



**THE RUSSIAN-AMERICAN
VLB EXPERIMENT**

Part II*

Ken Kellermann

Faced with the problem of 1) not being able to get enough local oscillator signal to the telescope focus, 2) losing our time synchronization, and 3) not being able to communicate with Green Bank by TWX, we had to make some quick decisions in order to be ready for the first observations, scheduled for September 30; this was the night of September 25.

The time problem solution seemed straightforward enough—someone had to carry the Swedish clock back to Leningrad and synchronize it with the NRAO clock that was still running (hopefully) at the Pulkova Observatory. Only in the USSR one does not just go to the airport and buy a ticket for Leningrad, particularly if you happen to be carrying an atomic clock (size about 4 x 2 x 1 feet, weight 150 pounds) with you. To make matters a bit worse, it was the end of the tourist season and the planes leaving the Crimea were booked solid. Matveyenko was assigned the task of somehow obtaining two return tickets from Crimea to Leningrad.

The communication problem was already being worked on. As soon as John had arrived in Crimea and learned that the TWX was not working, he began to put pressure on our hosts to get it fixed. Actually, a TWX machine had been installed and was operating. Only there were no lines from the Observatory to Yalta to handle TWX messages. The telephone was not much better.

About 50 percent of the words were unintelligible, and it was not surprising to find out that calls to "far off" Moscow (not to mention Green Bank, West Virginia) were nearly impossible.

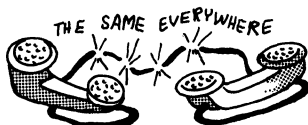
The man who was responsible for arranging the TWX was an assistant director of the Observatory (the local Ted Riffe). Unfortunately, he had been having some heart difficulties and had been sent to one of the local sanitariums to recuperate. Since he seemed to have played a critical role in the arrangements, John and Ivan Moiseyev went to the sanitarium to get some action. Upon arriving they learned that the poor man's electrocardiogram had gone off scale, to which Moiseyev replied that all he needed was a 10 dB pad, and he was hauled out of bed to negotiate with the telephone company. By the time I arrived on September 25, nothing had been accomplished, and on the morning of September 26 Matveyenko and Moiseyev put on their Sunday clothes and went to confront the phone company. For the next few weeks whenever either Matveyenko or Moiseyev showed up in their suit and tie, we knew it was time for another session with the phone company.

Nothing ever came of these deliberations, however, and we never did get the TWX working at the Observatory. Since it was only a few days from the first scheduled observations we thought it would be a good idea to telephone Green Bank and let them know we were still alive. Since the phone line to the Observatory was clearly marginal we called from our hotel in Yalta. The international operator stated that she would place the call at midnight. At 1 a.m. the phone rang—no answer; back to sleep. Half an hour later the same sequence. After a few such go arounds someone finally spoke to me and in a mixed broken English-Russian conversation we learned that the call would come through the following night. The following night, again after a few false starts, the message was "Amerika Nyet". The telephone lines were out of order, and it would be at least two weeks before we could call the U.S.A.

The only means of communication left was a telegram. At the telegraph office, I waited in a few lines, filled out a telegraph form, only to be

Continued, next page --

* Continued from January issue.



told it was the wrong form, and was handed a special form for international telegrams and was led to the international desk, where the "chief" spoke French (which was no help to me). She examined the telegram, looked in a big black book, and indicated she couldn't find Green Bank in her directory of U.S.A. "cities". It took a while to explain that Green Bank was not a major U.S. city and the telegram went off — or so we thought. Four days later the telegraph office called me at the hotel. They still wanted to know where Green Bank was.

Meanwhile, John was trying to get our 3 cm front-end installed and running on the telescope. Although there was an ample crew of local telescope mechanics, John was having considerable trouble getting them organized. They kept telling him that this was Russia, not America, and he should relax, have some Vodka, and not be in such a hurry. John was running around, tearing at his hair, mumbling "why didn't we bring Omar". Somehow, after three or four days they managed to get all six bolts in, to attach the receiver to the telescope.

Finding there was insufficient local oscillator signal reaching the mixer, Moiseyev remembered that there was another cable that might have lower loss going from the control building to the telescope a few hundred feet away. Since there was so little time remaining, John and I decided not to experiment with various cables but to move the VLB equipment over to the telescope. It took some courage to announce this decision, because the control room was on the second floor of the building, and it had taken the better part of a day to get the two heavy VLB racks installed. But our Russian friends took it in good spirit, and in order not to damage the equipment insisted on repacking everything in the crates. Unfortunately, the crates had been damaged in opening them up, and the better part of Friday morning (Sept. 26) was spent rebuilding the crates. Getting the crates down the stairs (which were only a few inches wider than

the crates) was a formidable task, but not nearly as difficult as trying to get them up to the operating room of the telescope structure which was about 15 feet above the ground, and accessible only via a narrow staircase. For this task a crane was summoned from the Crimean Astrophysical Observatory about 100 miles away. Even with the aid of the crane, access to the control room was blocked by a steel railing running around the whole telescope. This problem was easily solved with a hack saw, and the VLB equipment was ceremoniously hoisted into place in front of 15 to 20 spectators.

