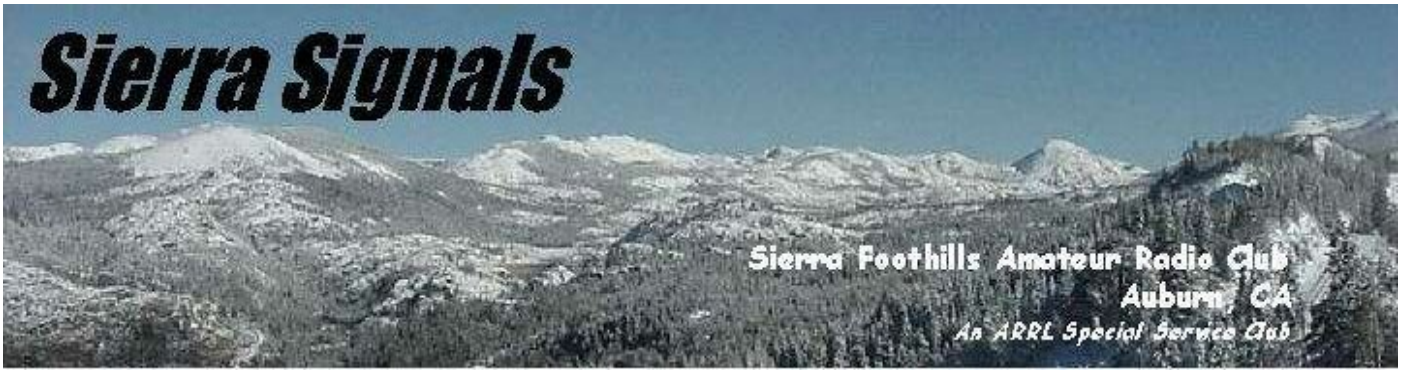

February 2008 P.O. Box 1005, Newcastle, CA 95658

AO-51's Dilemma

(Submitted by Greg, KO6TH)

Space is such a fickle place to work in. Wide swings occur in available sunlight due to spacecraft orientation and spin, and then there's this planet that keeps getting in the way every hour causing an eclipse. Incessant service demands from customers on the ground put demands on the limited power that can be generated. And the electronics, and more importantly, the batteries, like to be kept in cozy "shirt sleeve" comfort. On top of it all, the software needs to be configured and maintained, and reloaded after the odd surprise crashes. You think you have PC problems? It's enough to drive a command team nuts.

So it has been for the AO-51 command team this past month. I suppose it's all part of the challenge and fun in commanding a spacecraft. Situations and opportunities present themselves, and you deal with them the best you can. Some you can predict, some you cannot. All of them happened in January. And, somehow, they survi ved.

(*continued on page 2)*

2008 Calendar of Events

[Dates are local unless otherwise indicated]

Feb 2	**VE Session**
Feb 8	**Regular Meeting**
Feb 23	**Club Breakfast**
Mar 1	**VE Session**
Mar 14	**Regular Meeting**
Mar 29	**Club Breakfast**

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History: Gary, KQ6RT
Contesting: Fred, K6DGW

RESOURCES

REPEATERS
145.430 (-0.6 MHz/PL 162.2)
440.575 (+5.0 MHz/PL 94.8)
223.860 (-1.6 MHz/PL 100.0)

CLUB NET
Thursdays, 7:30PM, K6ARR/R 145.430

CLUB MEETINGS
Second Friday of the month, 7:30PM at the Library, 350 Nevada St, Auburn CA

CLUB BREAKFAST
Last Sat of the month at Susie's Café, Cirby at Riverside, Roseville – 8:00 AM

NET CONTROL OPS
Dave Jenkins, WB6RBE
Gary Cunningham, KQ6RT
Joe Sylvia, KF6OQY
Casey McPartland, W7IB

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We encourage members to receive Sierra Signals via email to save the Club the cost of reproduction and mailing

Thirty Years Ago At The SFARC

(Reported by Gary, KQ6RT)

February 9, 1978

Meeting was called to order at 7:55 p.m. by pres. Carroll Evans. (Placer High School)

Minutes of the January meeting were approved as read.

