating plugs (Aries A115). Both come with 25 pins; two of each will make J1-J4 and mating plugs for all four transverters. (Digi-Key.)
J5—2 pin, 0.1-inch spacing header (Digi-Key 929647-01-36; one of these will make J5 for all transverters).
L1—Center-tapped inductor; 40 m: 44t no. 28, T-50-2 (10 μH); 20 m: 34t no. 28, T-50-6 (4.7 μH); 15 m: 23t no. 24, T-50-6 (2.2 μH); 10 m: 18t no. 26, T-37-6 (1.0 μH).
L2—40 m: 12t no. 26 on FT-50-61 (10 μH); 20 m: 28t no. 28 on T-37-2 (3.5 μH); 15 m: 23t no. 28 on T-37-2 (2.3 μH); 10 m: 17t no. 26 on T-37-6 (1.0 μH).
L3—40 m: 14t no. 22 on T-50-2 (1.0 μH); 20 m: 12t no. 22 on T-50-6 (0.6 μH); 15 m: 9t no. 22 on T-50-6 (0.35 μH); 10 m: 11t no. 24 on T-37-6 (0.35 μH).
P1—Mating plug for J5 (Digi-Key 929955-06 or equiv).
Q2—PNP switching transistor; 2N3906, 2N3638A, etc.
Q5—Motorola RF transistor in TO-5 case; 2N3866 or 2N3053 may also be used. Heatsink: Mouser 33HS502.
RFC1—Subminiature RF choke (Mouser 43LQ series); 40 m: 12 μH; 20 m: 10 μH; 15 m: 3.9 μH; 10 m: 2.7 μH.
RFC2—Subminiature RF choke (Mouser 43LQ series); 40 m: 2.7 μH; 20 m: 2.2 μH; 15 m: 1.0 μH; 10 m: 0.47 μH.
RFC3—Mouser 43LS155 acceptable; if space permits, use a lower resistance choke (PA output will increase slightly).
T1—Toroidal transformer; core and secondary winding same as L1. Primary has 3t on 15/20/40 m; 2t on 10 m.
T2—Primary: 14t no. 26 on FT-37-43; secondary: 4t. See text for optional 10/15 – m modification.
T3—Trifilar wound transformer; observe phase. 40 m: 18t no. 26 on T-50-2; 20 m: 12t no. 26 on T-50-2; 10/15 m: 11t no. 28 on T-37-6.
T4—20/40 m: 15t pri, 5t sec, on FT-37-43 core; 10/15 m: 10t pri, 4t sec, on FT-37-43 core.
X1—Third-overtone crystal, ICM P/N 471265; 40 m: 15.870 MHz; 20 m: 22.870 MHz; 15 m: 29.870 MHz; 10 m: 36.870 MHz.
Z1, Z2—Ferrite bead; Mouser FB43-110 or Amidon FB-43-101.


1st RCV MIXER
2nd TX MIXER
BUFFER
DRIVER
PA
CONV OSC
TX MIXER
RX ANT
J1 ANT
J2 TX IF IN (8.8 MHz)
J3 RX IF OUT (8.8 MHz)
J4 POWER
GND
+12 V
KEYLINE
+12. V
+12 V KEYED
PA (50 Ω)
DRIVE ADJ
U1 NE602
U2 LM1496N
Q1 2N2222A
Q2 2N3906
Q3 MPF102
Q4 2N2222A
Q5 2N4427
D1
D2 1N914
RFC1
RFC2
RFC3 15 µH
R1 2.4 k
R2 3.3 k
R3 180 k
R4 510
R5 1.3 k
R6 100
R7 10 k
R8 820
R9 510
R10 1 k
R11 100
R12 10 k
R13 1 k
R14 270
R16 5.6 k
R17 2.7 k
R18 100
R19 100
R20 47
C1
C2
C3
C4
C5 0.1
C6 10
C7 0.1
C8 20
C9 39
C10 0.01
C11 50
C12 3
C13 0.01
C14 0.01
C15 20
C16
C17 0.01
C18 12
C19 0.01
C20 0.1
C21 15
C22 30
C23 0.1
C24 0.1
C25 0.1
C26
C27
C28 22 µF
C29 0.1
L1
L2
L3
T1
T2
T3
T4
X1
Z1
Z2
J5
P1
NC
● PHASING
* CROWN HEATSINK

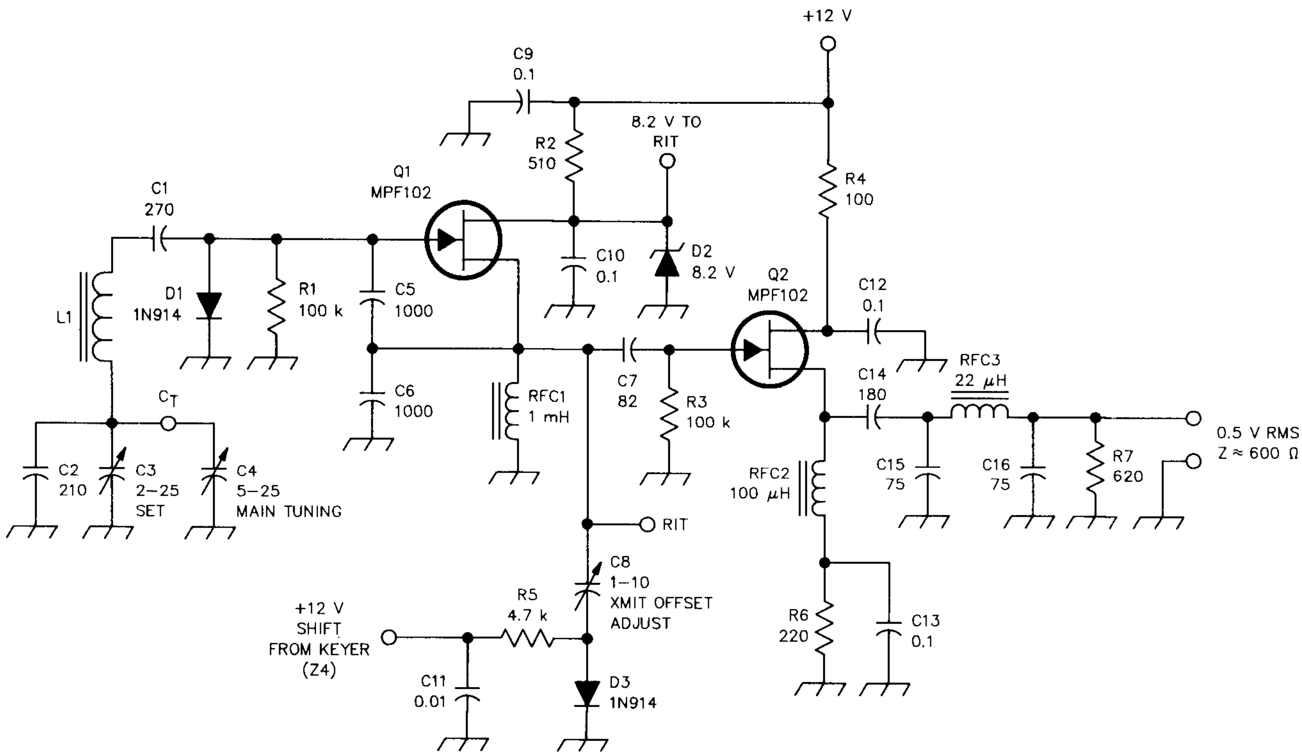


Fig 6—Schematic of the series-tuned Colpitts VFO (Z2). Its range is 3.885-3.955 MHz using the values shown (see text).

C1, C2, C5-C7, C14-C16—Polystyrene or silver mica, 5%.
C3—Air trimmer, 2.4-25.5 pF (Mouser 530-189-0509-5).
C8—Ceramic trimmer, 2.8-12.5 pF (Mouser 24AA021).
L1—59t no. 26 on Amidon T-68-6 (17 μH; Qμ > 200).
RFC1,2,3—Subminiature RF choke (Mouser 43LQ series).

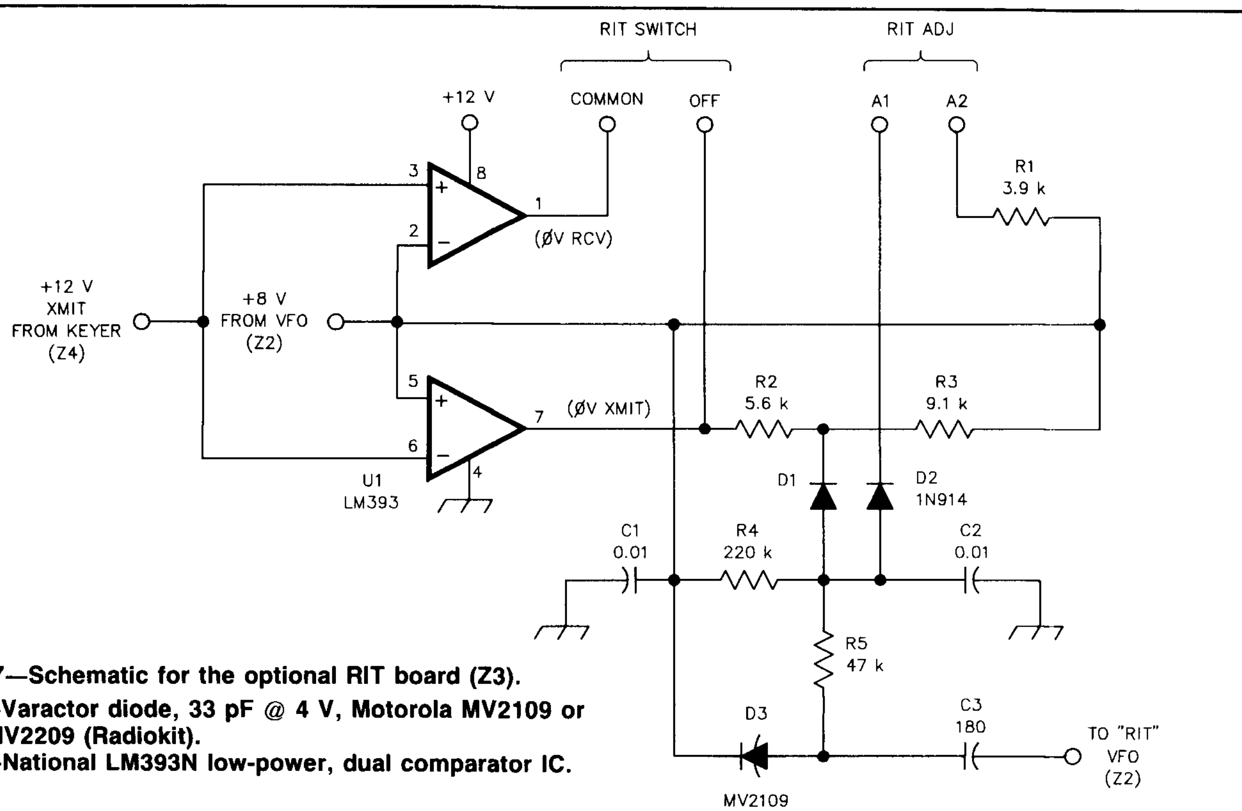


Fig 7—Schematic for the optional RIT board (Z3).
D3—Varactor diode, 33 pF @ 4 V, Motorola MV2109 or MV2209 (Radiokit).
U1—National LM393N low-power, dual comparator IC.