Meanwhile, Matveyenko and Kogan spent the day constructing a deluxe cardboard and wood box to carry a spare storage battery to provide extra power for the clock, sufficient for any reasonable emergency.

After a few hours sleep, the following morning I departed by car at 6 a.m. with Kogan and our rubidium clock to catch a 9 a.m. flight to Leningrad. The Swedish NiCd batteries had been recharged and were expected to be good for 10 hours. (Actually, when we got back to Green Bank and received a bill from Sweden for \$500 we found out that they were our batteries.) In addition, we carried a 50 ampere hour car battery in a deluxe box which provided about another 25 hours of safety. The plan was to fly to Leningrad, arriving about noon; have the afternoon to set the clock and recharge the batteries, and return on an evening flight to Crimea. Arriving at the airport we found that the plane was full and we would have to wait until 5 o'clock before leaving. Matveyenko then suggested that perhaps meanwhile we might like to visit a few museums and churches, which of course as he pointed out were as spectacular as the many museums and churches we had already seen in Moscow and Leningrad.

Just before plane time, the local "chief" at the airport (a rather formidable looking Russian "lady") wanted to know what was in our box, and why couldn't it go in the baggage compartment

Continued, next page --



and also "where was our personal luggage. " We tried to explain, carefully avoiding the use of the term "atomic clock" and had some difficulty in convincing her that we had no personal luggage because we were coming back in a few hours ! (Imagine a Russian trying to get on a flight from Miami to New York carrying a strange looking box (ticking, of course) with wires and batteries, and having only a voltmeter, pair of plyers, and a large screwdriver for luggage, and you get the picture.)

When we arrived in Leningrad at 8 p. m. it was cold and raining (it's always cold and raining in Leningrad) and we were greeted for the second time by Pariskii and his colleagues. Unfortunately, he explained there was some confusion about when we would arrive (not too surprising), and there was no car to take us to the Observatory. After getting a good soaking in the rain, we finally hailed a taxi (about the same whoever-gets-to-the-door-first priority as here); and at Pulkova we resynchronized the clock, charged the batteries, and were ready to return to Crimea. Unfortunately, being the end of the tourist season, not very many people were flying to Crimea this particular Saturday night and so to save some rubles, Aeroflot had cancelled our return flight.

The rooms at the Observatory dormitory were all occupied, but I was shown to a room that had an "extra bed" and sacked out for a few hours to wait for our flight which was now scheduled for 10 a. m. I guess the occupant of the room was a bit surprised the following morning to find he had a "roommate". (Again, for comparison, imagine waking up one morning in the Green Bank dormitory to find a Russian who can't speak English sleeping in your room.)

I tried a few words of greeting and quickly departed. About this time my friend Kogan reappeared as mysteriously as he had disappeared the night before. We were given some breakfast and told to wait for the driver to take us to the airport. The driver showed up soon enough but apparently

couldn't find the (VW type) van to take us to the airport. A sedan-type car finally showed up at the last minute. There then followed a "small discussion" on whether the "clock" would fit into the car. Someone got the brilliant idea that if the spare tire were removed the clock would fit into the trunk. But the driver objected, because we might get a flat on the way to the airport (about 5 miles away). I argued that it was already so late that if we had a flat we would miss the plane anyway, even if we had a spare. This "decided the question" and for the second time Pariskii and his group said good-by, wished us luck, and we departed for the airport and Crimea.

Halfway to the airport I remembered I had forgotten my Simpson voltmeter. A quick calculation (including a reasonable estimate of how late the plane would be) indicated that we had time to return to the Observatory and collect the meter. The send off party had not yet disbursed and so we received yet another send off and round of "good luck wishes".

This time we made it to the airport, only to find that there was a mistake on our ticket, and that actually the plane would leave at 11 o'clock, not 10 o'clock. Just to be safe I suggested that since we had to wait an hour we should plug the clock in and not drain the batteries. Upon opening the box to get the power cord, we found that the clock had stopped again! This time the batteries had lasted less than one hour. We consoled ourselves that after all it could have been worse and that it was fortunate that the plane had not left as expected.