Members, Guests and Visitors were introduced.

Treasurer's report: $384.25. Our Club now has 41 paid up members.

The Technical Committee report was given by Jim, K6ARR.

It was moved and seconded to have Jim, K6ARR look into the purchase of a G.E. Master Receiver, ER41A series. Motion passed.

It was moved and seconded to put WR6ADI on 146.145 OUT / 146.745 IN. The present 146.16/76 would not be reassigned. Estimated cost is $15 for Crystals. Motion passed. It was noted that the Placer County Sheriff's Communications Reserve would use 146.175 OUT 146.775 IN frequencies.

Our speaker for the evening Under Sheriff Ed Presley, WB6EDD gave a brief history of the Sheriff's Communications Reserve and talked in detail about current and proposed improvements.

Activities Coordinator Tom, WB6UBF briefed the Club on the dinner to be held Saturday night Feb. 11th at the Auburn Hotel.

It was moved and seconded to tie in SFARC equipment and Communication Reserve Equipment as outlined in the new master program proposed by the Technical Committee of the Placer County Sheriff's Communications Reserve. Motion Passed.

Sage, K6ZwZ is looking for at least 4 others with an interest in purchasing 220 machines.

The following were elected to serve as Club Directors:

Bob Bedynek, WA6EBI

Bob Colling, WB6AEU

Jack Crusinberry, WB6BPO

The meeting Adjourned at 9:15 p.m.

Al Schweigert, Secretary

73,

Gary - KQ6RT

AO-51...

(Continued from front page)

Chief among the unexpected is the software crash. As satellite users we focus a lot on the radios, but controlling a spacecraft is a lot about the computers that run the radios, control the power distribution, gather and send telemetry, and operate the bulletin board and other user services. Those computers run on software, and where there is software, there are crashes. Sometimes it's due to bugs, but often it's the harsh environment – alpha particles, radiation zaps, electrical glitches, and nasty stuff of all kinds. The hardware, of course, is designed to withstand these effects, but crashes still happen. Recovery from a PC crash on the ground is a matter of pushing the reset button, but when the reset button is in orbit, how do you push it?

To solve this problem, satellite designers build in special logic and timers that watch over the satellite's health. If something goes wrong, the satellite can automatically push its own reset button, dropping back to a safe mode where telemetry can be gathered and diagnostics can be run. From there it's a matter of pushing blocks of binary data – the system's software – into memory, not unlike sending a file to someone via packet radio. On Sunday, January 13th, that is what happened. The spacecraft suddenly stopped transmitting and dropped into the master boot loader, which is sort of like the BIOS on a PC. Fortunately, nothing appeared to be broken and the system was reloaded and restarted a few days later.

But even the expected changes can be sources for challenge. One of the predictable occurrences is the slow and orderly change of a satellite's orbit. It's physics. AO-51 is in a nearly "Sun synchronous" orbit, which means that the circle it makes over the Earth's poles stays oriented about the same compared to where the Sun is, even as the Earth goes through its yearly orbit around our star. But AO-51's orbit is not quite synchronous; the orbital plane drifts slowly, and that means that from time to time the orbit is exactly in line with Earth's orbital path. When that happens, the satellite never dips behind our planet, and is bathed in continuous sunlight.

Now, continuous sunlight might sound like a good thing. After all, it means that the spacecraft has a reliable and steady supply of power. And in space, steady, reliable, and power are all good things. But power is also heat, and when you have too much of it you can't just blow the excess out the vents in the back. I mean, fundamentally, there's a severe shortage of air up there to blow.

