

University of Florida Student Satellite Tracking Station

Recollections by Dick Flagg, edited for www.gatorradio.org

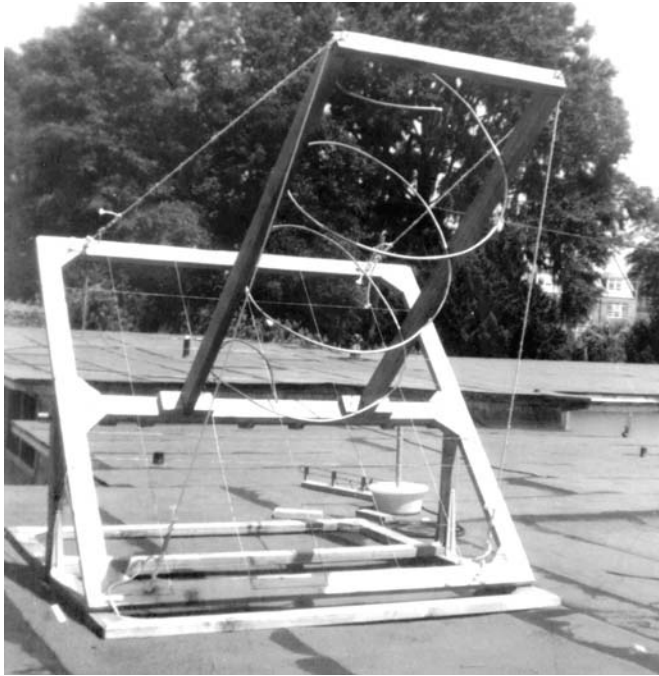
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The first formal organizational meeting for the tracking station took place in Professor Latour's classroom at the exact time that President Kennedy was shot.

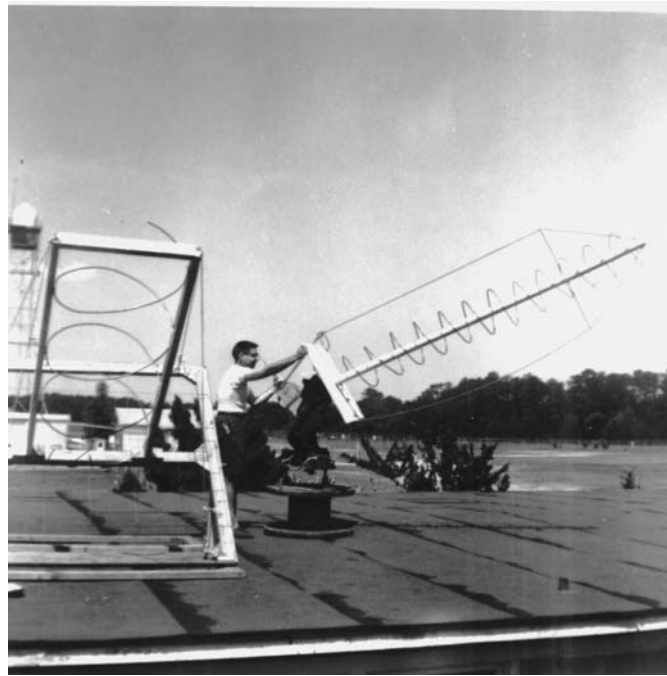
Our Faculty Sponsor was Professor M. H. Latour. He worked at the Cape summers and taught antennas (and many other courses) in the EE department at the University of Florida in Gainesville. Professor Latour was always very supportive of our efforts and often arranged for wonderful pieces of relatively new surplus gear to come our way. Students included Norm Kevers, Max Robinson, Bruce Blaze, Ralph Roth, Mario Guerrero, Alan Victor, Jim Bevel, Jerry, Dick Flagg, and others. Norm, Max, and Dick were the core group – with others joining in to help with various projects.

I built a 137 MHz nuvistor downconverter while working as a summer student at Patrick Air Force Base. This was built with the help of some RCA techs working in a satellite tracking station atop the Tech Lab. That was the summer I got shark bitten on the foot. So here I was at the end of the summer leaving the Tech Lab on crutches with my beautiful downconverter in the bottom of my briefcase. The guard at the door had the duty of checking the identity of everyone coming in and also made sure that no one going out was taking anything with them that wasn't supposed to leave the building. The guard usually did a thorough job of checking outgoing packages and briefcases but fortunately not that day – as I handed him the briefcase to hold as I hobbled out thru the heavy front door.