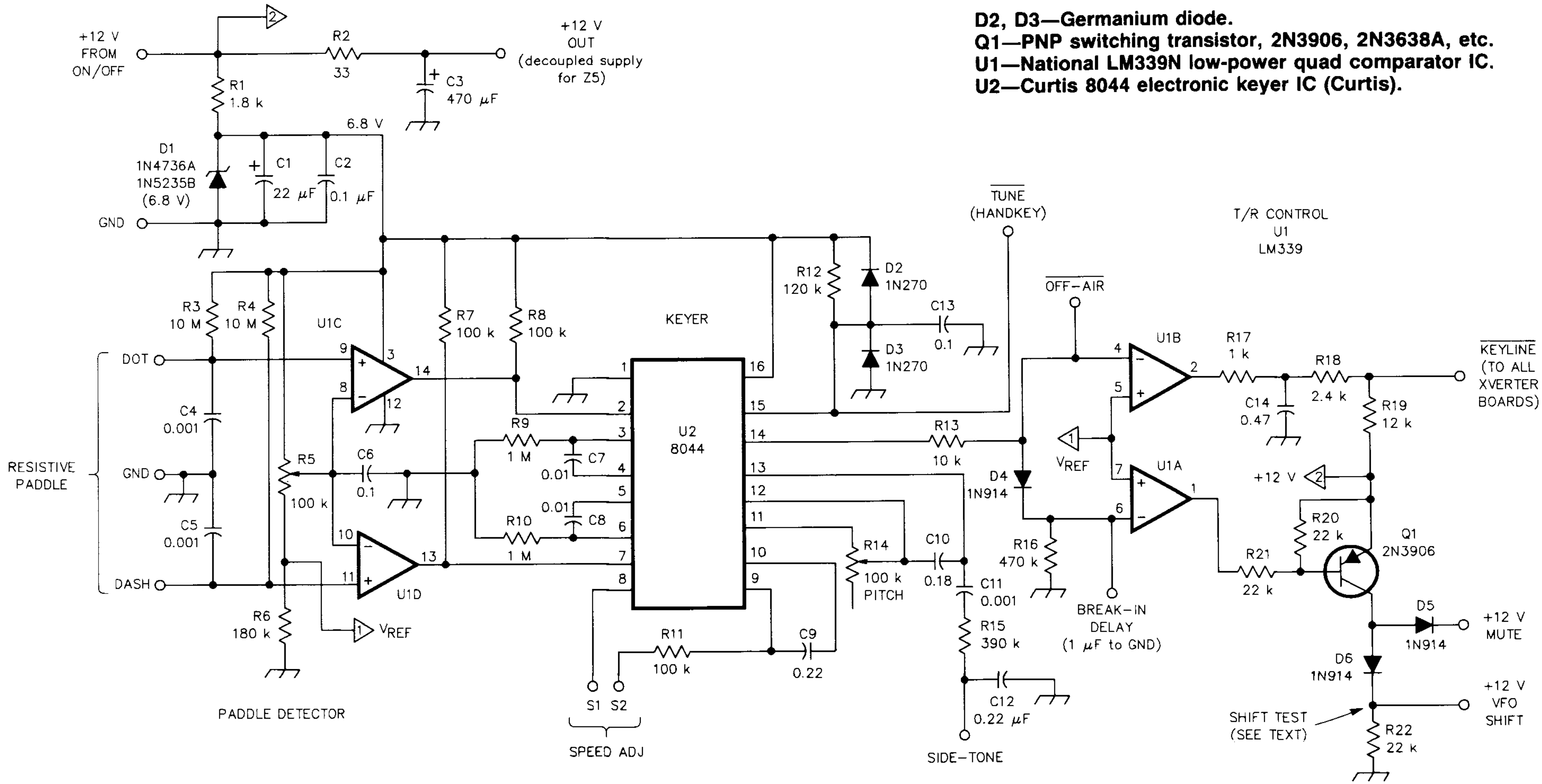


Fig 8—Schematic for the Keyer/Control board (Z4). See text for details on the resistive-touch paddle.

D2, D3—Germanium diode.
Q1—PNP switching transistor, 2N3906, 2N3638A, etc.
U1—National LM339N low-power quad comparator IC.
U2—Curtis 8044 electronic keyer IC (Curtis).

efficient at 12 volts.) Ferrite beads Z1 and Z2 were necessary to prevent self-oscillation at high drive levels, partly due to the compact circuit layout used for the transverter boards.

Another requirement with the tight layout is that toroids *must* be used to avoid interstage coupling. The broadband output circuit of driver Q4 also contributes to overall transmitter stability, as does the elimination of the decoupling capacitor on buffer Q3's source lead.

The key-line (J4 pin 1; 0 V transmit, 12 V receive) is fed in parallel to all transverter boards. The four lines are isolated by D6-D9 (chassis, Fig 3). The key-line input to the transverters should never be directly grounded; R17 and R18 (on Z4) provide current limiting.

VFO (Z2)

I used a standard series-tuned Colpitts VFO (Fig 6), a circuit often used by DeMaw.[5] The basic oscillation frequency is determined by L1 and the total series capacitance in Q1's gate-source circuit, or:

$$1/(1/C1 + 1/C5 + 1/C6 + 1/(C2 + C3 + C4)).$$

In this case, the total capacitance is around 100 pF.

C3 is used to set the VFO range to approximately 3.885 to 3.955 MHz. C8 shifts the VFO frequency slightly lower during transmit, and the point marked "RIT" is the input for Receive Incremental Tuning shift (see below). Q2, a source-follower, keeps Q1 isolated from load variation. It is followed by a single pi filter section, C15, RFC3, and C16, which provides adequate harmonic attenuation. R7 is used to reduce the Q of the circuit and help stabilize the load.

Drift is almost nonexistent, thanks in part to the low VFO frequency. I made no attempt to temperature compensate the VFO, but housing it separately seems to have given it enough thermal isolation to handle moderate ambient temperature swings.

RIT (Z3)

You have to design an RIT circuit (Fig 7) to appreciate the importance of isolating the transmit and receive control voltages. I finally opted for complete isolation by using an open-collector comparator. On receive, U1 pin 1 is low, which forward biases D2 with the voltage supplied by RIT control R9 (see Fig 3). On transmit, U1 pin 7 is low, switching in a fixed voltage divider (R2/R3) to forward bias D1. This arrangement shows no signs of chirp or drift.

I used a Motorola MV2109 33-pF varactor diode to provide about ± 1 kHz of RIT deviation. The voltage/-capacitance function of the varactor diode is nonlinear; you'll get a little more than 1 kHz on one side of the RIT control and a little less on the other. The total deviation could be increased by making C3 larger, but VFO stability might suffer since the varactor diode is operated at a low reverse voltage of about 2 to 8 volts.[6] Still, I haven't observed any drift, even at the 2-volt setting.

Keyer/Control (Z4)

The schematic for the keyer/control unit is shown in Fig 8. A Curtis 8044 keyer IC (U2) embodies most of the keyer circuitry. However, I replaced the usual paddle input circuit with two high-impedance comparators (2/4 of U1) and a resistive-touch paddle, shown schematically in Fig 3. The entire keyer/control board draws only a few mA.

To make the paddle, I used two mirror-image, single-sided etched PC boards with interlaced ground and signal patterns. The pattern was designed to maximize the resistance decrease with finger contact. (The paddle boards were incorporated as part of the keyer/control PC board layout.) I had a PC board manufacturer gold-plate the boards to prevent corrosion. Some jewelers will do this, too, but they warned me that typical gold-plating on jewelry wears off—not suitable in this case!

R5 controls the sensitivity of the comparator inputs, and is adjusted so that the (−) inputs are just below the (+) inputs, keeping both comparator outputs high. Touching either paddle pulls the respective (+) input below the (−) input, and the output of that comparator goes low to key the 8044.

The remainder of the keyer circuit is fairly standard, except that no protective diodes are needed at U2's inputs because the comparators clean up the paddle. R12 was selected for a comfortable dot/dash ratio; a pot can be used instead. An audio filter (C11, R15, and C12) was needed to keep large switching transients off the sidetone signal and to attenuate it, since it drives the LM386 input on the 8.8-MHz IF/AF board.

T/R control is accomplished with the other half of U1. When U2 is keyed, U2 pin 14 goes high, switching U1 pins 1 and 2 low. This drives the keyline low, keying the currently active transverter. The keyline signal is shaped and delayed slightly by R17, C14, and R18. Several milliseconds prior to the keyline going low, Q1 saturates, providing 12 V mute and shift signals. These signals must be isolated from each other; this is the function of D5 and D6.

For adjustment or practice, U1 pin 4 can be grounded by placing the keyer mode switch in the OFF-AIR position. R13 then becomes the load for the 8044 output (which *cannot* be directly grounded), and transmitter keying is prevented. The TUNE position of S8 safely keys the 8044, and doubles as a hand key input.

The T/R circuit is optimized for full QSK, but a capacitor can be added from U1A pin 6 to ground, as shown, to effect a break-in delay. D4 is needed in that case to keep the capacitor from holding up the key line.

One additional feature of the keyer board is that it supplies decoupled 12 volts for the IF/AF board (Z5), via R2 and C3, to reduce T/R clicks. Such decoupling is a necessity with full QSK, due to the sensitivity of the NE602/LM386 audio channel.

Antenna Tuner and SWR Bridge

As can be seen from Fig 1, there was little room for

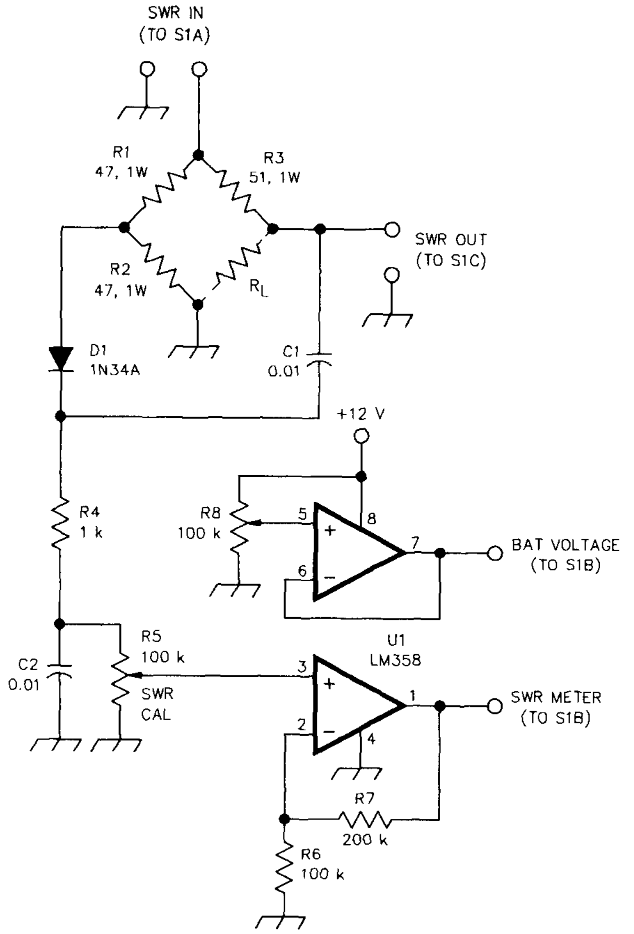


Fig 9—SWR/Meter Control board schematic (Z1).

R1-R3—Noninductive, 1-watt, metal-oxide film or carbon composition (Digi-Key).

U1—National LM358N, low-power dual op-amp IC.