Starting on January 4, 2008, the spacecraft's orbit had shifted just far enough that it missed the Earth's shadow as it sped around. It will be this way for the next few months. The command team realized that this meant that there would be no

cooling off of the spacecraft in the Earth's shadow, so temperatures would rise. If they got too high, they could permanently damage or shorten the lifetime of a critical system. At first, things were under control, but then came the software crash on the 13th. With the spacecraft in reset, the temperature of the batteries rose from 30 degrees (centigrade) to over 40. Too hot! What to do?

They had two choices. The first was to turn everything off and wait for eclipses to start up again. That should control the temperature, but it would also leave us without a satellite. Remembering the incessant service demands from us Hams on the ground, the command team tried a different approach.

It's not intuitive, at least to me, but when you draw power from a solar cell, it runs cooler. A substantial source of heat in a spacecraft comes from the solar array, which is bolted to the side of the spacecraft's frame. So, they decided to turn on the transmitters, several of them, to maximum power. This had several beneficial effects. First, the solar cells are running cooler, because of the power drain, and so is the rest of the spacecraft and the all important batteries. Second, several watts of energy (heat) is being beamed off-board, in the form of radio waves. And third, those radio waves are serving us Hams on the ground with a new and unique AO-51 mode.

For at least the rest of the month, AO-51 will be in mode V/US, where the uplink from the ground to the spacecraft is on VHF (145.920), and both the UHF (435.300) and S-band (2401.200) downlink transmitters are active. All of these links are in narrow-band FM mode. With the high transmit power, AO-51 is much easier to hear. This is an excellent time to try operating through the satellite, or even just listening to what is going on. Some are reporting reception on their HTs, though an extended whip antenna, ground plane, or small beam is still the best way to go. Don't forget that the other laws of physics are still in effect, so you will need to adjust your receiver to compensate for the Doppler effect. Start listening about 10 khz high (435.310), and tune downward as the satellite passes overhead. The uplink side should be adjusted as well, but since the effect is less on the lower bands, many get by without needing changes.

73s,

Greg KO6TH

January Meeting Minutes

(Reported by Wayne,W6DT)

The meeting was called to order at 7:30 PM by President Don Hay, WB6LPJ.

The salute to the Flag followed by the introduction of members.

Chuck Minton, KG6FFR gave a report on ARES activity during the last storm, which knocked out electrical power for many in the community as well as our members. Some lost power for as many as 4 days and a few in the community were "in the dark" for even longer. Phone service was also disrupted, both landline and cellular.

The treasurer, Leslie Nye, K7NYE, reported that we had $1611.83 in funds and an additional $250 in the repeater reserve fund. The Christmas Party drawing raised $383. A reminder was made that the yearly dues were payable.

On March 8, 2008 and April 5, 2008, the 2 Meter club repeater will be used to support other activities.

A suggestion was made by Rick, K6TF, that the club consider a "free" table at meetings where members could "recycle" radio and related items to other club members. If no one was interested in giving the items a new home, whoever brought it had to take it back home. Rick also advised that there were many links on the clubs WEB page that members might find very useful and interesting, including one showing a vacuum tube being hand made.

Mention was made of three members that became silent keys during the last year, Rob Carpenter, WW6G, John (Ed) Ahlstrom, KQ6CK, and Pat Cook, WD6ECC.

A discussion was held regarding a back up repeater. A committee consisting of Richard Kuepper. WA6RWS, Gene Freeland, KG6NYH and Jim Griffith, KI6AZH will report back. They were authorized to spend up to $500 for a controller and hardware. This is an additional $350 to be added to a previous allocation of which there is approximately $150 remaining.

The monthly drawing was held.

The meeting adjourned at 9:25PM.

Respectfully submitted,

Wayne Stilwell, W6DT

Secretary

Miscellaneous Radio

Collins KWM-2

In one of my rare forays onto the HF phone bands, I had a recent QSO with a 23 year old new General trying out his new HF privileges. He was full of questions after he found out that I'm an OF[1] and the QSO was one of the more interesting [and longer] I've had in quite awhile. The subject came around to "How has ham radio changed since I was his age?" One of his questions was intriguing … "What was the top-end radio in the later 50's?"

