Agreement on Packet Radio Standards (continued from page 1)
shift keying (ffsk). Max and psk are considered to be the most promising methods at this time.

7. The SSC will have to be open for different experimental approaches, and there is no general agreement and experimental validation of the optimum method.

Considering all the alternatives which were discarded, the above resolutions represent a significant narrowing of focus. If that wasn't enough, more was yet to come!

Eric Scace reviewed the work which had been done by the NJ AARON packeteer to adapt the international (CCITT) X.25 protocol to amateur needs. The adaptation of X.25 has been specified in link- and network-level documents by Terry Fox, WB4JPJ and Gordon Beattie, N2BZW respectively. Hank Magmusski distributed a tutorial document on connectionless protocols and described work which had been done to develop Revision 4 of the TIPM and LIPM software. This is the first implementation of TNG software utilizing only amateur call signs (and not firmware encoded) for addressing.

By the evening of the October 8, the group began to recognize that only the AMCOM ground stations separated from the TAP/0 or TIPM/0 approaches. The TAPR protocol users were willing to implement an interface based on the recommendations which would or could set the protocol. The differences were resolved and led to the unanimous adoption of a subset of an internationally recommended link protocol (specifically, it is called ANSI X.3.66 ADCP2-HDLC BA Class with options 2, 4, 7, 8, & 11).

Why is this important? First, this link-level protocol allows two AMCOM ground stations to construct a two-hop packet link. This same protocol can be used for two-terminal-to-terminal direct or via a simplex packet repeater. It represents only a slight extension of the CCITT X.25 LAPB link-level protocol and does not restrict future development of ISO level 3 virtual-circuit or datagram protocols.

The key feature of the new design is the adoption of a scheme for using call-sign addressing in a packet. The frame format looks like this:

```
| FLAG1 | CALL | CALL | CTL | INFO | TRS | FLAG2 |
```

where:

- **FLAG1**: Standard opening HDLC flag byte (01111110)
- **TOCALL**: The destination call sign (6 characters plus sub-station i-d code)
- **FMCALL**: The source call sign (6 characters plus sub-station i-d code)
- **CTL**: Standard HDLC control byte
- **FID**: Protocol identification byte for frames other than echo response packets
- **INFO**: Information field in information frames
- **FCS**: Frame CRC check sequence
- **FLAG2**: Standard closing HDLC flag byte

Framing to be followed by a local-area network simplex packet repeater will require a third address field following the FMCALL field. This field can be used to call the sign of the repeater. Now, details on this protocol will be published in the revised AX.25 specification document.

Collectively, the group considered that nearly every link design starts out with a statement something like this: Holy Cow, look at all the overhead bytes we have to send call signs! We can do it with just 4 bits. We have found that these other schemes have their own problems and that the penalty for the call sign overhead is relatively small compared to other delays on the link and in the view of the other benefits. In addition, both parties and their regulatory authorities are particularly defensive that the individual's call sign is sacrosanct and tantamount to being a personal name.

The AMCOM session ended with promises from various representatives to try to implement the required versions of this new protocol. In the interim, TIPM/0.04 will be available for use by AMCOM ground stations until the new software is ready.

**PAGSAT -- A New AMSAT Satellite Project**

By Dan Connors, K8DB and Tom Clark, W5WI

A new type of amateur satellite was proposed by Tom Clark, W5DL1, at the packet radio working group meetings held October 8-11, 1982 at the AMSAT laboratory in conjunction with AMSAT's annual general meeting. The meeting was also noteworthy in that it provided a focus for the various packet radio groups to coordinate their activities around the notion of a new protocol which is described by Hank Magmusski, KA6QH, in a companion document. The new satellite project has been tentatively dubbed PAGSAT (PAGSAT. The final name is yet to be chosen, pending resolution of some potential trademark conflicts. This satellite would build upon the reasonably low-cost spacecraft development, the current surge of interest in digital and computer techniques, and the technology being exploited by amateur packet radio applications. The basic idea is to implement an orbiting digital packet radio repeater with a capabilities. This satellite would allow amateur "electronic mail" service with a few-hour-delivery time to anywhere in the world -- via "virtual" e-mailbox for amateur radio and computer enthusiasts.

The "strewman" system proposed by Tom and discussed during the three days of meetings, would have one or more high-speed packet radio channels and alternate or one or more Baudot RTTY input/output channels. An on-board computer system would control a large amount of memory storage, with message storage as much as one megabyte for messages. Access to the message system would be somewhat like using a more-traditional computer- based message system (CBMS) using landline dial-up capability. In addition, a Board System (CBBS) (tm Ward Christensen). Using a pulse-code modulator and a low- or search orbit ("LEO"), the satellite would be available for several days for up to 15 minutes of message reading and writing. Although the LEO satellites are limited in their store-and-forward capability this could extend an AMSAT-OSCAR-8 type satellite to provide global coverage.

One of the major problems with such a concept is that packet radio equipment, and was a marked change in the amateur interest in computers. In order to make a PAGSAT a viable concept, the current packet radio experimentalist would have to consider considerable efforts to making reliable ground-station hardware and software available to AMSAT's user community, and would have to concentrate on a concentrated educational program to explain these new concepts -- some of the attendees at the working group meeting noted that they were surprised that the "war" vs. "peace" wars were raging in the early 1950s.