We mounted the downconverter and its power supply in a big steel box with blowers and took that to the top of a 120 ft radar tower. This was a surplus weather radar that was Professor Latour's pride and joy. The 137 MHz antenna was a quarter wave stub over a ground plane. There was an old Hallicrafters SX28 in the radar console but it was pretty flaky so I used my NC125 receiver. Norm Kevers scaled the radar tower and installed antennas and downconverter at the top. Norm also built the power supply and enclosure for the downconverter. As I recall he got so interested in it that he skipped more than a few classes that week.



VHF (136 MHz) helix



VHF helix, Max at the P-Band helix. The radar tower is on the left in the background

After some time we moved to a one-story WW2 temporary dorm that had been converted into office space. This building was located on what has become the parking lot for the "Swamp" – the huge Gator football stadium. Our new site was several hundred yards from the Radar tower and gave us lots more room. We put up several antennas on the large flat roof - a 137 MHz helix, a 20 m dipole, and a crossed baseline 137 MHz interferometer using dipoles. The baseline was laid out very late one night with a transit shooting Polaris. Campus police came and questioned us as to what we were doing running around on the roof at 3 AM.



136 MHz dipole - part of the crossed baseline interferometer



Up the pole - our ladder to the roof

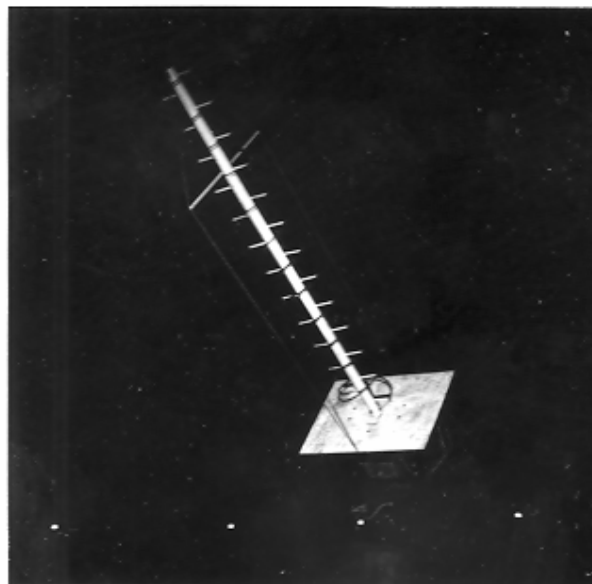
It was here that we copied [Morse code](#) and Russian voice from Vladimir Komarov on his Voskhod 1 flight in October 1964. Earlier that day I had heard HF signals from him in English sending greetings to the American people. This was out at the radio observatory at Biven's Arm – a couple of miles from the UF campus. During the day we put up the 20 MHz dipole at the tracking station on campus in preparation for an evening pass. Professor Latour came in and together we operated the station. There was an old 8 channel Brush stripchart recorder which was set up to display signal strength. Unfortunately the inking system was partially clogged up and we were having a terrible time getting it to write. This was where a piece of aquarium tubing came to the rescue. So there we are – [Russian voice](#) booming over the loudspeaker with Professor Latour blowing frantically thru the tube trying to keep the inking system pressurized long enough to get a good strip chart recording.

We won the engineering fair competition that year for the best student project. I still remember Norm at the blackboard explaining (in his best layman terms) the “out of roundness” of elliptical orbits to a crowd of eager and clearly impressed onlookers.

