



CROSSTALK

News Bulletin of the TRW Amateur Radio Club



Volume 98 Number 12

December 1998

Editor's Corner:

The 32nd Annual Awards Banquet was a huge success this year. Our Guest Speaker, Nate Brightman, K6OSC gave an interesting and informative talk about the history of the Queen Mary, as well as the Ham Station W6RO, onboard the ship. As always, the food was outstanding and by what others told me, they enjoyed themselves. I was glad to see Jan Parker, KD6AKD who recently had surgery, she seems to be recovering quite well, another member John Cheatham, KE6OJM was missed, you are in our thoughts John. As Banquet Chairman this year, I want to take this opportunity to personally Thank **Wendy Crawford, KQ6CG** for her enormous contribution of her personal time helping me organize this Banquet, as a matter of fact, Wendy has also helped in previous Banquets too. **Nina, KN6FL and Bill Whiddon, NM6X** also helped out, and without them, things wouldn't have gone so well.

As 1998 comes to an end, I have enjoyed producing this newsletter, and also want to Thank **Jim Harrison, K6OUE** for stepping in this summer and helping me out while I was out on company business. Jim also has been a regular contributor of articles. I hope to continue to put out an informative and enjoyable Crosstalk in the coming years.

Executive Board Nominations:

As Rich Sauer, N6CIZ our President mentioned at the Banquet, he will not be running next year. This leaves a really important position open for 1999, and hopefully some nominations will come in for this spot. If you have anyone in mind, please consider them and return the nomination form to me that is in this issue. There are some other key appointed positions that are open, check the back of the Crosstalk, and let Rich know if you can help out.

Robin Chacon, KF6LAS has volunteered to mail out the Crosstalk's to all of the folks outside of TRW. This is another one of those duties that you don't hear about, Thanks Robin for the much needed help.

By the way, Steve Papa, KO6VF our Librarian, has had this task for a long time in case no one knew. Thank You Steve.

Duane Park, WA6EIK Crosstalk Editor



TRWARC Monthly Calendar of Events

First Tuesday of each month	5:30 pm	Executive Board Meeting, R4/2041 (All Club Members are invited)
Second Tuesday of each month	5:30pm	Club Meeting Round Table Pizza, (Redondo Bch. & Hawthorne)
Second Tuesday of each month	12:00 noon	Emergency Communications Team Meeting R3 Emergency Operations Center
Last Saturday of each month	7:00 am	TRW/ARC Swap Meet Marine and Aviation (Northeast Corner)
After the Swapmeet	12:00 noon	T-Hunt Swap Meet Parking Lot - 144.72 MHz

Weekly Events

Every Monday Night (Except the 1st & Holidays)	7:30 pm	Disaster Communication Systems (DCS) Net DCS Members: Check in on 2 Meter Repeater
Every Wednesday	12:00 noon	ECT Net on 2 meter Repeater All Amateurs Welcome
Every Thursday	7:00 pm	Space Hams Net on 2 meter Repeater with N6SHI and W6EKK
Every Mon, Wed, Fri	2:00 pm	TRW Retirees Net 7185 KHz
Every Friday Morning	7:30 am	TRW Amateur Radio Club Breakfast Building S Cafeteria - Everyone is invited Talk-in on 2 Meters

Other Events

Computer Fair *Hours: 10:00 to 17:00 (get a \$25.00 annual pass see:*

<http://www.lacomputerfair.com/annpass.html>)

POMONA \$6.00 admission

Live Broadcasts: KFI-Jeff Levy "On Computers", KZLA, Y-107FM

December 5 & 6 (Sat. & Sun.) bldgs. 6 & 7

January 2 & 3 (Sat. & Sun.) bldg. 4

Fairplex Exposition Complex Exit Highway 10 at Fairplex Drive.

Go north to McKinley Avenue, turn right. Turn left on White Avenue to Gate 14.

RESEDA \$3.00 admission

December 19 (Sat.)

January 16 & 17 (Sat. & Sun.)

Sherman Square Entertainment Center From the 101 Freeway take the Reseda offramp,

go north to Sherman Way and turn right. Go one block to Canby Street. 18430 Sherman Way.

BUENA PARK \$5.00 admission

December 20 (Sun.)

Sequoia Conference Center Take the Beach Blvd. exit off the 91 Freeway.

Go one block north to 7530 Orangethorpe.