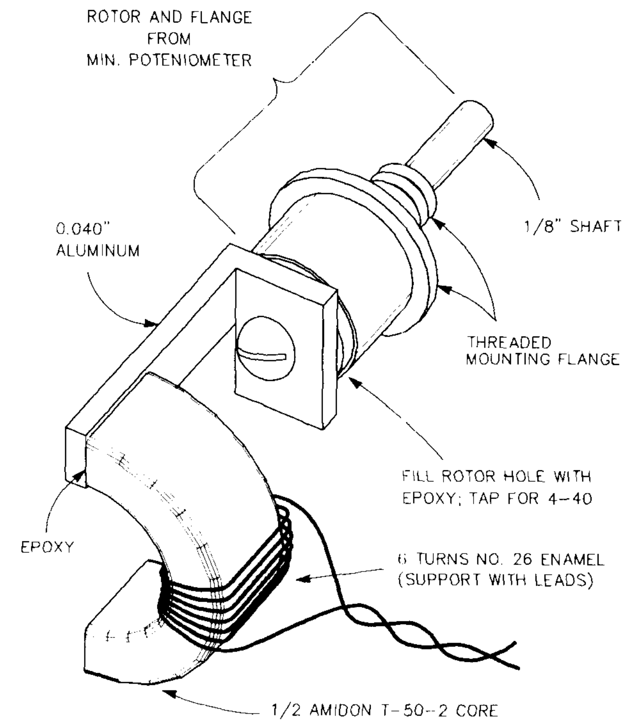


Fig 10—Variable inductor detail. An Amidon T-50-2, cut in half, is glued to a homemade aluminum bracket. The bracket is mounted on the rotor of a small potentiometer, the metal case of which has been removed. The core passes through a self-supporting 6-turn coil (no. 26 enamel).

the antenna tuner components. The resulting compromise is less than perfect; there are times when it is not possible to obtain a favorable match on all four bands.

The tuner circuit (see Fig 3) can be configured as an L-network or series network by S2. I found that one position or the other can be used to match most wire antennas on 40 through 10 meters. To improve matching capability, I used a small home-made rotary inductor, L2, in series with tapped coil L1. The construction details for L2 are shown in Fig 10.

The SWR bridge (Fig 9) is of the absorptive type, rather than in-line. This configuration provides a fairly constant load impedance to the PA transistor, which can't handle the mismatches that occur during antenna tuner adjustment.

Once this type of bridge is calibrated at a certain power level, no further adjustment of the sensitivity control is required, regardless of the band in use. This allows the user to adjust the L and C controls of the antenna tuner for the lowest null on M1 without worrying about resetting the forward sensitivity.

A disadvantage is that the SWR bridge cannot be left in-line during normal use, since it reduces the transmitted output by roughly 12 dB. (Actually, I've made a few contacts with S1 in the SWR position—up to several hundred miles on only 60 milliwatts!)

I found that the RF level inside the enclosure required RF decoupling at the meter terminals; this is the function of C1 (see wiring diagram, Fig 3). R3 was required to isolate op-amp U1, the meter amplifier, from C1. A capacitive load on the output of an LM358 may cause the chip to oscillate.

Additional Chassis Circuitry

In addition to the antenna tuner, there are a few other areas to point out on the chassis wiring diagram.

R2 and D1-D4 form a simple taper-charge circuit for recharging BT1. The external supply used as a battery charger can also be used to power the unit; it should provide around 400 mA at 14.2 volts. No external supply switch is needed, as D2, D3, and D4 enable the supply or the battery depending on which has the higher voltage.

DS1, a 3-lead red/green LED, is used both to indicate that an external supply/charger is connected (green) and as an RF output indicator (red). The latter function is needed because M1 only shows S-units—not transmitter output—when S1 is in the OPERATE position. C3, D5 and R4 supply enough current to turn on the red LED during key-down periods.

A simple IF attenuator (R6, R7, S6) is provided for times when signals are so strong that the AGC system is overwhelmed. (Field day is a good example!) A variable control could be used here, but I used an SPDT center-off switch instead to provide fixed attenuation of about −18 and −30 dB. To avoid a ground loop, the coax shield from the attenuator switch is not connected at the Z5 end.

[Part 3 of this article covering construction, operation and performance will appear in the December issue.]

Notes

[5]DeMaw, D., *QRP Notebook*, ARRL, Newington, CT, 1986, p 29.

[6]Johnson, D., "Tuning Diode Design Techniques," Motorola application note AN-551.

Initial Phase-3D Experimenters' Meeting May 7-9, 1990

Sponsored by AMSAT-DL in Marburg, West Germany; Minutes by Peter Guelzow, DB2OS (translated by Don Moe, DJØHC/KE6MN)

Day 1—May 7, 1990

Karl Meinzer, DJ4ZC, opened the first Phase-3D experimenters' meeting by outlining items on the agenda for the following three days.

He explained the situation since 1988 after AMSAT OSCAR-13 (P3C) was successfully put into operation and the reasons behind the decision to build a Phase-3D satellite. The Phase-3 series has shown the path into the future, and proven that AMSAT is capable of developing and building quite complex satellites. DJ4ZC further emphasized the decisive role played by Amateur Radio satellites and how they have particularly contributed to technical advancements.

A basic criterion behind the development of a Phase-3D satellite is an improvement in the link paths by at least 10 to 15 dB compared to OSCAR-10 and OSCAR-13. At most, 8 dB can be achieved with improved antennas, so that the transponder output power would also need to be increased by approximately 7 dB. On the lower frequencies, however, only 2 to 3 dB more antenna gain can be expected, whereas at SHF more than 10 dB extra gain is conceivable. Raising the transmitter power is thus one of the most important aspects, and a power budget of 200 watts should therefore be used as a basis. In the case of a 300-watt generator, solar arrays of 1.5 to 2 m^2 are required for a satellite stabilized in all three axes. For a spin-stabilized satellite similar to OSCAR-13, the solar array area would have to be increased from 1 to 5 m^2, making the cost very significant.

Karl pointed out that international cooperation is absolutely required on a project estimated to cost between 3 and 5 million DM (US$ 1.7 to $3 million). AMSAT-DL can provide 1.5 million DM (US$ 0.88 million) from resources of the West German Ministry for Research and Technology (BMFT).

DJ4ZC then continued by outlining the current prospects for launching Phase-3D. In 1988 the USSR made AMSAT-DL an offer to place a 200-kg satellite directly into a Molniya orbit for $1 million DM (US$ 0.58 million). In this case a supplementary kick motor for raising apogee would not have been necessary. At that time, money was unfortunately not available, and since the BMFT was negotiating simultaneously for another launch opportunity for a joint USSR-West German project, it was not possible to make a reservation. Conceivably there may be another launch opportunity in the future along with a renewed offer from the USSR.

The development of the new Ariane-5 rocket is proceeding intensively, and two qualification test flights of the rocket with different missions are planned on which there is still free payload capacity. The first test flight is a launch into the geostationary transfer orbit (GTO). At this time this mission is already completely taken up by the Cluster satellites. The second test launch will be into a low earth orbit (LEO) as required later for flights of the space shuttle Hermes. In the meantime however, ESA plans to replace this flight with an additional GTO launch since there is much greater demand and the suitability for LEO flights would be automatically assured.

DJ4ZC is counting on the first GTO launch since the final decision about the Cluster flight is still open, leaving some chance yet. Karl is also hoping to reduce the costs of the launch campaign further.

Jan King, W3GEY, then provided an overview of the launch opportunities in the USA. Recently, the Atlas rocket program has been expanded for flights with larger payloads into GTO. Since primarily only commercial flights are being planned, costs would be very high. The new Torus rocket should carry 450 kg into GTO and the first test flight is planned for 1994. There may possibly be a launch opportunity in this case, and Jan King and Bob McGwier, N4HY, intend to make further inquiries in this regard. As a result of increasing commercial interest and the ensuing higher costs, it is very difficult to locate any other openings. This also applies to the Titan-4 rocket, whereby two additional motor maneuvers are necessary to reach GTO due to the launch into LEO.

DJ4ZC would welcome a launch opportunity in the USA, but sees the best chances with the Ariane-5. The Ariane-4 would be out of the question since only a single satellite in the 200-kg class would be possible without triggering a costly configuration change.

Andras (Bandi) Gschwind, HA5WH, reported about the contacts with DOSAAF and launch possibilities in the USSR, and indicated that new prospects are opening up thanks to the political changes.

DJ4ZC recounted AMSAT-DL's cooperative effort with AMSAT-U-ORBITA and the Adventure Club on the construction of the RUDAK-II experiment and that further cooperation could be expected with them.

The next important item on the agenda was the financial situation. DJ4ZC emphasized that on principle each group must cover its own expenses. The solar generator and the rocket launch represent the major items in the total expense, whereby Karl Meinzer estimates the cost for just the satellite, without solar panels, at approximately 20%. The price for the solar generator from AEG-Telefunken amounts to nearly 600,000 DM! (US$ 353,000) Dick Jansson, WD4FAB, and Jan King, W3GEY, report that a 250-W bus design using SOLAREX solar cells was intended for a Phase-4 satellite, yielding an efficiency 22% better than before. Glass covers are available and the cost for 4.75 m^2 would be US$ 130,000.

AMSAT-DL already has over 1.5 million DM for the Phase-3D project available and is hoping for additional support. It might be possible to raise an additional 600,000 DM from various universities wishing to include experiments of their own.

According to W3GEY, AMSAT-NA can make $150,000 to $200,000 available per year from the members. Virtually no funds can be expected from the government. AMSAT-NA will cover its own expenses in any event.

Hennie Rheeder, ZS6ALN, reported that AMSAT-SA will receive money from projects promoting education and from universities and will also cover its own expenses.

Alberto Zagni, I2KBD, related that AMSAT-I was able to raise US$ 100,000 from donations for the Microsat project and sees a good chance that not only can it cover its own costs but also contribute to the entire project.

There are currently three groups active in AMSAT-VK. Furthermore, there is a possibility to obtain Aus$ 100,000 to

250,000 from the government. The problem is that this money is reserved for an Australian payload and must remain within the country.

From the University of Budapest in Hungary, Bandi Gschwind, HA5WH, is certainly willing to take on a project but has problems obtaining components and money.

Project OSCAR would like to participate in the Phase-3D project by donating hardware and money and could thereby support HA5WH, for example.

According to James Miller, G3RUH, AMSAT-UK can contribute nearly 25,000 (US$ 42,000) yearly. Such things as hardware, etc, are not likely to be forthcoming, however.

The JARL/JAMSAT might also be enticed into contributing financially. DJ4ZC may travel to Japan and negotiate with the JARL.

In Germany, DJ4ZC expects a certain degree of difficulty in obtaining money from scientific organizations or institutions since the conflicting interests could complicate matters relative to the BMFT.

W3GEY sees rather good chances of obtaining hardware donations since the industry has a major interest in qualifying products for space flight. DJ4ZC considers this to be very important and welcome, particularly in the area of navigation sensors for a three-axis stabilized satellite.

Tasks and Goals

In 1992, the WARC will be taking place and, among other items, will consider the Amateur Radio frequency allocations. In light of an international Phase-3D satellite project, the prospects would also be good for retaining microwave bands (500 MHz to 3 GHz).

Presentations at local and IARU events are strongly suggested. AMSAT-International should also participate in the WARC. A working group should be formed that can devote its attention to this matter.

Once again DJ4ZC emphasized the retention of the frequencies but also sees the personal motivation of each individual participant on the project. Besides the urge to do research, there is a certain degree of stimulation from working together on such a project, since it is done without payment and during free time!

Since the lifetime of the satellite should be around 10 years, we must consider today which modes of operation will be in the greatest demand in 10 years time. Doubtless, these will include the digital operating modes. "The world is going digital" and everything will change. Besides the normal analog transponders, such as for Mode-S, digital transponders must be seriously considered for such modes as high-speed digital picture and voice transmission. On the other hand, the fact cannot be overlooked that a Mode-B station is already a maximum for many radio amateurs and they want a simple station. The Phase-3D satellite must thus provide for both simple operating possibilities and the highly technical requirements of microwave transponders and digital payloads.

Alberto Zagni, I2KBD, commented that various institutions could provide significant sums for ecological experiments and that this might be a worthwhile goal.