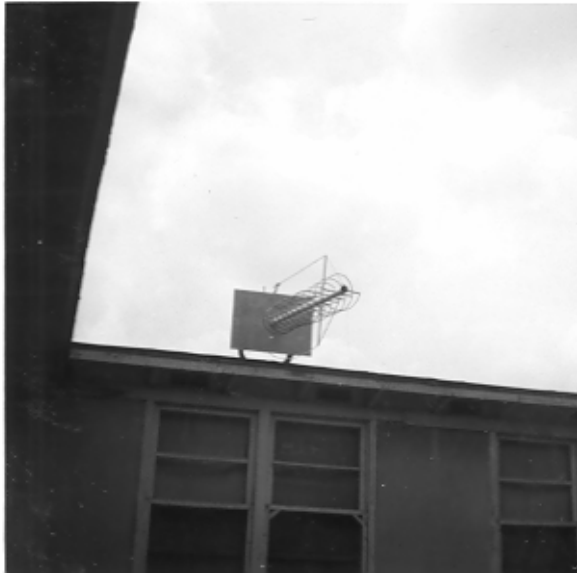
Jerry built up an SCR motor control for our steerable helix which was used for P-band telemetry (215-260 MHz) (listen to [Atlas FM/FM telemetry](#) and [ATDA telemetry](#)), and Gemini voice on 296 MHz ([listen to Gemini-9 here](#)). The downconverter was built in one night, right after final exams in June of 1965. We hoped to get it finished in time for the next day's launch of Gemini IV which would be highlighted by the first American spacewalk by Ed White. Unfortunately we never got it working till the next flight. It turned out there was a shorted capacitor which we didn't find till after the flight was over. I kept adding turns to an inductor trying to get the circuit to resonate but to no avail. Too tired to understand the problem.



Norm painting the helix.



Night shot of the P-band helix.



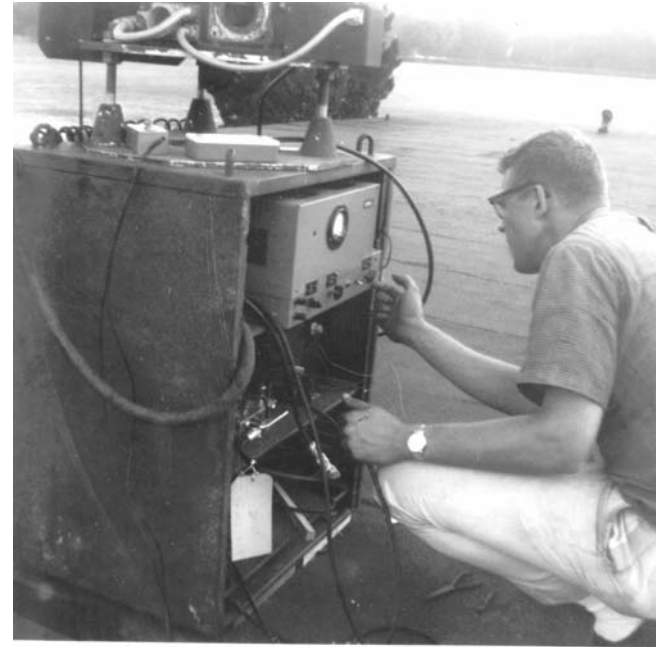
Looking toward the Cape – waiting for liftoff of a Gemini flight.



Final adjustments to the preamps.



Mario with P-band helix



Dick adjusting P-band preamps



Tracking console - Drake IIB receiver in center, HP608 on left

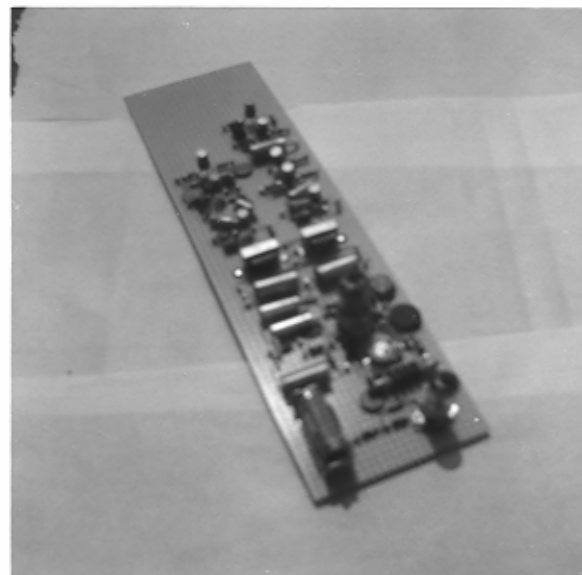


Tense moments during a Gemini flight. Dick and Ralph.

Max Robinson built a phase lock loop tracking filter and detector driving an XY plotter for measuring Doppler. Max had only 3% vision in one eye (and was blind in the other). We tracked several boosters on P-band using this and could even see staging on the Doppler plots. The PLL (called POLY) was built along the lines of a unit built by the SOHIO tracking station and described in QST. POLY also had a sweep feature which would scan over several tens of kHz and then lock up when a signal appeared - good for short bursts of Doppler shifted voice on Gemini.



