THE KF6XA TO W3NRG 10 METER PROPNET EXPERIMENT
COMPARISON OF SUMMER VERSUS WINTER PROFILES
SIX METER PATH ALSO CONFIRMED

Ed Sack, W3NRG
Member, Tucson Amateur Packet Radio Corporation
1780 Avenida del Mundo, #404
Coronado, CA 92118-4011
esack@pacbell.net

Abstract

As an active member of the PropNET system, W3NRG has recorded thousands of ten meter transmissions from fellow PropNET participant, KF6XA over the past four years. What makes these measurements interesting is that the path between the stations would not usually be considered "consistently viable" for 10-meter communications. A model for the transmission path has been proposed and winter and summer reception profiles compared. Recently, KF6XA and W3NRG have been able to show that the path is also viable on 6 meters, in verification of World War II research in the same area.

Introduction

An "unusual" 10 meter propagation condition has been documented in the collection of over four years of data using the PropNET system.[1] Thousands of automated ID's transmitted by KF6XA and received by W3NRG provide further evidence to support an explanation for this phenomenon as it was first observed during World War II.[2,4]

CONSISTENT RECEPTION

In an article published in the June 2002 issue of QST we reported on consistent reception of 10 meter KF6XA PropNET transmissions at W3NRG.[3] That reception was "unusual" in that these stations in Southern California are 63 miles apart and there are several hills in the path that are higher than the elevation of either station. A map and an elevation diagram of the path were included in the QST article.

When we say "consistent" we mean that confirmed reception occurs year round and at all hours of the day and night. However, the profile of the reception is very different in the winter than in the summer months.

In an article published in the Proceedings of the 22nd ARRL and TAPR Digital Communications Conference, it was noted that this unusual propagation condition had been observed by Burroughs and Attwood who were conducting HF and VHF propagation experiments over a similar path in Southern California during World War II.[5] They attributed the propagation to a sharp transition layer between colder surface air (colder due to the cooling effect of the Pacific Ocean in the San Diego area) and a warmer layer at a few thousand feet above sea level (warmer due to the heating effect of the sun.) Figure 1 is a suggested depiction of the path as we interpret their explanation.

We then added further observations concerning this propagation in an article published in the Proceedings of the 23rd ARRL and TAPR Digital Communications Conference citing various experiments conducted by KF6XA and W3NRG to identify the effects of noise and terrain on the observed data.[6]

The two stations use similar transceivers and antennas. Each transmits a PSK31 PropNET-formatted signal 8 times per hour. Only "captures" by W3NRG of the KF6XA ID which pass a CRC (cyclical redundancy check) test are counted. These captures are logged each day and summarized in a profile chart of the captures versus Pacific Standard Time for both the absolute data and data normalized to that hour for that particular month when the maximum number of captures are recorded.

DIFFERENCES IN THE SUMMER AND WINTER DAILY PROFILES

The hourly profiles of the captures are significantly different in the summer months than in the winter months. Figure 2 shows the data for the months of July and August 2002, 2003 and 2004 versus the data for the months of January and February of 2003, 2004 and 2005. The number of captures in the "daylight hours" during the winter months falls much more steeply than in the same hours during the summer months.

If the model proposed by Figure 1 has validity, then one would conclude from this data that either the delineation of the cold air - warm air boundary shows a greater change in the winter months OR the height above sea level of the boundary changes more dramatically during the winter months. If the model is valid, the height above sea level of the boundary could effect the refraction of the KF6XA signal into the W3NRG antenna.

The Pacific Ocean has a major influence on the surface air temperature some distance inland from the San Diego beach areas. The ocean warms and cools very slowly between the summer and the winter months. The effect of the water is to moderate lower level air temperature in the vicinity of the ocean shore not letting it rise as much as it does further inland in the summer and not letting it drop as far as it does inland during the winter.

At higher elevations, the warming effect of the sun has a greater influence on the temperature of the air than it does at the surface where the ocean temperature exercises greater control. One can, therefore, hypothesize that the warming effect of the sun versus the cooling effect of the ocean has an important effect on either the sharpness of the cool air - warm air boundary OR the height of that boundary above sea level. While it is "sheer guess" on his part, the author tends to believe that it is the influence of the height of the boundary rather than the sharpness of the delineation that we are seeing in the data.