All Shows Open to the Public 10:00 a.m. to 5:00 p.m.

Call for more information (408) 778-5200 or 800-800-5600 Fax# (408) 779-1374

Other Ham Swap meets:

Inland Empire ARC - 2nd Sat. ea. mo. 7:00 to 11:30 AM @ A.B. Miller High School, Walnut & Oleander

in **Fontana** Talk-in 145.480 (-600 pl=77.0hz)

EI Cajon ARC - 1st Sat. ea. mo. 6:00 AM @ Santee Drive-in Theater, Woodside Ave. @ Hwy 67 in **Santee** Talk-in 146.52

NEW: CAL POLY swap meet – 3rd Sat. ea. mo. 7-11am in lots F8,F9 and F10 @ CAL Poly Pomona at 3801 West Temple.

Talk-in TBD (*if you know, please email me... ed.*)



**1998 TRW ARC
Executive Board Officers
Nomination form**



Please indicate your nomination for the following positions, remember that the person must be a full time TRW employee, and a active member of the TRW Amateur Radio Club.

- President _____ M/S _____ Call _____
- Vice President _____ M/S _____ Call _____
- Secretary _____ M/S _____ Call _____
- Treasurer _____ M/S _____ Call _____

Return form no later than December 18, 1998

To: Duane Park
One Space Park Drive
R8/2778A
Redondo Beach, Ca. 90278

STS-95 Back Home *(via Newsline #1108)*

John Glenn in space

By the time some of you read this article, Senator John Glenn he will be back on Earth and probably looking for yet another challenge. What does the future have in store for him? That's what we asked his closest friend, Lieutenant General Tom Miller, K4IC. He says that kids and education will be at the top of the list:

"I think he can do so very much for young people today by talking and making, giving lectures to colleges. And he can talk the broad spectrum of his life as a military man, as a pilot, as an astronaut, and then as a private business man, later as a senator on foreign relations, and then following that senator on armed services committee, and then also on the committee for government affairs. So the broad spectrum he has makes him imminently qualified to lecture young people."

Tom Miller, K4IC

But the big question on the minds of many hams is whether or not John Glenn will still go ahead and get his ham license. This even though the STS-95 flight is almost history and he was not able to take SAREX with him on the trip. Tom Miller says that it just might happen:

"There's a good possibility that I might be able to convince him to at least to get his Tech License. Whether he will ever slow down long enough to get his General or Advanced Class, I don't know, but believe me I will be working on it. At least I will have him working on antennas and helping me from time to time." K4IC

Welcome home, John Glenn.

FBI ARRESTS GEORGIA HAM FOR INTERFERING WITH AIRCRAFT COMMUNICATION *(via the ARRL Letter Vol. 17 #46-47)*

The FCC, the FAA, and the FBI have announced the arrest of a Georgia ham for allegedly interfering with radio communication between aircraft and air traffic controllers in Northern Georgia. An FBI statement issued this week said that Kevin M. Kelly, N2BYE, an Advanced class licensee, was arrested without incident November 6 at his Cumming, Georgia, home by FBI agents accompanied by FAA and FCC agents. The arrest followed a search of Kelly's residence.

Kelly was charged in a criminal complaint with four counts of breaking federal law prohibiting knowingly interfering with the operation of a "true light" or signal used at an air navigation facility. The FBI said its case stemmed from FAA reports of "sporadic and momentary radio frequency interference" between aircraft and air traffic controller communications. The FBI said an extensive investigation showed the RF interference to be coming from the Hyde Park Subdivision in Cumming where Kelly lived. The FBI described Kelly, 46, as "a highly experienced electronics engineer" who was said to have been "extremely upset" about air traffic noise above his home. Kelly was scheduled to appear November 9 before a US magistrate in Atlanta.

70cm News - SCRRBA on splitting 70 cm

Don't look for Southern California to simply split the 70 cm repeater subband from its current 25 KHz inter system spacing to the commercial 12.5 KHz standard used nationally. While the commercial services have proven 12.5 KHz successful and desirable, it appears as if the Southern California Repeater and Remote Base Association will opt for a 20 KHz spacing plan sometime in 1999.

The decision to investigate a change from 25 to 20 KHz came at the organizations annual meeting held on October 17th. Proponents of changing to 20 KHz spacing say it would add another fifty repeater pairs and one more simplex channel. But it could also put Southern California as an odd man out as the rest of the nation seems poised to go with 12.5 KHz when the time comes to make such a change.