It was easy enough to cancel our flight, but a major problem to book a new flight. In Russia you can't buy airplane tickets at the airport, only at your hotel or at the Aeroflot ticket office in Leningrad. However, we were not staying at a hotel and, in fact, I wasn't supposed to be overnight in Leningrad at all, but we had all long ceased caring about details like travel restrictions. Also, as I mentioned before, you usually

TITLE
 THE RUSSIAN-AMERICAN
 INTERNATIONAL CLOCK TEST

Continued, next page --

have to make reservations at least three or four days in advance. To further complicate the situation, it was Sunday, and in Russia no one works on Sunday, including the airline ticket office. Nevertheless, I told Kogan to go into Leningrad and get us a ticket for an afternoon flight while I went back to the Observatory to "reorganize" the clock and batteries. (I was beginning to have blind faith in my Russian colleagues' ability to overcome all bureaucratic obstacles.)

Arriving back at the Observatory I was again greeted by Pariskii, whom I was sure by this time was getting tired of seeing me keep returning to the Observatory.

It was becoming increasingly clear that we were doing something wrong with the batteries. Someone suggested that maybe they were being charged backward, and perhaps the Russian definition of + and - was not the same as the American (or Swedish as the case may be) definition. The discussion then degenerated into the difference between "electrical" + and "physical" + and electrons and holes, etc., which was clearly all nonsense.

We later realized that our problem was that each night the line voltage which was nominally 230 volts would drop to about 190 volts and slowly discharge the NiCd batteries which were attached to run the clock in case of power failure. Since NiCd batteries were sealed there was no way to measure the state of charge until the terminal voltage began to drop, which occurred only as the batteries were nearly discharged.

Just to be safe, we abandoned the Swedish clock and batteries at the Observatory and packaged the NRAO clock and 50 ampere hour car battery for reserve. Although this increased the size and weight of our "portable clock", we figured we had enough reserve now to make it back to Crimea.

Kogan had telephoned that he had managed to get us two plane tickets for a 4 o'clock flight and that he would meet me at the airport before flight

time. Following another big send off and round of handshakes and good wishes, we departed once again for Leningrad airport. Only we could not find Kogan who was supposed to handle the arrangements for getting the clock on the airplane. He finally showed up at the last minute and explained that the bus he was riding on had a flat and he had to wait for another bus.

This time we didn't take any chances on the batteries running out and during the 3-hour flight Kogan and I took turns every 15 minutes running to the rear of the plane to check the batteries with our voltmeter. In order not to look too conspicuous, I pretended each time to be going to the toilet, but after a few sessions realized that that was even more suspicious looking.

We made it to Crimea and managed to transfer everything to the car without mishap. Toward the end of the plane ride the NiCd batteries had begun to fail and we switched over to the auto battery which we were carrying. Half-way during the car trip to the Observatory this too began to run down and we had to go over to the battery that was running the car. With this we made it to the Observatory and got the clock attached to the 230 (more or less) V AC. Moiseyev handed us a pair of wires which he said went to a 100 ampere hour, 28 V DC supply, deep in the basement of the telescope. After hooking up this "emergency" supply in case of power failure, we went off for a badly needed meal. All we had had to eat since breakfast was the usual Aeroflot "dinner" consisting of a crust of bread, an apple and some luke warm tea.

The next morning we found that our 28 V DC emergency supply had dropped to 22 V and so of course had discharged the "ultimate" 28 V 15 minute internal reserve battery. This was a very dangerous situation indeed since even a momentary power failure would mean disaster. We managed to get a good battery hooked up and Kogan was directed under threat of exile to Siberia to see to it that the batteries were

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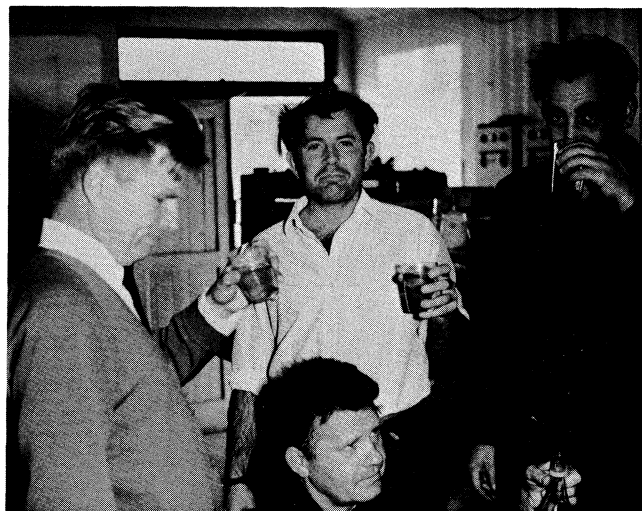
always kept charged for the rest of the experiment.