Hennie Rheeder, ZS6ALN, briefly outlined the goals in building the AMSAT-SA experiment for 29 MHz which is to allow educational bulletins transmitted in SSB compatible amplitude modulation to be received using simple converters. The high-frequency "Sounding and Atmospheric Experiment" aims at aiding scientific research into wave propagation. Furthermore, this would also provide a means of activating the 29-MHz band during the solar minimum.

Orbits

After a short break, Jan King, W3GEY, made a presentation about the alternatives to the Molniya orbit currently used by OSCAR-13. A major problem is the relatively poor accessibility to the satellite from the southern hemisphere of the Earth. Therefore, W3GEY theoretically analyzed various modifications which could possibly improve the situation. Shifting the argument of perigee by nearly 30 degrees from apogee does not provide any noticeable advantage.

A significant improvement and good access from the southern hemisphere can be achieved in a true Molniya orbit at 63° inclination by raising the perigee to nearly 8000 km altitude. The orbital parameters could be optimized to the extent that over a three-day interval five stable apogee positions result. Since the apogee does not drift, fixed antennas could be installed on the ground for operation at apogee.

5/3 Molniya Orbit Summary by Jan King

Perigee height	8086.0 km
Apogee height	39142.6 km
Period	718.0 min
Mean Motion	1.667 rev/day (5 orbits in 3 days)
Semi Major Axis	29992.5 km
Eccentricity	0.51774
Inclination	63.4349 deg
Arg of Perigee	270.0 deg
RAAN	270.0 deg
Delta V	472 m/s (True Molniya → 5/3 Molniya)

Stable Apogees

Apogee	*Longitude*	*Coverage*
1	2.5 deg	8.25h @ 40 deg N, 100 deg W
2	146.2 deg	7.25h
3	-70.4 deg	12.5h
4	+73.0 deg	3.75h
5	−142.2 deg	12.5h

DJ4ZC suggested that the orbit period might also be optimized if possible such that the local apogee would be sun synchronous, hence always between the same hours locally, such as from 16:00 to 23:00.

Furthermore a long-duration analysis is necessary for Phase-3D to ascertain the effects of the perturbations from the sun, moon and earth on the orbit. This was prompted by a reliable study by Victor Kudielka, OE1VKW, which showed that OSCAR-13 will reenter and burn up in the period 1995-1997. (See his article in *AMSAT-DL Journal*, June/August 1990.) Due to its different parameters, the orbit of OSCAR-10 is not in jeopardy.

—Dr. Victor W. Kudielka, OE1VKW, Peter-Jordan-Str 165, A-1180 Vienna, Austria

A working group "ORBIT" should be established to work on optimizing the orbit for Phase-3D. Suggested were W3GEY, N4HY, OE1VKW, DL2MDL, and G3RUH.

Then DJ4ZC elaborated on the properties of the plasma (water) rocket motor, which requires approximately 350 watts of electrical power to provide a thrust of 100 mN with an ISP of 4 to 5 m/s at 30 mg/s. This thruster could be used to fine tune the orbit, assuming it is even feasible. An alternative would be another 400 N motor from MBB, such as was successfully used in OSCAR-10 and OSCAR-13. AMSAT-DL is hoping to obtain another such motor from MBB. On the other hand, the safety procedures during the launch campaign are very critical and also quite expensive. Using a water thruster would simplify many aspects. In order to achieve the final orbit, approximately six months would be necessary and the orbital maneuver would automatically be performed at apogee for 2 hours each time. At this time a vacuum test chamber is urgently needed for testing the motor. The power for the motor could be supplied from 300 A/h, 26 V NiH batteries from the USA. Since the orbit of the satellite would be constantly changing, new navigational procedures and methods of orbit determination are also mandatory. In order not to overtax the command stations, a goal should be that command station investigation is required at most once per week. Over a time period lasting more than six months, this would otherwise be an excessive burden on the command stations.

Transponders

DJ4ZC then asked the various groups to describe their ideas to the other participants.

N4HY explained the interest of AMSAT-NA in developing a high-power wideband digital transponder with a 23-cm uplink and 13-cm downlink (Mode-S) for packet radio interlinking and digital video transmission at a maximum of 1.5 Mbit/s and a minimum of 64 kbit/s.

The RUDAK group will implement a digital transponder with several uplinks based on RUDAK-2 and the RTX2000 processor. There was not enough time to prepare a concrete proposal for the project prior to this meeting. The basic intention is to develop and build something along these lines.

The 29-MHz beacon in the experiment from AMSAT-SA could have more than the requested 50 watts. 100 watts at perigee are also no problem, although heat pipes are necessary for removing the excess heat. Dick Jansson, WD4FAB, indicated that these are available. The question arose at this point about how heat pipes might affect the rotation of the satellite.

AMSAT-IT has no specific suggestions, but would gladly participate in the "digital" corner.

Knut Brenndoerfer, DF8CA, suggested building an X-band analog transponder with a 10-GHz downlink. Output power of 20 watts with high antenna gain would support a bandwidth of 50 to 100 kHz. Materials and converters could be inexpensively obtained and adapted from receiving equipment for the direct broadcasting TV satellites (DBS). A bigger problem is the precise tracking with the receiving antenna. Transmitter transistors are meanwhile available for prices around 2,000 DM each (US$ 1,176.50). Further calculations on the link budget must still be performed.

Following lunch, Karl Meinzer, DJ4ZC, presented the results of a survey from the most recent AMSAT-DL members' meeting about which transponders are desired.

Mode	*For*	*Don't care*	*Against*
29 MHz DOWN	30%	30%	30%
50 MHz DOWN	30%	20%	40%
145 MHz DOWN	75%	20%	5% Mode-B
435 MHz DOWN	70%	20%	10%
145 MHz UP	0%	30%	70%
435 MHz UP	95%	5%	0% Mode-B
24 cm UP	30%	65%	5%
13 cm DOWN	70%	30%	0% Mode-S

The results indicate that there is a significant interest in a high-power 2-meter downlink with a 70-cm uplink (Mode-B). Especially notable is the strong interest in an additional 13-cm downlink (Mode-S). Interest in Mode-L is rather low, which is also indicated by the meager activity via OSCAR-13. The Mode-J transponder was essentially rejected.

James Miller, G3RUH, then reviewed the survey conducted by AMSAT-UK, which essentially concurs with AMSAT-DL's survey.

The survey by AMSAT-NA was not available at this time, but no Mode-B transponder had been planned for the Phase-4 satellite.

DJ4ZC elaborated on the design of the LEILA system in the transponder to detect and suppress excessively strong stations. At first such a signal would be marked with a CW beep. If this warning does not prove adequate, the signal would be distorted and attenuated by a notch filter. The onboard computer will perform this task and will be able to monitor several signals simultaneously. The expected gain should amount to around 10 dB, since the AGC for OSCAR-10 was constantly in the range of 10 to 20 dB.

Peter Guelzow, DB2OS, mentioned that the required transmitter power on the ground is the greatest problem for Mode-L. Particularly, the cable attenuation over longer runs has proven to be the biggest hindrance and many OMs are not willing to buy or build an expensive power amplifier in addition to an expensive transceiver. Conversely, installing a 13-cm converter directly at the antenna, in a manner similar to a preamplifier, is a relatively simple matter in comparison. DB2OS said furthermore that the transponders should be compatible to each other. Transponder time tables, as currently practiced with OSCAR-13, are quite unsatisfactory in the view of both the users and the command stations. Ideally, the transponders should be operable simultaneously and continually and should adjust their power output level to conform to the available power budget.

The subsequent discussion about the transponders sometimes became quite controversial, particularly concerning the Mode-B and Mode-L transponders, so that a final decision should be made at a later time. Instead the subject of "who builds what" was tackled.

AMSAT-NA wants to build a hard-limiting digital transponder with a 23-cm uplink and 13-cm downlink (N4HY) and a high-power S-band linear transponder using the HELAPS technique (W3GEY and Matjaz Vitmar, YT3MV).

YT3MV and Josef Koeferl, DC9RK, announced interest in developing a Mode-S transmitter. YT3MV also wants to perform the link calculations for the Mode-X transponder.

DF8CA and Hermann Hagn, DK8CI, want to pursue the design of a Mode-X transponder further. N4HY has contacts to other groups involved with 10 GHz that may also be interested.

YT3MV would like to develop a 24-GHz beacon with 100-mW output power.

AMSAT-SA will build the 29-MHz beacon experiment.

Werner Haas, DJ5KQ, would take over construction of Mode-B and LEILA at AMSAT-DL.

Antennas

A decisive factor in the transponder configuration is the question of the antennas, which then is dependent on the structure of the satellite, either a spin-stabilized ring or a three-axis stabilized box design.

Non-transponder Experiments

JAMSAT has suggested including a multispectral CCD camera for Earth observation. At 500 pixels the resolution should be approximately 20 km. A proposal is being requested.

The 29-MHz ionospheric experiment from AMSAT-SA is also in this category.

Day 2—May 8, 1990:

The second working session was opened by Karl Meinzer, DJ4ZC.

Spacecraft Design

The suggestion by W3GEY to raise the perigee to 8,000 km should be investigated further, in particular in regards to eclipses, sun angles, tracking the solar panels, etc.

DJ4ZC would like to have the physical details clarified this year!

Antennas

DJ4ZC reviewed the antenna situation using some specific numbers:

S/C antenna	1 m × 1 m = 1 m² (AO-10 & AO-13) →1.3 m × 1.3 m = 2 m² (P3D)
Isotropic antenna area:	$\frac{\lambda^2}{4\pi}$
20 dB antenna area:	$\frac{12 \times 100}{4\pi} = 8\lambda^2$
→Required area =	3 × 3 λ

2 m: Impossible
70 cm: w13 dBi Gain
24 cm: 20 dBi gain possible

Based on these numbers, DJ4ZC showed that it becomes easier to achieve higher gain from the antennas as the frequency increases. On 2 meters this is a difficult situation so that the only way to improve the downlink gain in comparison to OSCAR-13 is to radically increase the transmitter power.

In the following, DJ4ZC presented approximate link calculations to show how much transmitter power is required for the signal to be 20 dB S/N at the ground at a distance of 40,000 km.

Band	*29*	*145*	*435*	*1296*	*2400*	*10.5*
S/C Ant Gain	0	6	15	18	18	18 dBi
Gnd Ant Gain	−3	3	3	5	20	33 dBi
Noise Temp	2000	500	500	300	200	200 xK
Path Loss	154	168	177	186	192	205 dB
Power for 20 dB S/N in 20 kHz	100	12.5	12.5	18	2	2 W

After further discussion, the transponder question still remained controversial and should be discussed further in the individual groups. The final decision should be made at the next meeting. The request was made, however, not to include too many different transponder modes and to keep them as compatible to each other as possible, such as Mode-B and Mode-S simultaneously. Mode-L and Mode-B would be mutually exclusive, however, such as on AO-13.

The fundamental question is whether to use 70 cm for the uplink or the downlink. DF8CA suggested using only 70 cm for the uplink in order to supply the diverse downlinks from 2 m to 10 GHz from it.

HA5WH was requested to pass an offer along to the DOSAAF satellite group to build a high power Mode-B.

Power Subsystem

Solar Generator

On a three-axis stabilized satellite approximately 2 m² of solar panels will be needed. The solar cells from SOLAREX would provide nearly 280 watts at 15% efficiency. The panel configuration needs to be studied, in particular whether the solar cells should be mechanically oriented towards the sun. Would two or three momentum wheels suffice for attitude control or would a ball wheel be superior?

After a rough estimate, it seems to be more sensible to employ larger solar arrays instead of adjustable panels. The mechanical aspect, such as cable connections, etc, are very critical. WD4FAB will investigate various possibilities, such as 45-degree or fully articulated 360-degree tracking with the panels. The goal is nearly 200 watts of power at 28-V bus voltage. (BCR by HA5WH.)