First off, it intrigued me that he phrased it in the singular -- "radio." Up until about that time, the vast majority of ham stations consisted of a commercial receiver [there were many on the market] and a separate transmitter that was often home-brewed or converted surplus … or sometimes a commercial model but there were less of them on the market than there

[1] "Old Fart"

were receivers. Outboard linear amplifiers like we have today were unheard of since phone was AM. Final amplifiers were an integral part of the transmitter line-up, ran Class C, and were usually plate modulated. So, there isn't a single answer to his question. Arguably, the top-of-the-line receiver was the Collins 75A4, and there were some very good receivers by Hammerlund, Hallicrafters, and National too. But, it's harder to pin it down on the transmitter side.

The mid to late 50's were a time of significant change in ham radio, however. Single Sideband Suppressed Carrier [SSSC, which quickly became SSB] came on the scene. Transmitting AM, 50% of the power goes into the "carrier," which ironically "carries" nothing. The other 50% is divided between two identical sidebands on each side of the carrier. All of the information being transmitted is contained in just one of the sidebands, the other sideband being just an inverted copy of the first one. Thus, if you somehow got rid of the carrier and one of the sidebands, you could theoretically talk as far with 250 watts as you could on AM with 1,000 watts. That's a bit of an oversimplification, but was often cited as one of the big advantages of SSB [a second was that AM occupied ~6 KHz of spectrum and SSB only half that, and a third was that without carriers, hetrodynes from all the AM carriers would disappear from the ham bands, and they finally did].

SSB did not come on the scene to rave reviews and instant adoption however. Like all change, there were a few early "changers" and quite a few "very reluctant changers," and SSB sort of crept into ham radio slowly. You could receive it on the receivers of the day … BFO on, tune until you could understand it … but you had to turn the AF gain all the way up and use the RF gain to control the volume and thus you lost all AGC action. There were better ways to detect SSB and retain AGC, like product detectors, and newer equipment employed these changes. But the biggest impact of SSB on ham equipment was by far the advent of the transceiver – the singular "radio" my 23-year old QSO buddy was referring to. And, the real answer to his top-of-the-line radio question is undoubtedly the Collins KWM-2.

The concept of the transceiver, where you were guaranteed to transmit exactly where you were listening, solved a big

hindrance to the acceptance of SSB since doing that with a separate receiver and transmitter was more involved and difficult. And, in the KWM-2, Art Collins "went where no man had gone" in radio design. The "receiver" [i.e. what we think of when we tune a radio] covered 200 KHz from 2.955 to 3.155 MHz using an incredibly stable and linear oscillator [PTO]. That range was then hetrodyned to a 455 KHz IF where the miracle of the Collins mechanical filter did it's job, a balanced product detector produced audio, and it came out the phone jack.

200 KHz of tuning range wasn't much, and 2.955 to 3.155 MHz wasn't of much interest to hams, however. Art solved this little issue by putting a crystal controlled converter ahead of the "receiver." The converter hetrodyned any 200 KHz segment of the 3.4-30MHz spectrum to 2.955-3.155 MHz[2] where you then tuned across that segment with the "receiver." The transmit side just reversed the process. SSB, generated at 455 KHz was mixed up to the receive range, and then hetrodyned using the same crystal to the same frequency you were receiving. It was really a SSB radio, although it would generate CW by keying an audio tone feeding the SSB generator, much the way you generate PSK31 or RTTY today using the sound card in your computer. The KWM-2 sold for well over $1,000, which was a huge amount of money in those days, and the KWM-2A was the workhorse military HF radio in SE Asia in the 60's and early 70's.