As might be expected from the profiles in Figure 2, the absolute number of “catches” of KF6XA transmissions by W3NRG is much higher in aggregate for the two "summer" months than for the two "winter" months. The sum total for the summer months 2002 through 2004 is 11,223 while the sum total for the winter months 2003 through 2005 is 5494. The summer month average for the three-year period is 61.3 per day or 32% of the available transmissions. The winter month average for the three-year period is 31 per day or 16% of the available transmissions. One must recognize, however, that one or the other of the two stations was shut down for one to two week vacation periods in some of the winter months as well as some of the summer months. For this reason, we believe that the relative number of captures is a better indicator of the propagation by season than the absolute number.

IS THE "UNUSUAL" PROPAGATION ALSO PRESENT AT VHF?

The World War II experimenters reported measurement of the San Diego propagation phenomenon at VHF frequencies as well as HF. Recently, KF6XA and W3NRG were able to gather approximately ten day's worth of PropNET PSK31 data on 50.291 MHz. Figure 3 shows the normalized hourly profile of the W3NRG catches of KF6XA'S six meter transmissions for the period June 6 through 16, 2005. (The data in Figure 3 between 1600 and 2300 should be ignored. KF6XA had to turn his transmitter off during those hours due to a local TVI issue.)

Ideally, we would have been able to continue to record our regular 10-meter data simultaneous with the 6-meter experiment. However, equipment availability made that impractical at the time. As an alternative, Figure 4 shows the normalized hourly profile of the W3NRG catches of KF6XA's ten-meter transmissions for the period June 17 through June 30, 2005.

The very best that can be said at this early date about the comparison of Figure 3 and Figure 4 is that they are different. That is not all that surprising. Two weeks of 6-meter data compared with two weeks of 10 meter data does not provide anything like the statistics we will need to accumulate before making serious observations about the profile of the daily captures. Extended periods of data accumulation help to reduce the effects of local interference or equipment down times. Hopefully, the experimenters will be able to accumulate the equipment to carry out their 6 and 10-meter propagation profile experiments simultaneously. Being able to show a year of simultaneous capture data on the two bands would add significantly to a comparison of the 6 and 10-meter profiles.

NON-RECIPROCAL RESULTS

Whereas the number of ten-meter captures by KF6XA of W3NRG's transmissions has always been far less than the other way around, the limited amount of data recorded for six meters appears to be far more "reciprocal." In fact, KF6XA appeared to receive W3NRG's 6-meter PropNET transmissions at a rate higher then W3NRG recorded KF6XA. Figure 5 shows the KF6XA captures of W3NRG 6 meter PropNET transmissions during the period June 8-12, 2005. (We chose that period because KF6XA was able to leave his receiver on around the clock on those days even though he had to cease transmitting during the evening hours.)

We need to be careful not to read too much into this without further research since we have never fully understood the very non-reciprocal data we have reported for 10 meters.[6] Further, the transceivers, computers and antennas employed on six meters were different than those utilized on 10 meters. As with the question of the profile of the captures noted earlier, being able to collect 6 and 10 meter data around the clock for an extended period of time would add significantly to our understanding.

OTHER "UNUSUAL PAIRS."

As the number of participants in the PropNET program has increased, we have been watching for other station "pairs" which exhibit consistent beacon captures over distances or terrains that would not normally be expected to support 10-meter propagation. Recently we have noticed that W3GYK (grid location EM85vf) is showing a consistency in his daily captures of N4PSN (grid location EM84mo) that is similar to that seen between KF6XA and W3NRG. These two stations are approximately 60 miles apart and are separated by terrain that is somewhat similar to that which separates KF6XA and W3NRG. W3GYK is at 1120 feet above sea level and N4PSN is at 945 feet above sea level. However, N4PSN

is not located close to a large, cold body of water so it seems unlikely that there the model of Figure 1 is directly applicable.

VALUE OF THE PropNET SYSTEM

The K4HG web site: "http://propnet.findu.com/catch.cgi?last=24" provides an excellent overview of the daily captures between the two dozen or more domestic stations which participate in the 10-meter PropNET activity. Another feature of this web site found at location: "http://propnet.findu.com/yesterday.gif" provides a dynamic view of the formation and recession of propagation paths over a 24-hour period.

Figure 6 shows a typical 24-hour "findu" web site map of PropNET system activity. Stations reporting confirmed 10-meter reception are shown at the end of the black lines connecting them. (The map does not indicate whether the reception was two way or one way; that information is provided in the log of the contacts which is provided on the web site below the map.)

Some stations are set up for dual band activity. As example, in this period, W3NRG was participating on both 10 meters and 15 meters. The 15-meter reception reports are indicated by blue lines. It is apparent that during this period, propagation favored eastern area communications on 10 meters and the only transcontinental propagation reported for west coast station W3NRG was on 15 meters.