Batteries

From experience, two batteries will be required. The suggestion was made to use the NiCd battery for the plasma thruster and the NiH battery for supplying the transponder. Another possibility is to use the NiH battery for the first five years and thereafter the NiCd battery. AMSAT-DL has been in contact with SAFT, but the prices are quite high. AMSAT-NA can obtain bargain cells from GTE. The cells are now nearly five years old, but in good condition. Of the currently available cells, 40 need to be selected and stored. Each cell costs US$ 20; out of every five cells only one is usable, so that the entire battery would cost US$ 4000. WD4FAB is the contact person for the NiH battery.

IHU

For safety reasons, the COSMAC 1802 CPU should definitely be employed due to its very good track record since the IHU is a vital element for the entire satellite. No other CPU has yet been qualified for such an orbit. A correspondingly radiation-hardened CPU from SANDIA is on hand. However, the processor board should be redesigned to incorporate the memory on the main board also. The prices for radiation-hardened RAM components are very high, in the vicinity of US$ 85,000. Possibly the results from the memories in RUDAK-II should be evaluated first.

Bob McGwier, N4HY, stated his willingness to take over the redesign of the IHU. The command input/output arrangement should be retained as in the past, ie, Atari 800XL running IPS at the ground station and with the same protocol as with AO-13. At this juncture, the desire was expressed to have a diskette drive attached to the Atari 800XL since the operation with a cassette recorder is quite unsatisfactory. DB2OS explained how he makes due without a cassette recorder by connecting the Atari 800XL with an Atari 520ST. Thanks to software written by Stefan Eckart, DL2MDL, the Atari 800XL can be booted with the IPS GS software and IPS blocks can be transferred at 2400 bit/s between the two computers. Program sections and text can be edited and stored on the Atari ST and then passed via the RS-232 port to the Atari 800XL. In principle, it would also be possible to make a similar arrangement with a PC, but someone has to write the software. In the meanwhile the Atari 800XL product line has been expanded with newer compatible models so that suitable computers will also be available in the future. The advantage of this computer is the low interference level compared to other computers where the interference makes reception of the signals from the satellite virtually impossible.

Back to the design of the IHU onboard computer. Hanspeter Kuhlen, DK1YQ, recommended a hardware command decoder in order to be able to bypass the computer in an emergency. For RUDAK-2 a hardware command decoder was incorporated in order to be independent of the RS ground station and to avoid having to use their command system. DJ4ZC is absolutely against such a system since in his view the danger of a mistake thereby increases dramatically. Instead he would rather install a second standby onboard computer in the satellite, perhaps using the RTX2000. Going into great detail, Karl Meinzer then explained the disadvantages and dangers of excessive redundancy. For example, it must be impossible for the hardware command decoder and the computer to work against each other and thus become blocked. In the past, numerous satellites have experienced serious problems and near losses due to such occurrences. DB2OS referred to the experiences with OSCAR-10. Despite the defective onboard computer, the satellite is still quite popular when enough power is available to supply the transponder. If it were possible to switch off the transponder during periods of poor sun angles or eclipses, the lifetime of the battery could doubtless be extended significantly. DJ4ZC commented that the computer is vital for the functioning of the satellite and in the case of a total failure, the satellite would become virtually useless due to the lack of attitude control, and it would thus be better to switch it off entirely. After an extensive discussion, a very simple hardware command system was agreed upon, in which perhaps only the transponder could be switched on and off. DJ4ZC would like to see such a system successfully demonstrated, as aboard RUDAK-2, and to study the circuitry very carefully.

Another aspect is the electrical wiring in the satellite. Should a central multiplexer module, as presently used, or a new ring-bus design be chosen? N4HY and W3GEY explained the bus design using the Motorola AART component in the Microsat satellites. Thanks to this bus system, the otherwise mandatory cable harness could be essentially eliminated, and placing the individual modules into operation proved to be significantly simpler. The suggestion was made to use a module controller, such as the 68HC11 MCU, which passes the telemetry to the IHU via a serial bus. W3GEY is of the opinion that suitably radiation-hardened components could be obtained. DJ4ZC will prepare a specification with the requirements for the telemetry and other physical details and among other things check into the suitability of star or ring-shaped networks. The telemetry should provide approximately 128 analog measurements per second. 256 digital status points are planned for each input and output. The data should probably be available on the internal bus every 20 milliseconds. The battery charge regulator (BCR) should have its own telemetry unit. N4HY, W3GEY, DG2CV, and DB2OS plan to examine the topics of IHU, module controller and ring bus and to develop suitable concepts.

Propulsion

If the 400 N motor from MBB is used, a 150-liter tank for the dual-propellant fuel will be required. Questions and ideas regarding the tank design will be clarified by Dick Jansson, WD4FAB, and Dick Daniels, W4PUJ. According to DK8CI, there is someone at the University of Munich who would like to become involved in perfecting DJ4ZC's plasma thruster. Another possibility is the ion thruster RITA at the University of Giessen. The thrust from this motor amounts to nearly 10 mN at a required power level of nearly 400 watts.

YT3MV suggested an electrostatic fluid control system for the tank, whereby the propellant could be pushed towards the outlet pipes by taking appropriate advantage of the dielectric properties. Since there is no rotation, a suitable technique must be found that will empty the tank completely. DJ4ZC suggested a propeller, but since the propellant is chemically very aggressive, it is not yet clear how this could be achieved and with what kind of material. In the electrostatic method, a very high voltage may be necessary. Instead of the triangular design proposed by YT3MV, Karl considers a long cylinder shape with outlet openings to be a solution. DB2OS suggested perhaps using the high voltage to operate a traveling wave tube on S or X band. YT3MV was requested to prepare an analysis of this technique and to determine whether the necessary high voltage may be too high. Such a concept could really only be applied without hesitation to a water thruster. Possibly the rotating field from the magnetic coils inside the satellite could be used to cause the propellant to rotate by adding small iron particles. Another solution would be to employ the method previously used on AO-10 and AO-13: let the satellite rotate during the initial motor burns and then switch to a 3-axis stabilized attitude.

Separation System

Two systems are available: Super-ZIP cord and clamp band. Super-ZIP is very expensive, nearly 100,000 DM (US$ 59,000), but it was employed on the cylindrical adapter for OSCAR-13 and functioned successfully. A rope-like explosive band is mounted along a designated separation line and separates both sections after ignition. Martin Sweeting had built a clamp band for UOSAT and thus it seems likely that it could likewise be built for Phase-3D. Conceivable is also a 3-point mounting with explosive bolts. DJ4ZC wants to negotiate with ESA to determine the best solution for all parties involved.

Structure

Following the lunch break, Dick Jansson, WD4FAB, reported on the satellite frame and the thermal design of the Phase-4 structure. Using extensive overhead slides, he showed how the assembly of the structure proceeded for the Phase-4 model. At this time a model of the folding satellite antennas is being built at Weber State University in Utah. Furthermore WD4FAB explained the design of the antennas, the heat pipes and how the solar panels are mounted to the satellite structure. Much of the expertise and preparatory work for the Phase-4 study can be adopted for use in Phase-3D.

Karl Meinzer, DJ4ZC, thanked Dick Jansson for the very interesting presentation. If the final decision falls in favor of the ring-shaped satellite structure, then WD4FAB should take over the leadership in constructing the structure. A three-axis structure requires a completely new design.

Therefore it will be necessary to clarify with ESA before the end of the year which kind of satellite should be chosen. In the case of a three-axis design, the entire upper-payload position would be needed.

Dick Jansson, WD4FAB, has already performed extensive thermal design studies by computer. As soon as the decision on the structure has been made, he would then calculate the complete thermal design for Phase-3D.

Another point regarding the antennas: AMSAT-NA will investigate antenna configurations with switchable radiation patterns. DJ4ZC also wants to give some thought to the matter.

Attitude Control—Sensors

DJ4ZC described which sensors are needed for Phase-3D. On a three-axis stabilized satellite, an earth sensor as well as a precise sun sensor are essential. Additional sun sensors with lesser accuracy must be mounted on all four sides of the satellite in order to measure 360 degrees. On each side a sensor will be installed with an orifice angle of 45 degrees. In any case, only static sensors having no moving parts will be mounted. A CCD camera could also be a possible solution. Its price is around 600 DM (US$ 350). According to YT3MV, a 500 × 500 CCD array from Valvo costs only 80 DM (US$ 47) and the dynamic range is around 40 dB. Four of such CCD arrays would be needed. Infrared detectors might also possibly be practicable as earth sensors, but there are some other problems here. All participants were asked to be on the lookout for reasonably priced sensors.

DJ4ZC listed the specifications of the sensors as follows:

Sun sensor: 90 deg × 90 deg visibility, 0.5 deg resolution (q45) × (q45)

Earth sensor: the same, but 1 degree resolution

New sensor electronics will also have to be developed. W3GEY and HA5WH offered their services to build the SEU.

Momentum Storage

DJ4ZC will investigate various methods of storing momentum. Among others, there is the conventional method with momentum wheels, then magnetically isolated momentum wheels (Robinson, Estec), the ball concept (DJ4ZC) and fluid momentum control (WD4FAB).

Jan King, W3GEY, will undertake a study of fluid momentum control in regards to the total mass, the maximal steerable momentum and the power consumption.

Magnetic Reaction

The location and design of the magnetic coils can only be determined after the structure design is completed. The power consumption will be in the same range as on OSCAR-13. Since the intensity of the Earth's magnetic field at 8000-km perigee altitude is only about 1/10 that in a very low earth orbit, the orbital maneuvers will take nearly 8 times as long as for OSCAR-13.

Solar Generator

Dick Jansson, WD4FAB, knows a specialist who has experience in the areas of deployment and control. He could also investigate whether fully rotating panels are feasible.

Broadcast Transponder

Hennie Rheeder, ZS6ALN, made an extensive presentation about the 29-MHz broadcast transponder planned by AMSAT-SA. The modulation should be amplitude-compatible SSB (single-sideband with carrier), so that the downlink signals can be received with a normal AM broadcast receiver as well as with normal SSB equipment. A store and forward voice output is planned in which approximately four to six megabytes of RAM would provide nearly 15 minutes of speech. The uplink takes place via an analog/digital converter, the downlink via a corresponding D/A converter. N4HY suggested a 4-bit PCM modulation for the downlink such as in DOVE, OSCAR-17. DJ4ZC recommended suppressing the carrier and only adding it to the audio signal during broadcast transmissions. In this way, all kinds of modulation could be tried, even Karl's RSM modulation.

The uplink should preferably take place on 70 cm in FM or digital AFSK, whereby the signals would be digitized and prepared on the ground. Using block diagrams, ZS6ALN provided an overview of the hardware design. DJ4ZC spotted several problems in the design with feedback coupling and provided some tips on how to avoid HF feedback. HF could be coupled from the transmitter back into the oscillator and buffer. Through use of a modulator at 2 MHz and a subsequent mixing, this problem could be avoided. A power level of 50-watts EIRP at perigee would suffice, but DJ4ZC suggested 100 to 200 watts which would be quite good at perigee and could readily be made available. DJ4ZC specified further restrictions: the mass of the experiment could only amount to 5 to at most 10 kg and the volume between 5 and 10 liters. The activation period would be one hour with 200-watt PEP input power. The transmitter should operate linearly according to the HELAPS principle, thus resulting in a peak input power of 200 watts and an average input power of 20 watts. The downlink would be around 29 MHz, but the exact frequency must yet be coordinated. The uplink would take place in the 70 cm or 23 cm bands. The temperatures normally range between 0 and 10 degrees Celsius, maximally between −20 and +40 degrees. During thermal vacuum testing, the temperature will be cycled through a range from −25 to +50 degrees Celsius. The minimal demands regarding the vibration test are comparable to the vibrations in an automobile.