One of the major technical problems that will have to be solved before a PAGSAT (or the AMCOM channel for Phase IIIb) is viable involves modems. None of the standard commercial modems are suitable for noisy channels with Doppler shift. Several alternatives were discussed during the meeting. On the high-frequency end, modems included phase-shift keying (psk) and minimum-shift keying (msk). Discussions of data rates for up- and down-linked traffic ranged from 400 baud up to 56 kilobaud; the technical consensus was acceptable bit error rates and practical constraint of implementation cost and reliability plus available bandwidth. It appears that many of the satellite that likely rates were in the 400-2400 baud range. Although the Phase IIIb telecommand group have attempted to extend the baud tape data, and W4RI has been working on msks designs, the use of either technique will require considerable work in order to make it reliable and available by the amateur community. For any digital usage of amateur satellites, it is clear that modems will be considered that the traditional frequency-shift-keyed systems currently used for RTTY.

The strewman design that Tom presented involved multiple uplink and a single downlink (e.g., one callin uplink channel and per (continued on page 3)
PAGAT -- A New AMSAT Satellite Project 

(continued from page 1) 

happens four working channels). This built upon 
typical amateur net experience with the satellite 
acting as "TC" on a calling-and-answering 
frequency. After the user calls in and establishes 
that he has uplink traffic (or that the satellite 
has a message for him), he would direct to 
"GO" to a working message channel where the space-

craft's computer would "poll" the user until both 
he and the spacecraft are "QRT". This design is 
based upon the IRIDIUM 2 satellite where multiple 
users cannot hear each other, leading to 
possible collisions. In the uplink channels; thus, 
transmitting with The Walkie Talkie may not be 
"must down" (i.e., the total message traffic is full 
duplex, "must down" and down are about equal), led to the 
multiple uplink and single downlink system plan. The 
was that the uplink and downlink was full duplex 
(simultaneous transmission and reception), in 
volving the two bands (possibly 145-MHz uplink and 
435-MHz downlink). The design assumed that 3-1/2 
10-megabyte of storage was available on board 
which could be "filled" as required by the user's 
planning. All messages would be "bit regenerated 
(i.e., no direct channel exists between the users 
except through the satellite), and control of 
the communications would be by an active 
on-board computer. Other functions to be 
performed by this computer would include the access 
mechanism to manage the actual disk storage, 
handling of the protocols to allow multiple users 
to "speak" their messages up and down during a single 
passage and possibly in the downlink data stream during moments of inactivity.

On Saturday, the AMSAT members attending 
the technical forum at the local ham radio 
ballroom were able to discuss packet radio 
in action on the AMSAT's W2EKM (146.235) VHF 
repeater. W3WM brought a microprocessor-based 
Terminal Node Controller (TNC) developed by the 
Vanguard Amateur Digital Communications Group 
(VADCO), a 2024-type "slice" of a transceiver. Some 30 miles away in 
Stamford, VA, on the West Coast, K7WVR had his 220-
(miles, Zilog and Digital Research, respectively) 
clock and a similar TNC and modem. 
And in New Jersey, the two amateur radio 
operators exchanged messages via the public 
satellite. This impressive demonstration 
was the first exposure for many AMSAT members 
of the capabilities of digital techniques in amateur 
radio.

As the weekend proceeded, a number of informal 
discussions on packet radio continued. Among 
the experts there grew a general agreement on the 
design and implementation of the AMSS-ADEE 
(revised) and the future of packet radio on 
PAGAT too. Arguments for and against 
Tom's proposal for multiple uplinks (supporting a 
single downlink) centered on the estimated 
relative traffic loading on satellite uplink and 
downlink. These discussions included the observa-
tions:

-- CBM experience shows that users "browse" 
through stored information much more than generating 
new information. If the PAGAT is to be 
operated as a flying CBM, then the design should 
be considered.

-- The "QST" bulletin transmissions will be a very 
important PAGAT function for the users.

On Sunday, a proposal was made by Dennis 

Watkins-Johnson Tech-notes: Mixers

If you're interested in state-of-the-art RF 
mixers, you should see a copy of "Mixers: Part 1" 
and "Mixers: Part 2," Vol. 3 No. 2 and 3 in the 
Watkins-Johnson Company. These are monthly 
periodicals distributed to educational institutions, 
engineers, managers of companies, government agencies, 
technicians, individuals, and those in radio 
organizations by sending their subscription request on company 
letterhead, stating position and nature of business. The Watkins-Johnson Company, 3333 Hillview Avenue, Palo Alto, 
CA 94304.

QEX November 1982

Controller Chip for EPSON Matrix Printers

The trade magazines have advertised the EPSON 
M-150/160 series of dot-matrix printers which are 
designed for pocket devices. Now there is a 
single-chip microcontroller to provide serial 
and parallel data interfaces for these printers. The 
FP-150 chip is packaged in a 40-pin DIP, uses a 5-V supply, and supports serial 
110/9600/1200/800 baud, and 
breaks ASCII characters. Single-qu.

plus extra for crystal, jumper, potentiometer, and 

Contact: Friday Partnership, Z.W. Wentworth Close, 
Rudheath, Northwich, Cheshire, WC 7RE, England, 
tel: (0606) 47566.