While it is natural to view the PropNET system as a vehicle for DX propagation alert, the author has often noted that the "discipline" inherent in the PropNET activity provides an opportunity for path and mode data collection which supplements the semi-anecdotal conclusions we arrive at in our regular ham radio activity. The fact that many of the PropNET stations have equipment devoted to the activity 24/7/365 provides a "stable base" for data collection. The fact that most of the stations are using similar transceivers and antennas adds another degree of stability. The fact that PropNET reporting is now "automated" thanks to the addition of an Internet-based data-collection server that feeds an Internet-based charting system (PropNET.findU.com) makes data accumulation and visualization easy and fun.

We believe that the PropNET system has evolved into a powerful vehicle for band and mode experimentation and invite more stations to join in the fun.

References

1. 1. "BEACONet" by Ev Tupis, W2EV, QST, May 2002, p38.

2. "Radio Wave Propagation, Consolidated Summary Technical Report of the Committee on Propagation of the National Defense Research Committee," Charles R. Burrows, Chair. Academic Press Inc. 1949

3. "Collecting Propagation Data on 10 Meters using BEACONet^31," by Ed Sack, W3NRG, QST June 2002, pages 37-39

4. "New Old Data on Beaconet^31," by Ed Sack, W3NRG, Technical Correspondence, QST September 2003, page 74.

5. "Southern California Coastal Propagation Phenomenon," by Ed Sack, W3NRG, Proceedings of the 22nd ARRL and TAPR Digital Communications Conference, pages 198-205.

6. "Continuing the KF6XA/W3NRG PropNET Experiment - Non-Reciprocal Beacon Capture," by Ed Sack, W3NRG, Proceedings of the 23rd ARRL and TAPR Digital Communications Conference, pages 135-138.

