Tips for Successful 6m EME DXpeditions

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INTRODUCTION

With the continued reduction in solar cycle activity, the prospect for terrestrial ionospheric propagation on 50 MHz from higher latitudes outside the "TEP Zone" has declined dramatically. This has stimulated many serious 6m DXers to consider a new approach for contacting distant lands on the "Magic Band". Until 2002, it was virtually impossible to complete a 6m contact with a DXpedition to a rare DXCC or portable station using the moon. However, thanks to the very substantial increase in sensitivity afforded by K1JT's digital mode of JT65A, EME (Earth-Moon-Earth) contacts between single yagi stations on the 6m band are now possible. Not surprisingly, JT65A quickly became the worldwide standard mode for communications on 6m EME.

The popularity of JT65A mode on the HF bands and the inclusion of 50 MHz and digital mode capability in so much new commercially available equipment also contribute to the increase in operators capable of operating JT65A mode on 6m. As a result, we are seeing a growth in the number of large 6m stations around the world to facilitate working DX via EME through the use of this revolutionary weak signal mode.

Certainly, if you are a DXpeditioner interested primarily in large numbers of contacts with the simplest equipment, HF is a much more productive option. However, if you enjoy the challenge as well as the reward in overcoming the odds and completing contacts by sending your signals a half million miles for each contact, then you are just the type of DXer for 6m EME! I have always thought of EME DXing as having much in common with fly fishing. If your primary interest were to obtain large numbers of fish, you could haul a net behind a motorboat, or even just drive to the fish market and fill up your cooler. However, if you were more interested in relying on yourself, in a way that will require all your skill and cunning, and interacting with nature, then fly fishing will be more thrilling and rewarding - even if some get away!

Like fly fishing, in EME it is the challenge of the adventure and the process - plus the thrill of actually landing one - that makes it so rewarding! And of course another reason it becomes an attractive option for many of us is the fact that, for many distant spots halfway around the earth, EME is the only way to make a contact on 6m nowadays!

Details on JT65A mode, how it works and how to set it up for EME are covered elsewhere and will not be discussed in detail here. Instead, on my 50th anniversary year of being a VHF DXer and also on the 50th anniversary of the Central States VHF Society, I felt this would be a propitious time to share some techniques I have learned about successfully activating rare DXCC on 6m using EME.

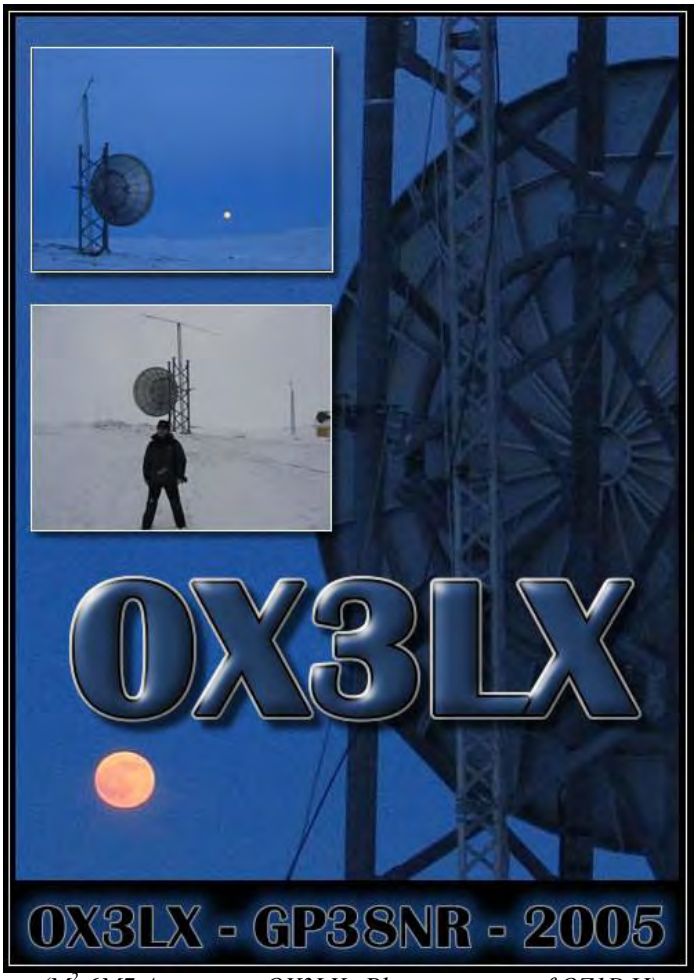
It is my hope that, by providing more of a "DXpedition Checklist" for successful operation, more stations will be encouraged to operate 6m on Dxpeditions. Photos of a few other 6m EME Dxpeditions are shown in **Figure 1**, in the group of Figures at the end of this article. Software references here apply specifically to the use of JT65A mode as found in WSJT10.