Max's baby POLY – comes to life on a breadboard.



POLY, our phase-lock tracking filter and demodulator takes shape on vector board.

Jerry built a joystick controller for steering the helix which was on an old WW2 radar antenna mount. We wound the steerable helix very late one night. We dragged a torpedo shaped trash can out into the parking lot and I crouched precariously on top of it as Norm ran around in an ever decreasing spiral feeding out a spool of copper tubing which wound around the trash can. It is possible that beer was involved. Campus police came and questioned us as to what we were doing running around the parking lot at 3 AM.

After a year or so Professor Latour got a telemetry ground station for us surplus but the freekin thing was at least 10 racks of demods and synchronizers and we had quite a struggle to get any of it going. Jim Bevel finally succeeded in demodulating a data tape which we found in one of the drawers in the racks of telemetry equipment.

Then a bit later he came up with the Telstar command antenna from the Cape – this was a quad helix array on a big pedestal. The mount went to Biven's Arm (the radio astronomy observatory located a couple of miles south of the UF campus). Bruce Blaze and Alan Victor worked on getting it running – a huge undertaking. That antenna mount was fitted with P-band helices and was used to track one of the Saturn launches. Eventually the helices were removed and a 30 ft dish was mounted on that pedestal just in time for Apollo 17. My one and only experience with heliarcing came when I built the counterweight supports out of some very hefty aluminum channel. This antenna was used to track Apollo 17 at the moon as well as to monitor Soviet Lunar missions. We used a tunnel diode low noise amplifier at the feed for S-band. Tracking was imprecise at first and often involved one team member standing behind the dish waving their arms to indicate the direction to the moon. [Sven Grahn traveled from Sweden for the Apollo 17 launch and during his 3-week stay in Gainesville we \(and a gang from the physics and EE departments\) erected the dish and managed to copy voice signals from the crew in lunar orbit – “the barber pole is gray.”](#)

One memorable event with the dish – I was out working in the control van alone – doing some wiring on the azimuth control circuitry. Stupidly I got two wires reversed – hence creating a positive feedback loop on the speed control. When I punched on the azimuth motor drive the dish took off spinning and accelerated thru 90 degrees in just a few seconds. Thank God I was looking out the window at the time – and got it turned off before the dish spun off the pedestal and into the lake.

The antenna was also used for solar monitoring as part of the radio astronomy program. Jeff Jeffries (a student helper in the RA lab) equipped the control van with a high powered stereo. He would often bring young ladies out to Biven's Arm (to see the dish) and with floodlights on the dish he would slowly elevate it to the sounds of the 1812 Overture. Rumor has it that this ploy was hugely successful and Jeff would often come into work in the morning with a large grin on his face.

There was one final move of the satellite tracking station to Weil Hall – the main engineering building on campus at the time. Roof space was limited and we were all nearing graduation so the station (and all those racks of the telemetry system) were abandoned in place in a top floor room. The 30 ft dish and pedestal were stolen from Biven's Arm. Norm joined the Air Force and later became a Captain for Delta Airlines. Max worked for a year or so in Physics and Astronomy and then went to Western Kentucky to work in the EE department. I worked in Radio Astronomy for several years – then went with Pan American World Airways as a telemetry engineer at Patrick AFB. Norm, Max and Dick are all



Give a kid some wire and a soldering gun and look what you get.

enjoying our retirement years. Unfortunately time and circumstance have separated the rest of us and I no longer know where they are. I hope their memories of those years are as happy as mine are.

Thanks to Max and Norm for their recollections, corrections to my faulty recollections, and additional pictures.

Richard Flagg
Honolulu
September 10, 2007

Additional pictures



The Revere tape recorder to the left of the central console.



The station configuration was always evolving. Here we see two Drake receivers - one belonging to Max and the other to Dick. Also new equipment racks.



Max at the controls. Poly is in the top of the half-rack behind Max. The infamous Brush recorder in the center



Yet another configuration - Nems Clarke TM receiver and spectrum display in the center rack. Telemetry demodulation and display gear in the right hand rack.



Max and Norm - discussing plans for the P-band helix antenna.



Jerry in front of the Telstar antenna controller