SAN DIEGO EFFECT AS SUGGESTED BY WW II STUDY

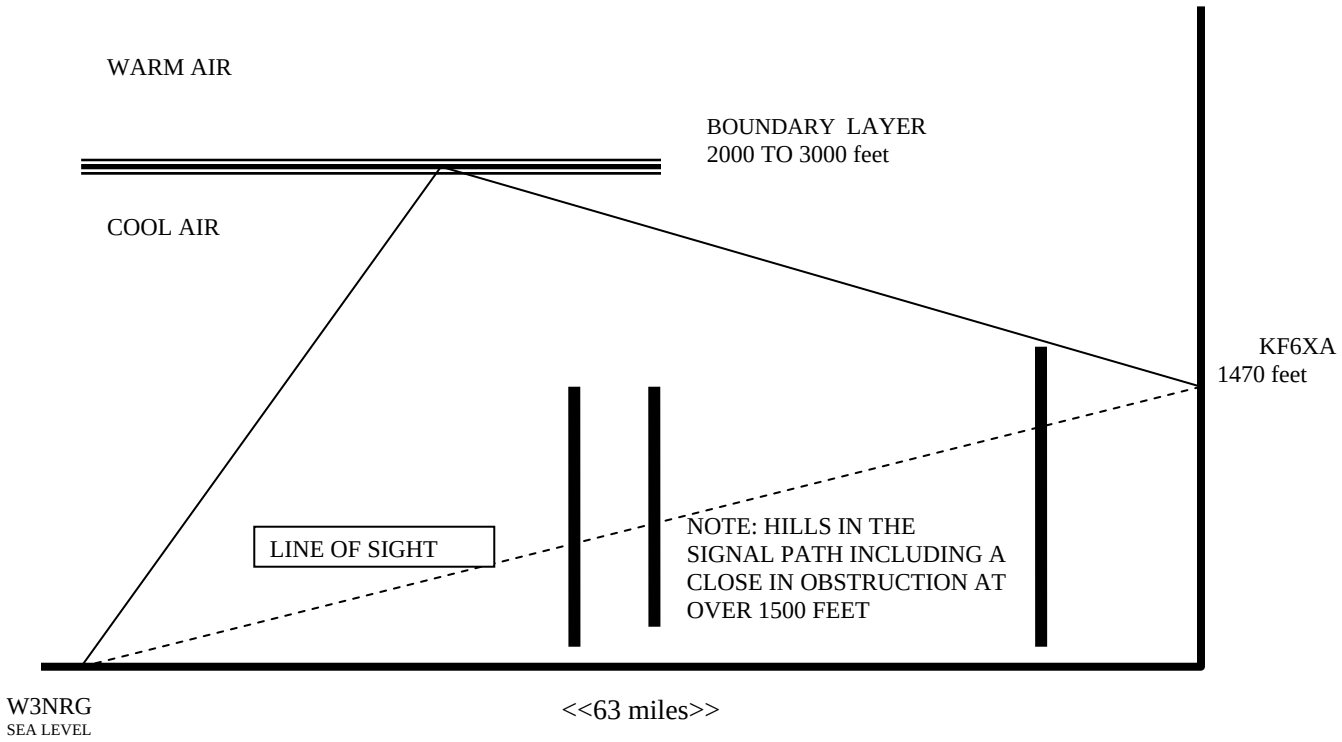
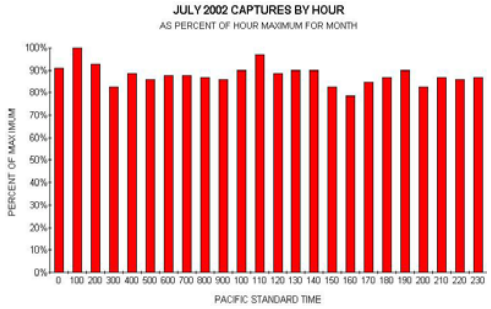
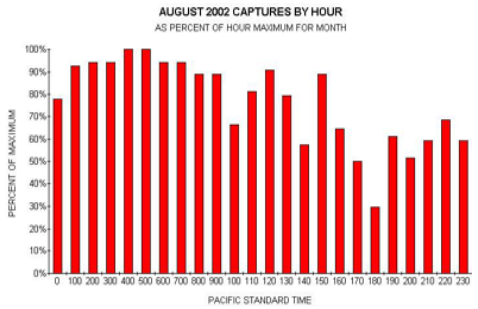
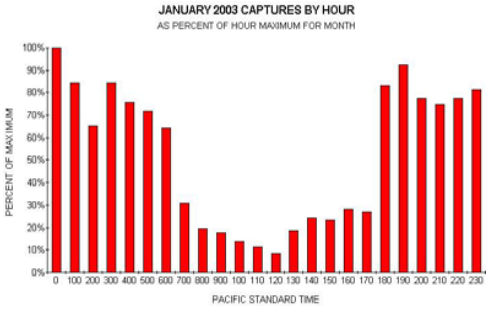
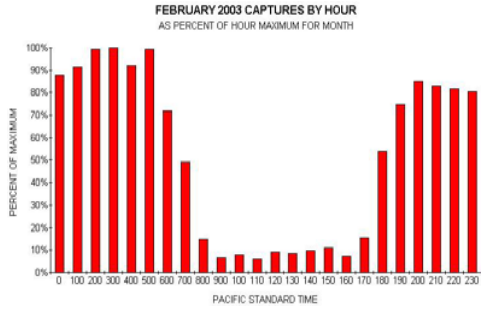


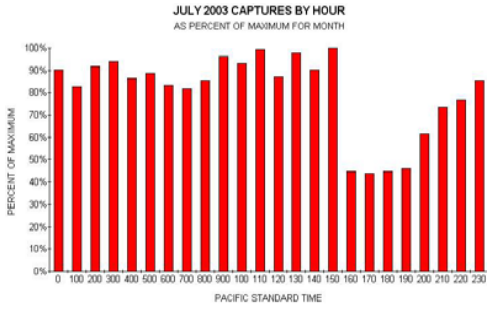
Figure 1. Suggested Model for KF6XA to W3NRG Beacon Propagation