The lower left-hand switch selected the crystal for the 200 KHz segment you wanted to operate. The crystals plugged into a board behind the switch. The top knob just to the left of the tuning dial tuned both the receive preselector and transmit exciter circuits, and the one to the right tuned the transmit power amplifier [a pair of 6146's]. Collins sold a power supply which included a speaker. They also made an outboard VFO [looked like a condensed version of the KWM-2] that would allow you to transceive on either the main or the outboard VFO, or operate split, transmitting on one and receiving on the other. The KWM–2A was identical to the -2 except it had a switch above the band switch that switched in a second board of crystals, and through a mechanical linkage, changed the legends on the band switch. Our maintenance depot troops would just leave the ham band crystals that came with it in the bottom board and put the rocks for our military frequencies in the top board. Thanks to this, I got 5 weeks or so on 20m CW as HS1FJ during a mission to Thailand our commander gave to us as sort of a respite from war.

Although it wasn't specifically ruggedized for the service we put it to, the KWM-2A was astoundingly sturdy. Maybe the best example involves the first 14 months or so that my team and I were in SE Asia. The US had begun clandestine bombing of North Vietnam in the first part of 1964, well before the so called Tonkin Gulf incident[3]. The USAF aircraft were based in Thailand and they needed navigation assistance crossing Laos and North Vietnam, and we and another team provided that using transportable TACANs. The mission plan was to jump onto mountain tops in NVN or Laos at night and set up a LAPES shock cable held up in the air on collapsible poles. The C-130 would then make a very low pass with the rear ramp down. Our equipment was packed on shock pallets tied together in a train, and riding on roller rails. A long tail hook hanging out the back from the end pallet would snag our cable,

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[2] Technically, 3.4-5.0 and 6.5-30 for the –2. The –2A covered the entire range.

[3] Late August 1964

and the aircraft would fly out from under the pallets. Instant-opening cargo parachutes would land them. We set up the equipment and ran until we ran out of JP4 for the 400 Hz turbine generators, anywhere from 10 – 15 days. We burned the equipment up with thermite and the Army or Marines would come get us in a couple of CH-3's ["Jolly Green Giants" although these giants were generally black].

Despite the shock absorbing pallets and the cargo chutes, you can likely imagine that the landing was still very hard, hard enough to disable an M60 machine gun a couple of times. We packed the tubes separately, we removed the rubber feet so the case could be strapped down flat on the pallet loads, and we blocked the tuning rack inside with cardboard. Other than that, they were "straight out of the box," so to speak. We ran 21 of these missions in maybe 14 months, Tom's team ran 20, and 82 KWM-2A's worked flawlessly, which blows me away.

I and two of my guys had ham licenses. Take just a moment, let your imagination run free, and see if you can get a feeling for how hard it was for three hams to light off the thermite and, two by two, reduce our 42 new KWM-2A's to slag puddles.

How would a KWM-2 stack up against today's radios? Well, I seriously doubt an ICOM IC-7800 [at $10K, it is in the same general inflation-adjusted price range as the KWM-2 in the late 50's] would survive a LAPES extraction without a whole lot of additional shock packing, and maybe not even then. Nor would my TS-850 or FT-847 [my K2 might but I'm not going to find out]. Performance wise, today's receivers would likely win, but maybe not by much. The KWM-2 was a vacuum tube rig, and tubes are inherently noisier than today's solid state devices. It had a remarkable blocking dynamic range comparable to the best receivers of today however. Incidentally, the Collins S-Line [75Sx/32Sx] was really just a KWM-2 split into a separate Tx and Rx. The two were tied together and offered the ability to operate separately or in a transceive mode. You'll still hear KWM-2's and S-Lines on the air, often in the evening on 75, and I worked a station using one in the Jan NAQP on SSB. The Jan QST carried an article on it. They had no memories, DSP, or all the other bells and whistles we are used to today, but they did their primary mission [being a SSB radio] supurbly. I sold my "S3 Line" many years ago. I wish I still had it.

73,

Fred K6DGW

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Doc, KG6YHH

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