STORM OR SHOWER, LEONIDS PROVIDE THRILL OF A LIFETIME

Hours of lost sleep were a small sacrifice to the many VHF and UHF enthusiasts who got the thrill of a lifetime working meteor scatter during the Leonid shower November 16-18. "For nearly all radio operators, it was spectacular," enthused Shelby Ennis, W8WN, of Elizabethtown, Kentucky. "This was the year of the fireballs." Leonids get their name from the constellation Leo, which appears to be their source in the sky. The meteors originate from debris and dust in the wake of the comet Tempel-Tuttle, showing up each November.

(STORM OR SHOWER, LEONIDS PROVIDE THRILL OF A LIFETIME – Cont.)

Approximately every 33 years--the length of time it takes for Tempel-Tuttle to orbit the sun--the shower can reach storm proportions.

Ennis and others also seem to agree that this was the year for long-distance contacts, possibly a few record-setting ones. "My biggest thrill was working Vermont on 2 meters, which is over 1400 miles," said Larry Lambert, N0LL, who lives in northern Kansas. He said he encountered one "burn"--or trail--that lasted nine minutes, during which he was able to work 11 stations. Most, if not all, agree that the Leonids showed up a bit earlier than predicted, and that this year's event was a shower, not a storm. Some predicted that next year will be "the big one" that some had thought might happen this time around. Even so, all reports indicate gratifying results for those who participated. "I came home from work between 1800 and 1900 UTC on the 16th, and things were wild," Lambert said. His skeds at the predicted peak of 1900 UTC on the 17th failed for the most part, he said. While high-speed CW has been the preferred mode for meteor scatter contacts, Ennis said that as a result of the numerous long-burning fireballs this time, SSB turned out to be "much more effective than HSCW." Ennis said HSCW worked best for times prior to the shower's peak, but SSB was "far more effective" once long bursts begin to appear. Some stations were able to put several new grid squares, states and even countries into their logbooks, thanks to the Leonids. During the two days he operated, Bill Mitchell, K0WLU, in Minnesota, logged 124 stations in 99 grid squares on 2 meters, using both SSB and CW and running just 90 W into a Cushcraft 17B2 antenna. Not only that but he operated for several hours on emergency power after he lost electricity at his house. He used a marine battery to power his rig and amp, and an inverter to run his rotator!

Arliss Thompson, W7XU, in South Dakota, reported "exceptionally good" conditions on the morning of November 16. "I hope I'm around in another 33 years!" he said. Thompson worked several new grids and states on the bands from 50 MHz to 432 MHz, including his first-ever 432 meteor-scatter QSO with N6RMJ in California--possibly a record at 2036 km (for his part, N6RMJ reported dozens of MS contacts on 6 meters through 70 cm). The 144.200 MHz gathering spot on 2 meters had "so many signals that we couldn't copy anyone," Thompson said, expressing appreciation to those who moved off the calling channel to clear the congestion.

For those whose visibility was not obscured, the view from the ground also was spectacular in some US locations, although the peak viewing was in Asia. Ron Dunbar, W0PN/3, in Maryland, stepped outside to check the sky early on the morning of November 17.

"Only five seconds after I stepped onto the deck, a brilliant Leonid streaked by from due east to due west," he said. "As it arched down to the western horizon, it exploded!" Dunbar said the resulting light was so intense it lit up his backyard. Dunbar concluded that this year's Leonids shower was "definitely not normal, to say the least" because of an apparently greater numbers of larger particles generating more impressive burns. "Every trail I saw during the 15 minutes I was out there was most likely created by pieces of cometary debris of a size between a marble and a chicken's egg," Dunbar said in a posting to the Meteor-Scatter reflector, "and the fireball had to be considerably larger."

An ATV-carrying balloon launched by NASA scientists at the Marshall Space Flight Center in Huntsville offered live, real-time viewing of the Leonids shower via the Internet (see <http://www.leonidslive.com/>). At last report, the balloon was being retrieved from North-Central Georgia.

The Russian Mir space station and apparently all communication satellites came through the Leonid shower unscathed. The two cosmonauts aboard Mir took temporary refuge in the Soyuz escape spacecraft during the peak of the meteor shower. During an earlier spacewalk, they had installed a meteorite trap to possibly catch some of the debris.