A FEW 6M EME BASICS

FARADAY ROTATION. A JT65A contact typically requires about 4 minutes IF the propagation is reciprocal. However, even when conditions are most favorable for EME, you always run the risk that at any given time, Faraday rotation will cause the polarity to rotate so that one (or both) stations will not be able to copy the other at their best (if at all). This polarization shift is what makes it very rare for two stations to be copying each other best at the same time, and is the reason why most EME contacts are completed by running schedules. Running a schedule, usually over a period on an hour or so, permits each station to have a chance to eventually exchange required contact information with the other. It therefore usually takes longer to complete a contact with a station on the other side of the world via 6m EME than it does using "strong signal" modes via the ionosphere on the HF bands. However, it can still be MUCH more productive than sitting in front of a radio for months on end just listening to white noise on the 6m band!

MINIMUM STATION SIZE. I consider a minimum sized "real" 6m EME station (one that can contact a similarly sized station during optimum EME conditions) to be one with a 14 dBD gain antenna, under 1 dB feedline loss, a low noise external preamplifier in front of the receiver, and 1000w output in JT65A mode. A single yagi has to be around 70' (21m) long to have that kind of free space gain. However, horizon-only stations can make up some of the gain they need if they have a quiet location with terrain suitable for making good "ground gain" to supplement the inherent yagi gain.

GROUND GAIN. A large percentage of EME-capable stations on 6m have antennas without elevation. They rely on the extra ground gain provided by clear, uncluttered, smooth terrain in front of their antennas on moonrise and/or moonset. When

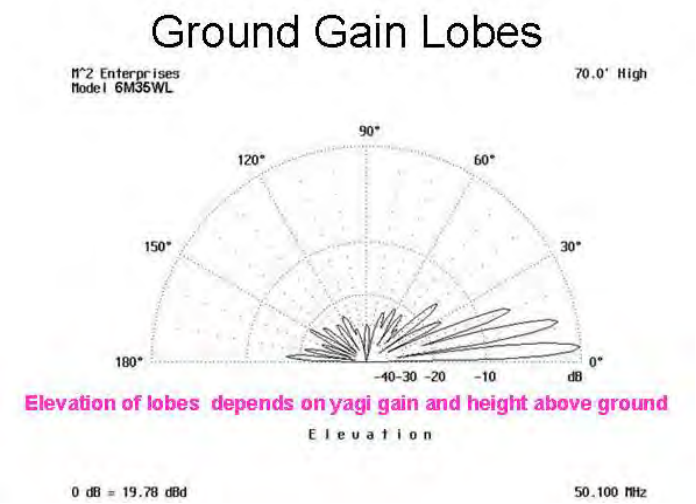


(M^2 6M7 Antenna at OX3LX, Photo courtesy of OZ1DJJ)

aimed on the horizon, the vertical pattern of a single yagi becomes a series of sharp, high gain lobes and deep nulls due to ground reflections. Indeed, with a good, flat clear area in front of an antenna (unobstructed by buildings, a sloping roof or HF antenna below the 6m beam, etc.), the ground gain of an antenna leveled on the horizon often makes a well located single yagi perform like an array of 2 or 4 yagis - at least when the moon happens to move in front of one of these ground gain lobes.

Generally speaking, ground gain lobes are broader with antennas at a lower height, although the lobes from such antennas also are higher in elevation and comparatively weaker. For most stations with single yagi antennas, one of the most critical elements in the equation for making an EME contact on 6m involves taking advantage of these extra ground gain lobes. For a good 7 element long boom yagi such as an M2 6M7JHV mounted at a "DXpedition height" around 20' above flat ground, ground gain lobes would typically be found around 7 and 15 degrees elevation. The quality of the higher ground gain lobes will depend more on the condition of the terrain nearer the antenna in the direction toward the moon, and that is one reason the second lobe often seems to be more effective than the first, or lower , "main" ground gain lobe. It is much easier to have some control over the terrain a few hundred feet in front of the antenna, compared to the landscape many thousands of feet away. Theoretical ground gain lobes for an M2 6M11JKV yagi

at 70’ above conducting flat ground is shown below (plot courtesy of K0GU):



Of course, if you have the good fortune to be able to overlook a large lake or sea, so that your most distant horizon is over water, you will not only have a good first lobe but probably also have a negative horizon due to the curvature of the earth. In such a case, you will find there is a "bonus ground gain lobe" located around zero degrees elevation. Be sure to use this extra ground gain lobe to advantage, and by all means plan to operate when the moon is down as far as negative 2 degrees!

Because of these valuable multiple ground gain lobes, a single good yagi (or yagis stacked side by side) are better for EME than multiple yagis stacked vertically. For DXpedition use, it is much easier to use a single good yagi. When I am on an EME DXpedition, I usually keep my yagi aimed on the horizon when the moon is below 15 degrees elevation. If there are no ionospheric, tropospheric, ground clutter or other complications to interfere with my success, I typically expect to complete contacts with around 4 stations during each moonrise/moonset.