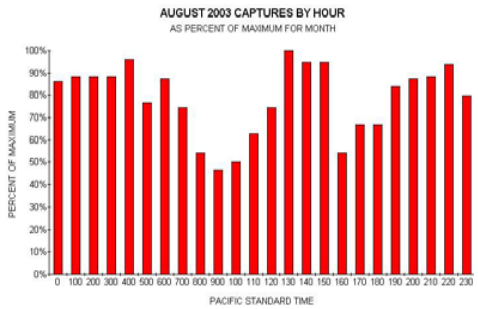


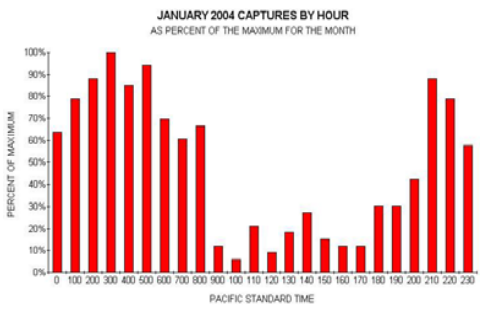


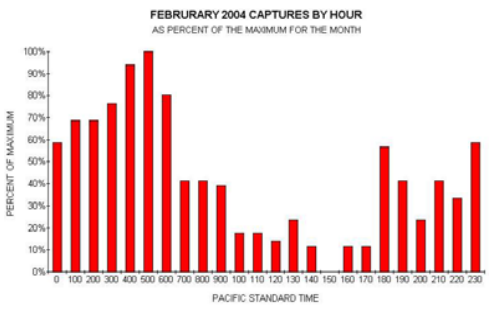


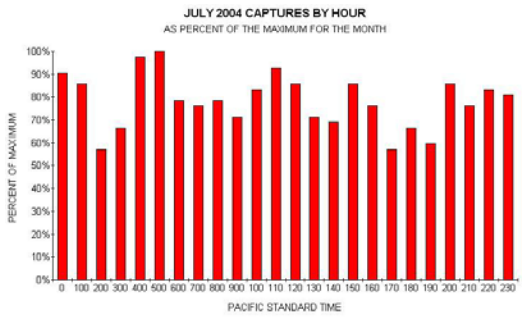


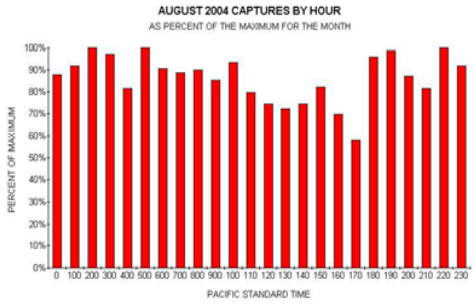


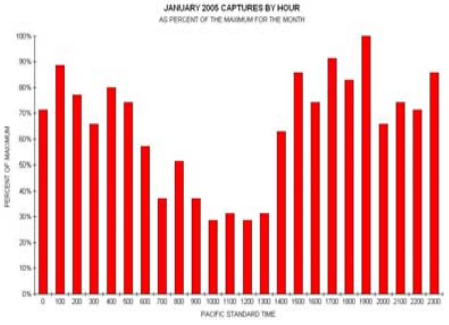


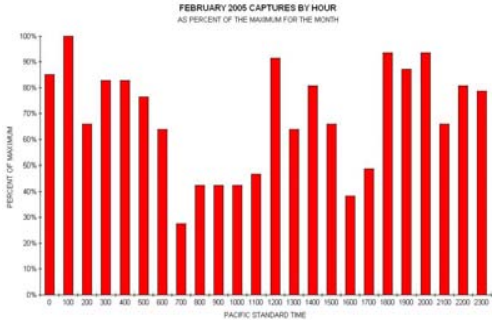












SUMMER PERIOD

WINTER PERIOD

Figure 2. Comparison of Summer and Winter PropNET Beacon Capture Profiles for KF6XA Reception at W3NRG