The transmit antenna should be made from nonrusting steel tape, comparable to rolled up measuring tapes. A prototype of the experiment should be completed by mid-1991, according to ZS6ALN.

Day 3—May 9, 1990:

After punctually opening the last working session, DJ4ZC went back to the subject of flight attitude control. The "reaction wheel" system also needs a sensor to measure the angular acceleration. Someone needs to look into the various sensor types for measuring brief time intervals. The flight attitude sensors can be used for long time intervals. DJ4ZC outlined two different techniques, one is a laser gyro method whereby the technology might be available from a CD player, and the other is a so-called "wine glass" gyro, in which mechanical oscillations are generated and then measured.

Work commitments:

On the final day, the assignment of the various tasks topped the agenda. DJ4ZC systematically went through a list of the individual units in the satellite and the following work groups and contact persons were determined:

Transponders:

AMSAT-NA (N4HY, W3GEY): Mode-L to Mode-S (23cm/13cm). HELAPS S-transmitter, hard-limiting digital transponder. Analysis of required power and efficiency.
YT3MV and DC9RK: High power Mode-S transponder, analysis of Mode-X. Components via AMSAT-NA.
AMSAT-DL (DK8CI, DF8CA): Mode-X design study.
AMSAT-SA (ZS6ALN): 29-MHz experiment and high-power transmitter.
AMSAT-I (I2KBD): L-band receiver.
AMSAT-DL (DJ5KQ): Transponder, Mode-B, Mode-L, LEILA.
HA5WH: "USSR" Mode-B transponder.
JAMSAT: 29-MHz "parrot", same frequency digipeat, intersatellite communication. Proposal expected.
RUDAK: Proposal expected.

Non-Transponder Payloads:

JAMSAT: CCD camera, proposal expected.
YT3MV: Picture transmission standard for CCD camera.
WEBER (WD4FAB): TBA, impact, radiation sensors. Proposal expected.
AMSAT-SA (ZS6ALN): Ionospheric experiment, including rest of transponder.
AMSAT-VK (VK5AGR): Proposal expected.

Solar Generators:

WD4FAB: Deployable array, including mechanical control.
W3GEY: Costing.

BCR:

HA5WH: BCR design

Batteries:

WD4FAB: NiH battery
W3GEY: NiCd battery, selection of 2 × 20 cells.

IHU:

N4HY: IHU 1802 design.
N4HY, DG2CV, DB2OS: internal bus architecture and module controller.

Propulsion:

DK8CI: Inquire at University of Munich about motor development.
DJ4ZC, W4PUJ: Tank, volume constraints, supply system.
YT3MV: Electrostatic fuel delivery
DJ4ZC: Investigate MBB 400 N motor.
DJ4ZC: Tank production.

Attitude Control:

HA5WH: SEU
W3GEY: To look for cheap sensors.

Momentum storage:

WD4FAB: Summarize fluid control system.
DJ4ZC: Study magnetic wheels.
WD4FAB: Solar stuff constraints (??).

Thermal Design:

WD4FAB: Thermal study, solar panels. Define structure constraints.

Structure:

WD4FAB: Weber State University.

Antennas:

W3GEY suggests measuring the antennas this time on a test range.
DJ4ZC: Identify antenna contractor and constraints.
WD4FAB: Identify antenna contractor.

Separation System:

WD4FAB: Fabrication of 1-m mount clamp.
DJ4ZC: AR-5 user manual to WD4FAB.

Orbits:

G3RUH, W3GEY, N4HY, DL2MDL, VK5AGR: Orbit problems, orbital studies.
DJ4ZC: Long term study paper from OE1VKW to DJØHC.
DJØHC: Translations.

Attitude:

G3RUH: Pointing angle and sun angle studies.
DJ4ZC: Sensor constraints.
N4HY: Solar array control trade offs, illumination.

Launch opportunities:

DJ4ZC: Investigate launch with ESA.
HA5WH: USSR launch possibilities.
VK5AGR: Chinese launch.
N4HY: USA launch possibilities.

WARC-92:

DK1YQ: Contacts with FTZ, Gabriel/Reuter about 23 cm as up and downlink.
DB2OS: Ditto, contacts with ON6UG.

Monetary funding:

- Each group covers its own expenses.
- YT3MV receives support (material, etc) from AMSAT-NA, AMSAT-DL, etc.
- G3RUH via AMSAT-UK

Australian Launch Opportunity

Graham Ratcliff, VK5AGR, presented a report about projects by the Australian government. Two rocket launches will be purchased, one with a high risk, the other with a lower risk. AMSAT-VK received an offer to have an Amateur Radio satellite fly along. To date there is no Australian payload, but a lot of ideas. The possibility exists to build a satellite similar to Phase-3D in Australia with AMSAT know-how. We would then have two Phase-3D satellites! Aus$ 2.5 million + 10 million are available. DJ4ZC should cultivate the contacts and present a proposal, possibly visiting Australia to clarify the details personally.

Next Meeting

The next meeting should take place in one year at around the same time. AMSAT-SA and AMSAT-VK would be happy to organize the next meeting.

73s,

Peter, DB2OS

Components

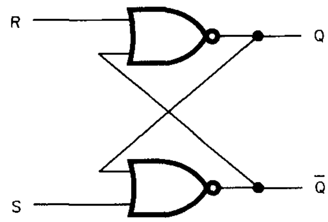
By Mark Forbes, KC9C
PO Box 445
Rocklin, CA 95677

Continuing the discussion of digital fundamentals this month, I'll cover the flip-flop or latch. Fig 1 shows the most elementary latch, which is made from a pair of NOR gates (it could also be made with NAND gates, although the inputs would be inverted). The two inputs are called S, for SET, and R for RESET. The outputs are Q and "Q Bar" (inverted Q). I'm not sure if anyone knows what the Q stands for.

Note from the truth table in Fig 1 how the S-R flip-flop works. If the SET pin is taken to 1 (HIGH), then the Q output also goes to 1. If the flip-flop is RESET with a 1 on the R pin, then Q is reset to 0. If both S and R are 0, then Q remains in whatever state is was set (or reset) to previously...in other words it *remembers*. Thus, the flip-flop is the most elementary form of memory, and is the basis for all memory. This example is a 1-bit memory. Note that both SET and RESET pins cannot both be 1, since that wouldn't make any sense.

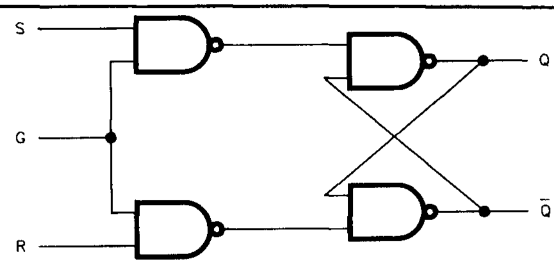
In some applications, S and R might be common to several different latches, and we wouldn't want to have a latch change state unless we meant it to. To facilitate this, we can add another pair of gates in front of the basic latch circuit and define another input called the GATE. The GATE input prohibits the S and R inputs from being recognized unless GATE has been enabled. Fig 2 shows this circuit and its truth table. Here, I've used NAND gates so that the inputs remain *active high*; that is, a 1 causes action. If NORs were used, the circuit would be *active low*; that is, a 0 would cause a set or reset function (and S = 1, R = 1 would be the memory function; 0,0 would be disallowed). Note that when either of the inputs to a NAND is 0, the output is 1; thus, as long as the GATE input is 0, the latch is in the memory mode. To SET or RESET the latch, the GATE input must first be brought to 1, solving the problem described at the beginning of this paragraph.

I've received several comments that the descriptions of basic components that I've been running these past few columns have been helpful. Please drop me a line and let me know what particular components you'd like to see discussed. In the next column I'll describe how to use a transistor as a switch.



S	R	Q	$\bar{Q}$	
1	0	1	0	
0	1	0	1	
0	0	Qn	$\bar{Q}$n	memory
1	1	Not Allowed		

Fig 1



	G	S	R	Q	$\bar{Q}$
disabled	0	1	0	memory	
	0	0	1	memory	
	0	0	0	memory	
	0	1	1	not allowed	
enabled	1	1	0	1	0
	1	0	1	0	1
	1	1	1	memory	
	1	0	0	not allowed	

Fig 2

HARRIS SINGLE-CHIP POWER SUPPLY

Harris Semiconductor has introduced a very interesting pair of products that, literally, are power supplies on a chip. The HV-1205 is for use with up to 120-V ac input, and the HV-2405 uses up to 240-V ac input voltage (despite the strange variation in literature, the American power grid standard voltage has been 120 V and 240 V since just after WW II, not 117/234 or 110/220). As you can see in Fig 3, the chip is simply "plugged into the wall," and with only 4 external capacitors, provides regulated dc voltage on the output. The input ac frequency can be from 48 Hz to 440 Hz.

Output voltage can be selected between 5 V dc and 24 V dc, meeting the needs of just about any solid-state dc power supply. Output current, as would be expected, is not extremely high—50 mA maximum—but for many applications that is sufficient. Harris' literature suggests applications such as low-current power supplies, secondary power supplies, and battery backup systems. Two excellent Amateur Radio applications that come to mind are QRP or small receiver power supplies, and NiCd battery chargers. The standard wall chargers for most HTs supply about 50 mA of charging current; with the Harris chip, the bulky wall charger could literally be integrated into the wall plug itself!

This is really an exciting part, and I think it's an indicator of what is to come in the area of ac control ICs. If you find this chip interesting, let me offer one word of caution: With no transformer, any power supply you build will not be isolated from the power grid, thus passing any transients straight through to the dc side. Still, this shouldn't limit its application possibilities, and a transformer can always be added for isolation. If you'd like more information on either the HV-1205 or the

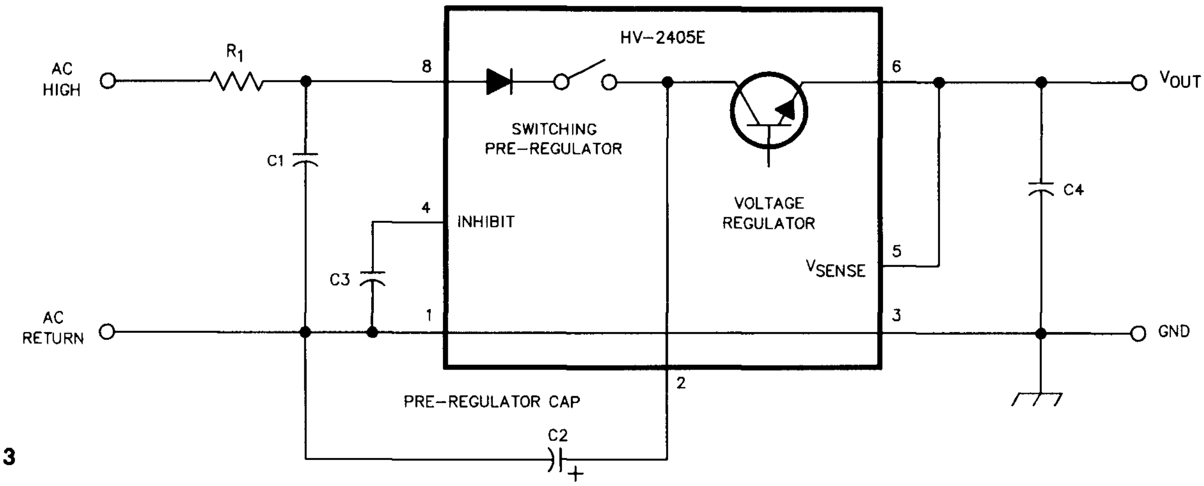


Fig 3

HV-2405, contact Harris Semiconductor, PO Box 883, Melbourne, FL 32902-0883. They also solicited comments on the data sheet, so if you have any, be sure to let them know.