NEXT SAREX MISSION, STS-93, DELAYED

The only Space Amateur Radio EXperiment, or SAREX, shuttle mission scheduled for 1999 has been postponed at least until March. Mission STS-93 aboard the space shuttle Columbia had been tentatively scheduled for a January launch. The postponement was blamed on delays in shipping the primary payload. A new launch date from Kennedy Space Center is not yet known, but NASA has said it will not be before March 18. The mission will last four days.

Schools in Florida, Rhode Island, Texas, and Virginia now are on the roster to make Amateur Radio contact with the STS-93 astronauts. A school in Indiana that was on the original SAREX schedule had to drop off because of the change in the launch date.

Hams flying aboard STS-93 will be Commander Eileen Collins, KD5EDS, as well as Michel Tognini, KD5EJZ, and Catherine Coleman, KC5ZTH. Other crew members are Jeffrey Ashby and Steven Hawley.

If all goes as planned, students at each of the schools on the schedule will get a chance to directly interview the astronauts via a ham radio linkup. Typical passes last approximately 10 minutes. Specific times and dates of the school contacts have not yet been arranged.

• **PANSAT NEWS ***

*(If you didn't already know, a small Amateur Satellite was launched from the last Shuttle activity STS-95, Jim Harrison, K6OUE mentions this Satellite in his column, **fyi, the Naval website he mentions is unavailable as of this writing.** I haven't been able to get a lot of information on it, but here is what I found. Ed.)*

The Petite Amateur Navy Satellite (PANSAT) is a small, spread-spectrum communication satellite developed by the Naval Postgraduate School (NPS) as an educational project for officer students. PANSAT will be a tumbling spacecraft with a weight of 150 pounds to be launched on STS-95 in 1998. PANSAT will most likely be launched from the Space Shuttle by means of the HitchHiker program. The launch will place PANSAT in a Low Earth Orbit (LEO) with an inclination of at least 28 degrees. The spacecraft will supply direct-sequence, spread-spectrum modulation with an operating center frequency of 436.5 MHz, a bit rate of 9600 bits per second and 4 MB of message storage. Amateur radio ground stations will be able to utilize PANSAT for store-and-forward communication.

Through use by the amateur radio community PANSAT will supply a means to demonstrate spread-spectrum communications. In addition, PANSAT provides many potential applications for low-cost communications. The low probability-of-intercept would be an important feature for the military in downed-pilot-rescues. The pilot could obtain his/her location through a GPS system and uplink the information to the orbiting satellite at low risk. Examples of civilian uses include emergency rescue and communication to remote areas.

To prepare the spacecraft for flight it will undergo functional and environmental testing at the system and subsystem level. The environmental testing includes thermal vacuum, random vibration, and electromagnetic interference and compatibility (EMI/EMC) testing. All testing will be conducted using NPS space test facilities. A modified amateur satellite ground station is needed to communicate with PANSAT. The NPS ground station utilizes off-the-shelf software, is microcomputer controlled, and is equipped with a spread-spectrum modem. The NPS ground station is similar to a typical amateur radio user station, except it has spacecraft command capability. The NPS ground station is also utilized as a classroom instructional laboratory.

[Info via the Naval Postgraduate School]

Student satellite to hitch ride with John Glenn aboard STS-95

by JO1 Diane Jacobs, Naval Postgraduate School Public Affairs

MONTEREY, Calif. (NWSB) -- When John Glenn makes his historical return to space after 36 years this October, another, yet smaller feat will also make history. The Navy's first amateur satellite, designed and built by students at the Naval Postgraduate School, will hitchhike on the same space shuttle mission and launch into orbit.

The Petite Amateur Navy Satellite (PANSAT) has been at the heart of student-driven research since its pen-and-paper conception in 1989 and thesis work of close to 60 students. Measuring about two feet wide, and weighing 150 pounds, the communications satellite will orbit the Earth once every 95 minutes. It will provide communications using ham radio, and serve as a space-based laboratory for students in the space systems engineering and space systems operations curricula at the postgraduate school. "We're designing and building everything. There's only two things we went out and bought: solar cells and batteries," said Dan Sakoda, systems engineer for the project. "Every circuit board was designed here, and all components, down to the smallest level, were selected, purchased and soldered into the boards. I don't think any other university does that."