The following day (Monday) we were making some last minute system checks when it was announced that there was a telephone call from Green Bank. It was Mike Balister; we each yelled into our respective telephones for a while (sometimes alternately, sometimes simultaneously) trying to communicate, but without much success. Russian telephones make the GB-CV tie lines sound like a high-fi set. After about 10 minutes of this nonsense, Mike asked to speak to Ken Kellermann. He thought he had been talking to John Payne. I found it hard to believe that I could really be mistaken for John, until a few weeks later when I was handed the phone and told "Green Bank". The noise at the other end said, "This is Howard." and thinking I was talking to William E. Howard III, I proceeded to transmit some information about our return trip—visas, etc., which obviously were not being understood at the other end. I later realized that I had been talking to Howard Brown at the 140'.

About all I learned from Mike was that they were ready to observe the following day, and that he would try to call again. Mike also gave me some numbers relating to the error in the time transmissions from the Loran C station in Turkey, but I could not understand what the numbers meant. The same numbers were sent to us by telegram with small changes every few days for the next few weeks and did little but add to my confusion. Finally, after two weeks of trying to figure out what it was all about, a letter arrived from Barry Clark, which he had mailed a month earlier, containing a nominal ephemeris for the true transmissions. Realizing that the many telegrams and letters were giving just the corrections to this nominal ephemeris, I made a quick calculation and was delighted to find that the time derived from the Loran transmissions agreed with the time we imported from Sweden to within $\pm 10 \mu\text{sec}$. This was really a remarkable achievement because we later

realized that I had forgotten what day it was and had calculated the time for the previous day. This was fortunately cancelled by an error of 1 day that Barry made in computing the ephemeris.

The first observations were planned just as a test for the main run two weeks later. The plan was to run a few tapes on 3C 273 and 3C 454.3, the two strongest sources at 3 cm. The run on 3C 454.3, unfortunately, came about 3 a.m. local time in Crimea. So when it was finished John and I looked about for a ride back to our hotel and some badly needed sleep. We found our Russian colleagues upstairs breaking open the Vodka, Cognac, and the little square bottle of "Spirits". After completing 2 percent of the scheduled observing it was clearly time for a celebration. Following two hours of eating, drinking, and declarations of Soviet-American friendship and cooperation (see photo) we were finally taken to our hotel.



The following morning (late) we were met by Moiseyev, had a leisurely lunch, after which we were told "oh by the way" a telegram arrived this morning. It was from Barry. The frequency

Continued, next page --

had been set wrong at Green Bank and he wanted to repeat the run on 3C 273 in about two hours. Although we had left instructions at the Observatory to remove the 3 cm receiver and put up the 6 cm one in preparation for the next run, the telescope crew fortunately had declared a holiday and were still celebrating. We made a quick trip out to the Observatory, arriving with about an hour to spare. John and I were a bit dismayed to find the telescope locked, and no one seemed to know the whereabouts of the key. But Moiseyev finally arrived to open the door and we managed to run the tapes on time.

The plan was to immediately return the tapes to NRAO for processing before the next run two weeks later. Considering that it usually took from a few weeks to a few months to get tapes back from reasonably accessible places like Puerto Rico, Sweden, or California, this might be thought to be wishful thinking. But it had all been carefully arranged in advance. Immediately following the second 3C 273 run, the tapes were quickly packed up and driven to Yalta, where Vitkevich was waiting to leave for Moscow — there he would deliver the tapes to the foreign office of the Soviet Academy of Sciences where they would be collected by a driver from the U.S. Embassy, who would bring them to the U.S. Scientific Attache at the embassy who would then give them to a returning American "geologist" who was flying to Washington that afternoon. Having been alerted by the State Department, Barry would be at Washington to collect the tapes when they arrived. It seemed like a "sure fire" scheme and we could relax until the next run, scheduled for two weeks later. Actually, our real troubles hadn't started yet; but more about that next issue.

(To be continued in the May issue.)

Any rural mother can state her role sardonically enough in a sentence: it is to deliver children—obstetrically once and by car forever after.

A SHADY ANNOUNCEMENT

Jon Spargo

Rumor has it that Millman, the moon god, will attempt revenge on Earthlings for stealing his rocks by shutting off the sun on March 7, 1970. Millman informs us that the beginning of this truly amazing feat will occur at roughly 1004 EST, with the real fireworks scheduled for about 1303 EST. However, skeptics claim that he will not succeed and that by 1511 EST it will be all over.

If, with the aid of a telescope, you would like to witness Millman's attempt, otherwise known as a solar eclipse, you are cordially invited during the previously stated times to join the fun (weather permitting) at a choice location in my back yard on Pine Grove Road. Don't forget to bring your camera. Millman will appreciate the publicity.

P.S. I suggest that your camera be of the type capable of focusing at 12-18 inches. I also suggest black and white film with a medium ASA rating. Filters optional.

GRANDPARENTS

Beaty and Jamie Sheets. Their daughter, Becky, and husband John O'Brien are the proud parents of Christopher Shawn born January 20.

Sis and James Michael. Their daughter, Jane Kay, and husband Gene Kirk are the proud parents of Christopher Michael born February 8.