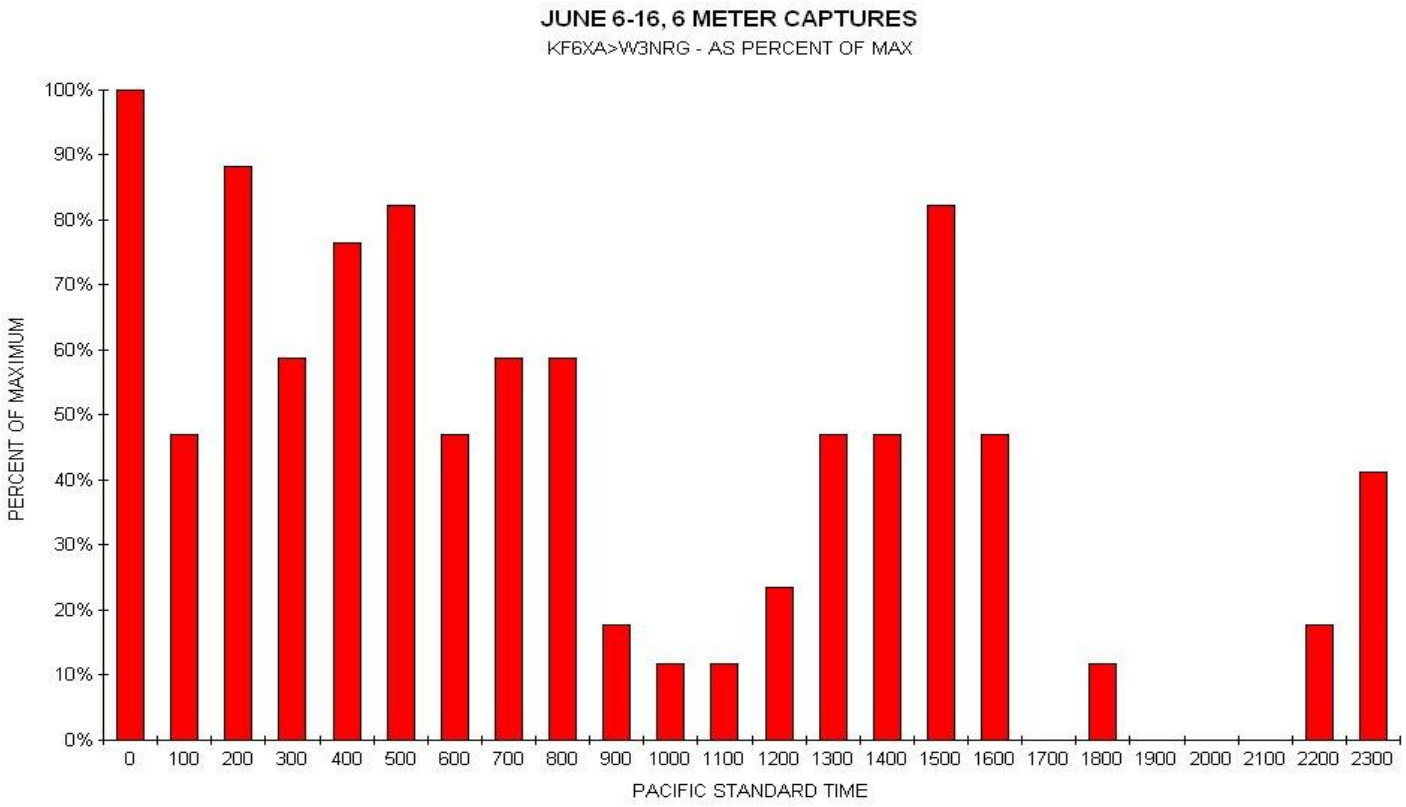


Figure 3. Normalized Hourly Profile of the W3NRG Catches of KF6XA's Six Meter Transmissions