While past students created the satellite's hardware, current student LT Ken Hunter has invested 15 months to develop the satellite's user service software. "This performs the communications functionality in the software," he said. "Not only do I have to do the satellite's software, but also the ground station software, which is a network of computers. It's a much larger project than I first anticipated."

Hunter had to start from scratch, learning the basics of computer software. It took five months "just to get comfortable enough to do anything," he admitted. And, he didn't quite make the "grandiose plans" he originally intended either. "When I finish, it will be working, and provide all functionality's. It just won't have a lot of the bells and whistles," he said. "But, I'll have those bells and whistles already designed, so a new student can come in and put them in." Hunter, who graduates this month with a master's degree in computer science, added that his work actually doesn't go up with the satellite. Once the satellite is launched and orbiting, his software is sent up, and then it becomes operational. The possibility of a computer "crash" exists, and the engineers and students have thought this through, too. One field Hunter studied was "fault tolerance" and how software can correct itself.

"I've figured that if something happens with the program, you just can't reach up and press "Control, Alt, Delete." So, I've designed the software to detect errors as they occur and fix the simple errors on its own.

(Student satellite to hitch ride with John Glenn aboard STS-95 Cont.)

For a complicated error, it will notify someone down here for remote repair. It's a bit of artificial intelligence -- it's self-aware to see when something's wrong," Hunter said. Sakoda said the space shuttle mission that will launch the satellite is primarily to support research with the Hubble Telescope. He considered this a piece of good luck for the student satellite, since it, too, is then assigned a high-altitude orbit. "This means there's more distance to fall, and a longer time to return to Earth," he said. He figures the satellite will remain in orbit between four and six years. Students can add software, make adjustments, and upload or download information when the satellite orbits within a two-to-eight-minute window over the ground station in Monterey. "Students really gain a lot as far as getting the big picture of a space system development. They're not just getting a master's degree in designing a filter, or software. They see the whole spectrum, the life cycle of development," said Sakoda. "No one said, 'Build us a small communications satellite.' We looked at the curriculum, and looked for something that could fill a void and get students who span across this highly inter-disciplinary type of curriculum. Students who come through our curricula will be able to fly the spacecraft. You don't get this kind of opportunity elsewhere." Sakoda predicts this program will continue, especially since its sponsors -- the Naval Space Command, and Space and Naval Warfare Systems Command -- support such education. As for the Navy, said Hunter, which uses a lot of satellite systems, this may be the start of a new way of thinking. "The Navy's leasing and using some aging satellites. We're looking at using small, cheap spectrum satellites," he said. "A network of these could replace the existing satellite infrastructure."

-USN-

NAVAL POSTGRADUATE SCHOOL



Petite Amateur Navy Satellite (PANSAT)



Contributions by Jim Harrison K6OUE

Two new amateur satellites;

I would recommend that everyone listen to the Space Information Net on the TRW 2 meter repeater. This net is every Thursday evening at 7:00 PM and is hosted by Ronnie N6SHI of Space Hams International and Stan W6EKK. You will find out about interesting things like the following.

Sputnik-41

On Nov. 10, a mini-sputnik was released by hand from the MIR space station. It is called Sputnik 41 or RS-18. It was sponsored by the Aeroclub de France and is part of a program of satellites made in collaboration with Russian and French students. The satellite transmits recorded greetings in French, English, and Russian, and a tone whose frequency is proportional to the satellite's internal temperature. It also transmits a recording of the beep-beep signal from the original Sputnik launched in 1957! It transmits on 145.812 MHz FM with about 200 mW and has an operational lifetime of at least 30 days (battery power only). A web site with QSL information is at <http://www.ccr.jussieu.fr/physio/Satedu/sputnik41.html>.

The Space Information Net on Nov. 12 gave the information about Sputnik 41 and someone called in and said they had already heard it. After copying down the times when the MIR passes overhead, given by Ronnie N6SHI during the net, I tuned my radio to the frequency later that evening and heard the satellite at about S3. It must still be following close to MIR because it was there right at the time the MIR was passing overhead. I was using a base station radio with a vertical antenna on my roof, but it could probably be heard with a handheld if you are outside. I heard it again the next morning. It starts at 145.815 MHz and moves down to about 145.810 MHz due to Doppler shift. It can be heard for about 8 minutes. The MIR orbit pass times are posted on the TRW ARC web site by W6EKK. When you read this it should still be transmitting, they released one last year that lasted for 50 days.