MICROPROCESSOR-COMPATIBLE DTMF TRANSCEIVER

California Micro Devices (CMD) just announced their new CM8888 DTMF *transceiver*. That's right, this is not just a receiver, but a transmitter as well. Thus, you can use this circuit to generate DTMF tones, plus you can also decode them for paging, remote control, and a variety of other ham uses. The CM8888 is also directly compatible with the Intel 8086 and 8088 family of microprocessors that are found in the IBM® PC family and their many clones, plus the very popular Intel 8051 single-chip microcomputer. The chip has an operational temperature range of −40 to +85 degrees Celsius, so it is perfect for repeater usage where conditions may not always be "room temperature."

CMD also offers the CM8870 DTMF receiver, and the CM8880 DTMF transceiver. The CM8880 has a more generic interface than the CM8888, and can be interfaced to the 8086/8088 plus 6800/68000 microprocessor families with only a few external logic parts.

These are all attractively priced as well. The CM8870 DTMF receiver sells for $2.95 for 18-pin DIPs at 100 pieces. The CM8880 is packaged in a 20-pin DIP, and the 100-piece price is $3.95. One hundred pieces of the CM8888 in 20-pin DIP packages sell for $4.95 each. All three parts are also available in small outline IC packages (SOICs, for surface mounting) and plastic leaded-chip carriers (PLCCs). For more information on any of these components, contact California Micro Devices, 215 Topaz St, Milpitas, CA 95035-5430, phone 408-263-3214.

Corrigendum

The "Microsat Demodulator" article in the September 1990 issue contains an error in Fig 3. The polarity of the 20-μF capacitor (connected between pin 7 of U1 and a 220-ohm resistor) is reversed.—*John C. Reed, W6IOJ*

Conducted by: Stan Horzepa, WA1LOU
75 Kreger Drive
Wolcott, CT 06716-2702

9th COMPUTER NETWORKING CONFERENCE REPORT

The ARRL and the Canadian Radio Relay League (CRRL) jointly sponsored the Ninth Amateur Radio Computer Networking Conference at the London Regional Art Gallery and Museum in London, Ontario, on September 22. Over 130 people attended the conference. The majority of the amateurs present were from Canada.

Harry McLean, VE3GRO, started the morning session by welcoming everyone and saying how proud the CRRL was to host this year's conference in Canada. Paul Rinaldo, W4RI, was introduced and also welcomed everyone. He stressed the importance of conference and made some points about the future of digital communications with respect to how we use it in our hobby.

Keith Sproul, WU2Z, discussed his work on long-distance packet mail-forwarding via satellite. He talked about future plans to use satellites for mail-forwarding instead of slow HF packet.

Harold Price, NK6K, presented his and Jeff Ward's (GØ/K8KA) papers on PACSAT. Their five papers describe their solution for a broadcast protocol that is being used presently on UoSAT-14.

Bob McGwier, N4HY, gave Hanspeter Kuhlen's (DK1YQ) overview of the current RUDAK II design. He showed a number of slides of RUDAK II and of the people involved. Bob then reported on the latest news concerning the digital signal processing (DSP) projects. He displayed AEA's DSP-232 box and the TAPR-AMSAT DSP board. The AEA unit will be standalone with over 40 modems currently designed for its use. It is based on the Motorola 560001 processor and its design allows users to upload new code to the unit as necessary (rather than replacing EPROMs). Software will be available for people to write their own applications. The TAPR-AMSAT board is an IBM® PC/XT/AT plug-in card that is based on the TI TMS320C2. It will have software similar to AEA's DSP.

Glenn Elmore, N6GN, presented an overview on how the amateur community was utilizing bandwidth and discussed the need for a high-speed Amateur Radio network. Kevin Rowett, N6RCE, followed with a discussion about HubMaster, which he and Glenn are building as a solution to the need for higher speed networking.

Jon Bloom, KE3Z, discussed his thoughts about future digital networking. What will the network of the future look like? Will it be a voice/data network? Jon said that these issues need to be addressed so that we will be able to compete with the other concerns who may wish to take over our radio spectrum in the future. Amateur Radio needs to present a clear plan on what it intends to do.

A. Langi talked about a system called CELP, which is a high-quality speech processing system for packet-radio transmission and networking.

W. Kinsner, VE4WK, presented an excellent paper on forward error-correction for packet radio.

Don Lemley, N4PCR, discussed the problems associated with current networking and the need for faster digital networking software and radios. The PackeTen® system is a digital hardware and software networking solution that is compatible with the today's standards, while allowing for some type of transition in the future.

After lunch, Phil Anderson, WØXI, spoke about 9600-baud operation of the G3RUH modem with the Kantronics Data Engine and DVR2-2 transceiver. He also discussed the workings of a BPQ Node in an enhanced network.

Tom Clark, W3IWI, first discussed future HF operations and solutions with the soon-to-be available DSP products. The DSPs will permit the usage of different encoding and modulation schemes that will result in better HF digital operations. Second, Tom talked about the inadequacy of the current message transfer protocols and how they cause massive amounts of congestion. He discussed a new file transfer protocol that provides a more efficient and robust method for transfer on HF. Tom ended by talking about BULLPRO, his recommendation for broadcasting bulletins on VHF.

Dewayne Hendricks, WA8DZP, spoke about the current development of TCP/IP in the Macintosh® environment. He discussed having this capability available in the new Apple® communications environment, which will be available in System 7.0, which looks to be very promising to Macintosh TCP/IP users.

Phil Karn, KA9Q, updated the status of his work on TCP/IP. No new platforms have been finished, but he has worked on a few new commands and improving operation at higher speeds. Phil continued with a discussion on MACA (Multiple Access Collision Avoidance).

James Geier discussed the work done at the Air Force Institute of Technology designing a packet network for the Air Force.

Frank Warren, KB4CYC, finished the afternoon speaking about the software he developed as a utility for NTS work. The software provides a variety of useful functions for NTS operators.

The day ended with dinner at a local eatery followed by the hospitality suites that provided a place for everyone to meet and discuss what they were doing and what had happened at the conference. Some amateurs displayed the latest technology in packet radio in a number of rooms on Saturday night.

by Greg Jones, WD5IVD

AUSTRIAN AMATEUR RADIO PROJECT TO FLY ON MIR

The Austrian Amateur Radio Experiment (AREM), a 2-meter packet-radio beacon and voice-synthesizer transmitter, will fly on the MIR operation scheduled for January 1991.

A laptop computer will be connected to a TNC and a voice synthesizer, which will feed a 144-MHz transceiver. An external 2-meter antenna attached to MIR will be used for the transmissions. The TNC will use 1200-bit/s AFSK with AX.25, so all ground stations will be able to receive the transmissions with their normal packet-radio equipment.

Data transmissions will alternate with voice transmissions. If time permits, the cosmonauts can switch off the beacon, and use the microphone for live contacts.

To further ham radio by using the satellite transmissions in education, a special program will be prepared for use by school teachers who hold amateur licenses. Interested parties can contact Wolf Hoeller, OE7FTJ, at Amraserstrasse 19, A-6020 Innsbruck, Austria, or the OeVSV at Theresiengasse 11, A-1180 Vienna, Austria.

Phase 2 (scheduled for November 1991) envisages an uplink and the use of simple PBBS software.

by Wolf Hoeller, OE7FTJ, from *QSP*, as translated by Alexander Czernin, OE3ACC, via CompuServe's HamNet

MORE PSK ACTIVITY

On September 10, John Mezak, K2RDX, in San Jose, California, contacted Julius Breit, W9UWE, in Chicago via 1200-baud PSK packet radio on 10 meters. John was very surprised at the throughput using PSK under very marginal conditions (see page 13, *QEX*, May 1990). John and Julius were able to chat keyboard to keyboard even though they had no S-meter readings and 10 meters was closing down. John's station used a TAPR PSK modem with an MFJ-1274 TNC, ICOM IC-751A and J-pole vertical antenna.

The results on 10 meters were so good that K2RDX started sending CQ packet-radio beacons through OSCAR 13 on Mode B. The majority of his beacon packets were demodulated and correctly received on the downlink frequency. Even mode L signals were consistently coming through despite 10 dB S/N ratio (maximum) at his receiver (from his own transmit signal). On the OSCARs, John used an FT-736R at 25 watts on 435 MHz and 40 watts on 1269 MHz with an external power amplifier. Considering the length of time OSCAR 13 is visible, John believes a considerable amount of traffic could be handled by a few PSK packet-radio stations during an emergency without requiring much satellite transponder power.

from John A. Mezak, K2RDX

BETTER BULLETINS

Want your bulletins to have a better chance of being read? There is some pretty rough competition for readers' attention with 25 to 100 new messages a day appearing on many PBBSs. Here is a technique I've seen that will help you improve the odds of getting your bulletin read rather than ignored.

The potential reader has only a limited amount of information available to decide whether or not to read your bulletin, ie, message size, date, addressee, addressee's location, addresser and title.

The first two items that we will look at are addressee, and addressee's location. Think of the former as "Topic" and the latter as "Distcode." By correctly using these two fields, you can give your potential readers more information to entice them to read your message. Note that both Topic and Distcode are restricted to six characters.

Historically, bulletins are addressed to ALL@ALLUSA, etc. ALL does not specify your intended audience. More specific are NETROM, IBMPC, MODS, DX, SALE, INFO and WANTED. These clearly communicate something about your intended audience, giving your message a better chance of being read. These examples are by no means the only valid topics.

The next item you can use is Distcode, which are the well established distribution "codes" supported by PBBSs. You may also see Distcode referred to as @BBS, Route Code or Route. Examples of Distcode most commonly used in the Chicago Area Packet Radio Association (CAPRA) network are: NORIL (Northern Illinois), ALLIL (all of Illinois), DIST9 (the Ninth Call Area), and ALLUSA (the entire United States). The geographical areas mentioned are, at best, approximations. It would not be surprising to find ALLIL in southern Wisconsin, for instance. Take care when typing these Distcodes; they must be typed exactly. Bulletins to SALE@ALLIL will get forwarded around the state while bulletins addressed SALE ALLILL won't get forwarded anywhere.

Please exercise restraint when sending bulletins to widely-distributed Distcodes such as ALLUSA. The packet-radio network is a finite resource. Putting 10 pounds of bulletins in a 5-pound network does no one any good. First, is the message of sufficient interest to send to everyone in the country? Second, realize that your message will likely take several days (or more) before it makes its way around the country. Is the information in your bulletin time-sensitive? Use your best judgement and, if in doubt, ask your packet-radio friends and/or SYSOP. Many packeteers believe that the only dumb question is the one you didn't ask and will be glad to help.

Message size is also important. Some PBBSs restrict the size of outbound messages at forwarding time, particularly for widely distributed Distcodes. This means that your 5000-character bulletin can be cut off before being completely sent. There is no hard and fast rule, but staying under 2000 characters seems advisable. If you must send longer messages, break them up into smaller chunks and send each chunk separately. If you do this, please number them such as "3 of 7" so the reader can find the remaining pieces. It is unlikely that all chunks will arrive at the same time or even on the same day. An example of a good title for a split bulletin might be "NOCODE (1 of 3)."

Pick a meaningful title for your bulletins. If you are selling one piece of gear, say what it is in the title. Summarize the content of your bulletin in the title if at all possible. Think of the title as an index to all the messages stored on the PBBS. A good title is one of the most effective ways of getting your message read. For example, if I sent this article as a bulletin on the packet-radio network, I would say SB INFO@NORIL and title it "Sending Better Bulletins." Since this article is about 4000 bytes, I would probably not split it for @NORIL because the CAPRA network can handle it, but I would split it in half if the Distcode were @ALLIL because some of the long haulers won't handle 4000 bytes.