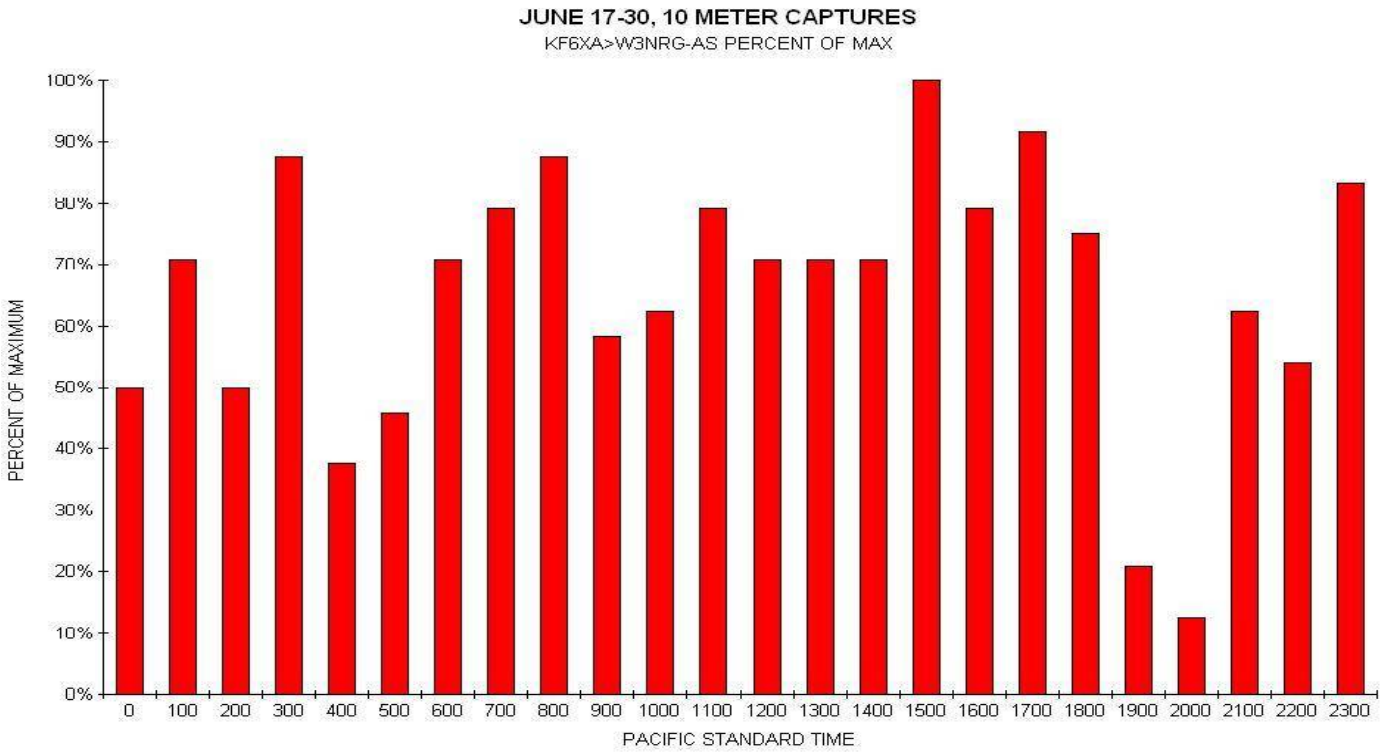


Figure 4. Normalized Hourly Profile of W3NRG Catches of KF6XA's Ten Meter Transmissions