PANSAT

During the John Glenn shuttle flight, an amateur satellite was launched from the shuttle on Oct. 30. The Petite Amateur Navy Satellite (PANSAT) was built by the Naval Postgraduate School in Monterey, California. It is an educational project for demonstrating and experimenting with spread spectrum communications. It will provide store-and-forward packet communication using direct-sequence spread spectrum modulation in the 70cm amateur band. It will be available for use by the amateur radio community, but will require special hardware for the spread spectrum modulation and demodulation. The NPS will provide documentation for communicating with PANSAT in a couple of months, after checkout of the satellite. Their website is <http://www.sp.nps.navy.mil/pansat/>

Digital Television is here

As of Nov. 1, the television broadcasters are supposed to be transmitting digital television signals. I have been surprised at how little this has been mentioned in the general media, and how hard it is to find information about DTV. Some of the amateur television hams have looked at the transmitted signals on spectrum analyzers and they say that the DTV signals are perfectly flat across the entire 6 MHz TV channel, unlike analog TV. This shows that they are transmitting the maximum amount of information possible over their allotted bandwidth, which is one of the advantages of digital transmission. After searching around on the web, I found a page that gives the FCC channel assignments for digital TV. These channels were assigned on April 21, 1997, so I can only assume that they are still current. I am curious to see what a DTV signal will look like on a regular TV. Will it be a pattern of black and white dots, or will the information be so randomized that it will look like white noise, and so look just like no signal at all?

Los Angeles TV channels	
Current NTSC Ch.	DTV Channel
2	60
4	36
5	68
7	8
9	43
11	65
13	66
22	42
28	59
34	35
50	48
58	41

- K6OUE

Banquet 1998 Pictures

If you have any good photos and would like to see them printed, please send them to me.



TRW AMATEUR RADIO CLUB

ELECTED OFFICERS

President	Rich Sauer	N6CIZ	R9 / 2873	(310) 813-5869
Vice President	Elizabeth Kunkee	KS4IS	D1 / 1024	(310) 813-0524
Secretary	Craig Gullickson	N6ED	R6 / 2529F	(310) 812-5389
Treasurer	Steve Lambert	KF6KIC	R6 / 2529	(310) 812-5019

APPOINTED STAFF

447 Repeater Autopatch	Duane Park	WA6EIK	R8 / 2778A	(310) 813-4219
Activities Chair/Asst Swapmt	Greg Martens	N6RRY	M1 / 1275	(310) 813-4049
Crosstalk Editor	Duane Park	WA6EIK	R8 / 2778A	(310) 813-4219
Emer. Comm. Coordinator	Rich Sauer (acting)			
Librarian	Steve Papa	KO6VF	O2 / 1715	(310) 812-5305
Membership Chairperson	Dave Nelson	AB6DU	R8 / 2144	(310) 813-9775
Past President	Bob Briggs	KD6WYQ	M7 / 2939	(310) 813-2622
Publicity Chairperson	Dave Nelson	AB6DU	R8 / 2144	(310) 813-9775
QSL Manager	Bryan DeAro	KN6OW	120 / 1020B	(310) 812-4789
S.P. Packet/Internet Sysop	Chris Wachs	WA2KDL	R7A / 2100	(310) 813-1506
SEA Representative	Nina Whiddon	KN6FL	01 / 2020	(310) 813-9351
Swap Meet Manager	Rich Sauer	N6CIZ	R9 / 2873	(310) 813-5869
Technical Chairperson	OPEN			
Training Chairperson	Bryan DeAro	KN6OW	120 / 1020B	(310) 812-4789
Trustee of W6TRW License	Elizabeth Kunkee	KS4IS	D1 / 1024	(310) 813-0524

TRW/ARC Hotline (Club Answering Machine)	(310) 813-8569
W6TRW 2 Meter Repeater (Open Repeater)	145.32 (-600) PL 114.8Hz
W6TRW UHF Repeater (Open Repeater / Closed Autopatch)	447.00 (-5 MHz) PL 100 Hz
W6TRW-3 Packet Radio Internet Gateway and BBS (1200 Baud Port)	146.745 (-600)
W6TRW Internet Home Page	http://w6trw.sp.trw.com/w6trw/

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FIRST CLASS

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