Good luck with your own bulletins. Attention to these considerations can only help.

by Jim Morrison, N9GTM, from *The CAPRA Beacon*

ROSE PACKET-RADIO NETWORKING LIST

The following list of ROSE operations was provided by Andy Funk, KB7UV. This listing was generated on September 22. Send corrections and additions to KB7UV@KD6TH.NJ.USA.

Andy is aware that an extensive ROSE Switch Network exists in Texas-Louisiana-Oklahoma, but unfortunately he does not have complete information. He would appreciate hearing from ROSE Switch Network managers and ROSErver/PRMBS SYSOPs with the aim of maintaining an accurate, up-to-date list of all ROSE activity.

ROSErver PRMBS:

Packet Radio MailBox Systems (partial listing):

Call Sign	*Address*	*Freq*	*Location*	*Notes*
KD6TH-4	201744	145.07	Wyckoff, NJ	ARRL OBS
KB1BD-4	609426	145.07	Cranbury, NJ	ARRL OBS
WB2GTX-4	201746	144.97	Secaucus, NJ	ARRL OBS
KB4CYC-4	908985	145.51	N. Plainfield, NJ	ARRL OBS
WA2VXT-4	609426	145.07	Waterford, NJ	
N2ELC-4	201729	145.09	Lake Shawnee, NJ	ARRL OBS
WB2HVF-4	201387	145.51	Little Falls, NJ	
NN2Z-4	TBA	145.05	Neptune, NJ	Internet gateway
WB2COP-4	TBA	145.03	Middletown, NJ	
KE2M-4	TBA	145.07	Woodbury Hgts, NJ	
WA2NDV-4	TBA	145.03	New York City, NY	
WB2QJA-4	TBA	145.05	White Plains, NY	
WB2IBO-4	TBA	145.03	N. Massapequa, NY	ARRL OBS &
WB2IBO-4	TBA	441.00	N. Massapequa, NY	alt. NTS PBBS
AI2Q-4	TBA	145.01	Freeport, NY	ARRL NTS PBBS
K2ZM-4	TBA	145.09	Rye Brook, NY	
WA2YEI-4	TBA	145.57	Goshen, NY	
KB4VSP-4	TBA	145.01	Peekskill, NY	HF—attended
K2ADJ-4	TBA	145.51	Beverly, NJ	NJ ARES/ RACES
KA3CNT-4	TBA	145.03	Lititz, PA	Lancaster Cty
N3LA-4	TBA	145.07	Spring City, PA	
N3LA-5	TBA	145.01	Spring City, PA	
W6AXM-1	TBA	145.07	Garden Grove, CA	ARRL NTS PBBS
WB2MIC-4	TBA	145.07	Wells, VT	

Access Points:

ROSE X.25 Packet Network (partial listing):

Call Sign	*Address*	*Freq*	*Location*	*Notes*
N2DSY-3	201744	145.07	Little Falls, NJ	
N2DSY-6	201746	144.97	Little Falls, NJ	
N2DSY-9	201387	145.51	Bergenfield, NJ	
KA2VLP-3	609426	145.07	Hightstown, NJ	
KB4CYC-3	908985	145.51	Piscataway, NJ	
WA3YRI-3	609261	145.07	Mt. Holly, NJ	
KD6TH-9	212456	145.07	Manhattan, NY	
N2EVW-7	609530	221.01	Ewing, NJ	
NX2P-7	201729	145.09	Sparta, NJ	
NX2P-3	201579	145.09	Lake Mohawk, NJ	
NX2P-10	201209	HF Port	Lake Mohawk, NJ	
NX2P-11	201786	145.57	Lake Mohawk, NJ	
KA2MSL-3	914856	145.57	Greenville, NY	
KA2QHD-3	201922	144.97	Asbury Park, NJ	*
N3ET-2	215791	145.01	Allentown, PA	#
N3ET-4	215797	221.01	Allentown, PA	#
W3PHL-3	215935	145.01	Valley Forge, PA	#
W3PHL-7	215933	221.01	Valley Forge, PA	#
N3EH-3	717737	145.07	Mechanicsburg, PA	*
W2VY-9	813989	145.07	Tampa, FL	*
HK4RCA	7320,940002	145.01	Cerro Boqueron	%
HK7LSB	7320,976001	145.01	Barranca Mermeja	%
HK6HPZ-3	7320,963001	145.01	Pereira	%
HK4LRM	7320,940001	145.05	Metroswitch MCMD	%

* Indicates switches not yet interconnected with the rest of the network.

% Indicates switches linked with each other, but not yet linked with the rest of the network.

WESTERN WASHINGTON PACKET COORDINATION SHIFTS

A meeting was held on September 13, 1990, to discuss packet-radio coordination issues in the Western Washington State. Bob St Andre, WA7NAN, called the meeting to order and started off the discussion with a history of what had happened in packet-radio coordination during the last few years. As a note, packet-radio coordination was turned over to Northwest Amateur Packet Radio Association (NAPRA) with a block of frequencies from the Western Washington Amateur Relay Association (WWARA) in April 1989.

The discussion continued regarding various problems that have arisen as a result of the packet-radio community growing rapidly and changing. WWARA is concerned that packet-radio coordination needs to be done with RF and neighborhood interference in mind. NAPRA members present shared these concerns, adding that they have had problems with individuals assigning themselves a frequency and causing problems for others. NAPRA also feels that they do not have the same recognition as a coordinating body that WWARA has.

More discussion was heard on specific examples of problems and, while these issues were of great concern to all, the group agreed to save them until they had a better direction on who would actually be coordinating packet radio and by what standards, which was the next topic of discussion.

The board members from both groups in attendance agreed, in principal, that the WWARA should be the packet-radio coordinating body and that both the NAPRA and WWARA boards should appoint official representatives to mediate and come up with specific recommendations on packet-radio coordination.

by Nancy L. McKibbin, KB7BJE, from *The Coordinator*

TSARC PACKET-RADIO Coordination Form

The information identified in this questionnaire will be used by the Tri-State Amateur Repeater Council (TSARC) Packet Coordinator as input data for the Packet Coordinator's data base (TSARC is frequency coordinator for Connecticut, the metropolitan area of New York City and Northern New Jersey). Many system operators have provided information in the past, but many important pieces of information were not requested or provided. For this reason, we are asking you to provide information on this form.

Please, if at all possible, submit your data electronically to any of the following:

Via packet radio:	N2DSY@N2DSY.NJ.USA.NA
Via uucp:	...!att!hou2d!n2dsy
Via Internet:	n2dsy@hou2d.att.com

If you must use the mail, then send a diskette in any IBM PC/XT/AT format. If this is not possible, then send the information in a printout of the form to:

J. Gordon Beattie, Jr, N2DSY
206 North Vivyen St.
Bergenfield, NJ 07621

Your questionnaire will be processed by the Coordinator using the following procedures:

a. The Coordinator will review the application and ensure its completeness.

b. The Coordinator will study channel usage and consider possible alternatives.

c. The Coordinator will consult with any existing coordinated co-channel packet-radio system operators who may be affected by the proposed addition of, or the changes to the system.

d. When specific coordination guidelines are approved by the Council, the Coordinator will proceed with steps e and f.

e. The application will be reviewed by the appropriate network manager(s).

f. If approved by the network manager(s), the Coordinator and TSARC President will sign and issue the coordination for a specified period. All coordinations will be subject to review at expiration.

TSARC Packet Coordination Questionnaire

1. Purpose of the Proposed System:
2. Primary Contact Parameters
   - Contact name:
   - Contact call sign:
   - Street address:
   - City:
   - State:
   - Postal code:
   - Home telephone (if any):
   - Business telephone:
   - Fax telephone (home or business):
   - Home BBS:
   - Other Email:

   Secondary Contact Information
   - Contact name:
   - Contact call sign:
   - Street address:
   - City:
   - State:
   - Postal code:
   - Home telephone (if any):
   - Business telephone:
   - Fax telephone (home or business):
   - Home BBS:
   - Other Email:
3. Location Parameters
   - Site name:
   - Street address:
   - City:
   - State:
   - Postal code:
   - Location telephone (if any):
   - Location fax telephone (if any):
   - Height above average terrain:
   - Height above sea level:
   - Latitude:
   - Longitude:
   - Explanation:
4. Digital Operational Parameters
   - Call sign (and SSID):
   - System type (select all that apply):
   - Digipeater Switch: ROSE X.25 Switch, KA-Node, NET/ROM, IP gateway, other
   - Server: PBBS, cluster, gateway, other
   - Explanation:

Radio Operational Parameters
- Frequency:
- Modulation type:
- Modem type:

Speed (bit/s):
Signal rate (bauds):
RF signal bandwidth:
Transmitter power:
Antenna type:
Antenna gain (reference to dipole):
System ERP:

5. Connectivity Parameters
   Hard wire paths and speed (eg, W2VY-6 / 9600 bit/s):
   RF (on-air) paths and speed (eg, WB2JQR-3 V KD6TH-3 / 1200 bit/s):
   Explanation:
6. Remarks:
   from J. Gordon Beattie, Jr., N2DSY@KD6TH

TRACKING SOFTWARE BEING PIRATED

Some of BBS SYSOPs called AMSAT Headquarters wondering if Instant Track was now shareware or in the public domain. It seems that some people are uploading the software to BBSs, which permit anyone to download a copy for free. In many cases the copyright information is still intact when running the program!

None of AMSAT's tracking software is shareware or in the public domain. Software distribution provides major funding for construction, launch and operation of AMSAT's satellites. Pirated versions of the AMSAT software represent a serious threat to future spacecraft development. If you find software being distributed by BBSs that does not look like freeware, please inform the SYSOP immediately.

from AMSAT

STRAY BITS

Don Hughes, KA1MF, is now the IP address coordinator for the state of Rhode Island, as is Ken Stritzel, WA9AEK, for the state of Illinois.

EU-HAM, an electronic newsletter covering the digital ham radio modes, was recently started by Jean-Marc LeClere, FC1DFR. Concentrating on European digital activity, the newsletter is now two issues old. Subscription information may be obtained from FC1DFR via any of the three addresses:

Via BITNET to LECLERE@FRGREN81.BITNET;
Via INTERNET to LECLERE@CICG990.GRENET.FR;
Via mail to BP 106, 91171 Viry-Chatillon Cedex, France.

The JARL FO-20 (Fuji-OSCAR-20) Command Team reports that FO-20 is experiencing high temperature problems. As of the weekend of September 29, the battery temperature had risen to near 45° C. Extended exposure to high battery temperature decreases the useful life of the battery. The natural cooling of the satellite during eclipse is not occurring because FO-20 is currently experiencing a period of eclipse-free orbits. Since a reduction of transponder operation availability is one way to reduce the internal temperature build-up, the FO-20 Command Team will monitor satellite performance and operations during these times and may turn off the transponder if they determine that the satellite is in danger. (from AMSAT)

Your *Gateway* editor has a new Internet address (horzepa@gdc.portal.com). The old address (70645.247@compuserve.com) still works, but the new one is less expensive to use, so it is the preferred one.

GATEWAY CONTRIBUTIONS

Submissions for publication in *Gateway* are welcome. You may submit material via the US mail or electronically, via CompuServe to user ID *70645,247* or via Internet to *horzepa@gdc.portal.com*. Via telephone, your editor can be reached on evenings and weekends at 203-879-1348 and he can switch a modem on line to receive text at 300, 1200 or 2400 bit/s. (Personal messages may be sent to your *Gateway* editor via packet radio to WA1LOU @ N1DCS or IP address 44.88.0.14.)

The deadline for each installment of *Gateway* is the tenth day of the month preceding the issue date of *QEX*.