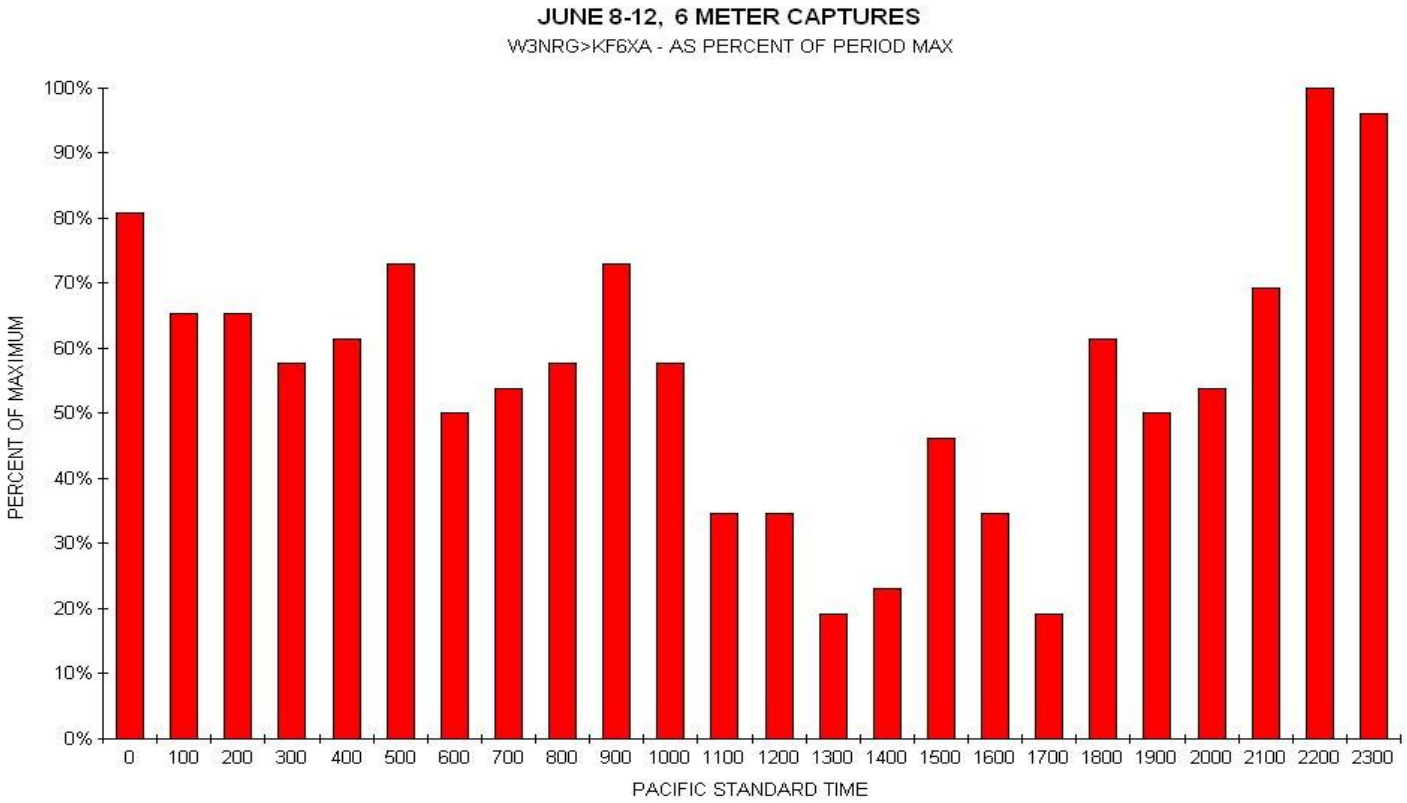


Figure 5. . Normalized Hourly Profile of the KF6XA Catches of W3NRG's Six Meter Transmissions

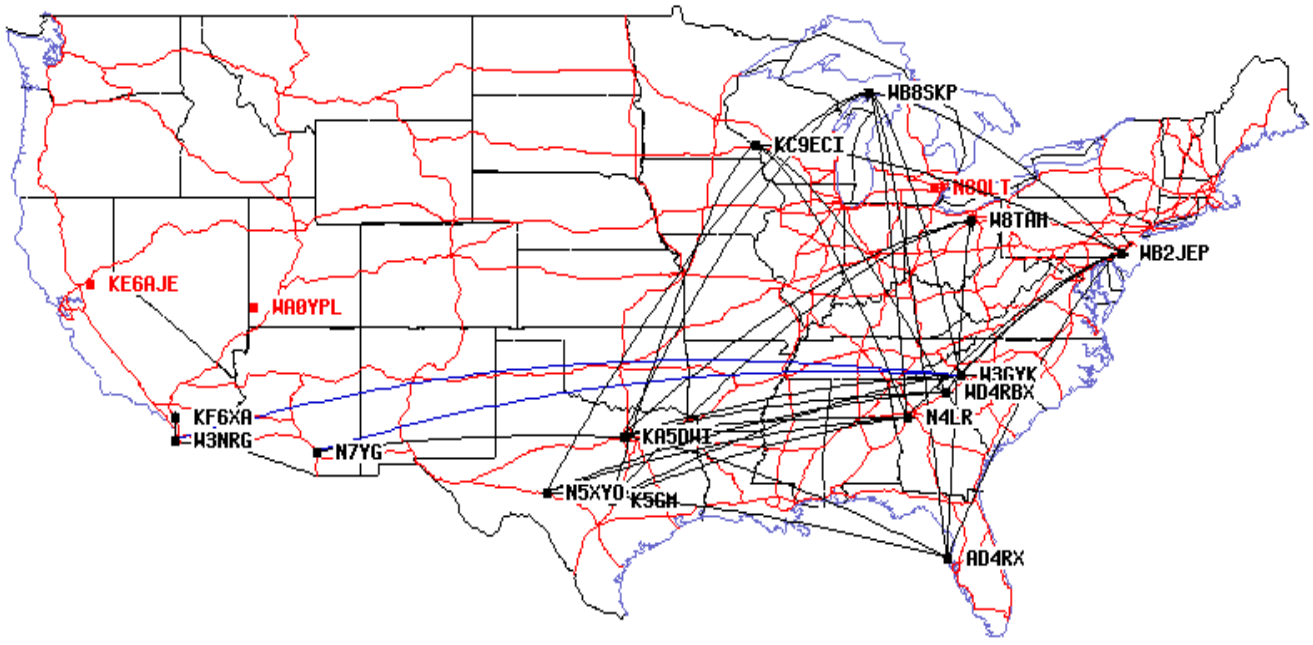


Figure 6. Findu/Livex Map of PropNET Confirmed Reports for July 5, 2005
Black Lines - 10 meters Blue Lines - 15 meters

BIOGRAPHICAL PAGE

Ed Sack, W3NRG
Member ARRL and TAPR
1780 Avenida del Mundo
#404
Coronado, CA 92118-4011
esack@pacbell.net

Ed Sack, W3NRG, has been a licensed radio amateur since just after World War II. After graduating from Carnegie Mellon University in 1954 with a PhD in Electrical Engineering he began work at the Westinghouse Research Laboratories in the areas of television display and solid-state electronics.

Ed has held executive positions with the Westinghouse Corporation, the General Instrument Corporation and was the Board Chairman and CEO of Zilog, Inc. before his retirement in 1998. He is the author of over 40 technical papers and articles including his prediction of "Computers on a Chip" in an IEEE paper published in December 1964.