GAIN COMPENSATION. Remember that a larger home EME station essentially compensates for a smaller station on the DXpedition end of the circuit. Therefore, the increasing number of large home stations (both with and without antenna elevation) greatly increases the potential number of contacts capable of being made by a smaller DXpedition station, provided certain considerations are addressed well in advance. In fact, a good portable 6m EME station now can probably fill up as much time as desired on EME contacts, within the constraints of available common moon time.

PROPAGATION COMPLICATIONS. I certainly do not mean to suggest that a 6m EME contact is commonplace or trivial. In fact, nothing could be farther from the truth! 6m remains one of the most difficult bands on which to operate moonbounce. Signals are usually very close to the noise level, making every single dB of mutual gain critical. The situation is exacerbated by the fact that 50 MHz signals are high enough in frequency to be affected by tropospheric ducting and low enough to be adversely affected by just about any kind of perturbation in the ionosphere.

For a successful 6m DXpedition, it is necessary to provide a very dedicated effort to make the most of the available resources and maximize the opportunity for contacts with as many capable stations as possible. This not only means being available when there is common moon with other stations, it also means effective planning and operation techniques. This is particularly important for a portable 6m DXpedition station such as mine, which I consider to be very minimal in size.

Successful 6m EME DXpeditions require:

1. Careful Planning
2. Proper Equipment
3. Correct Operating Procedure

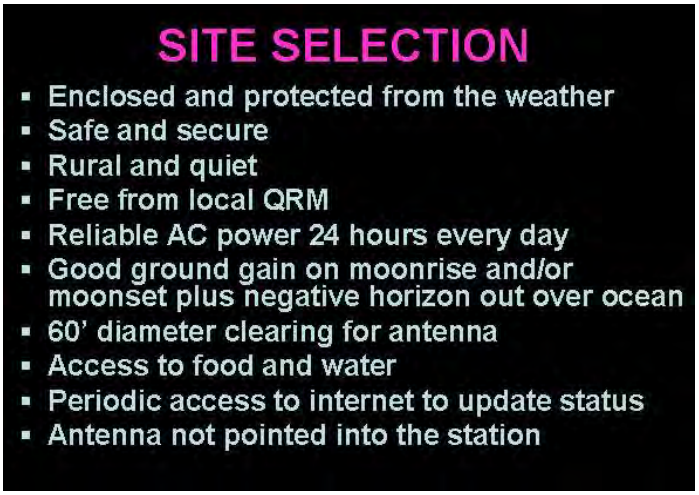
DXPEDITION PLANNING

Much of the success of a 6m EME DXpedition depends on careful planning before the trip. In this section, I will review some of the points I consider critical for a successful operation. See **Figure 2** for a checklist summary of these points.

ACCESSIBILITY AND DEMAND. When considering a destination for a 6m EME DXpedition, I try to find a DXCC that is accessible and “relatively affordable” to reach. It also has to be a location that is still very much needed on 6m by serious 6m DXers in Europe and North America, which is where most the 6m EME stations are located. And of course, it must be someplace that will issue you a license to operate 6m. I never consider going anywhere with all my equipment unless I first have a license in hand to show the customs people.

SITE SELECTION. In concert with searching for a desirable DXCC, it is essential to also locate a good site to set up an operation there. In fact, until I find a suitable operating site, I won’t make additional plans to travel to that DXCC or apply for a license to operate there. Google Earth and the internet are excellent tools for evaluating potential sites. Ideally, the site will be protected from the weather, afford security for the equipment, be in a quiet, rural location free from QRM, have access to good AC power 24 hours every day, and have great ground gain on moonrise and moonset. Access to food and water is also an important consideration, because it is a serious complication if you have to carry them with you! An additional plus would access to the internet, at least from time to time, to provide status reports and lists of stations already worked. However, I have never had ready internet access during any of

my 6m EME DXpeditions, and that certainly has not prevented me from successfully making random 6m EME contacts.



One of the hardest and most critical aspects in finding a suitable operating site is locating a spot to setup that is adjacent to a clearing large enough to setup and rotate a large yagi. Of course, if you are in the northern hemisphere, the moon will pass to the south, so your clearing needs to be on the south side of your ham station. In the southern hemisphere, it is just the opposite. The purpose of this orientation is to ensure that you won't ever have to point the antenna or one of its main side lobes back at yourself in the ham shack. Not only is this a safety issue, but it also can cause interference with the computer or electronics in your equipment.

LOCAL QRM. QRM can take the form of overload from local commercial broadcasting, spurious transmissions from commercial broadcasting being propagated to your location, RFI from nearby electronic equipment or overload from other amateur operations. If you are planning to be part of an HF DXpedition, you are likely to encounter obstacles such as scheduling conflicts in addition to QRM from QRO HF multi-operator operations. A certain amount of the QRM from proximity to such operations can be avoided through good RF filtering and grounding on the part of all stations, and generous application of ferrite filters on all your (and their) audio and computer leads. However, the best way to insure a low noise level is to increase the distance between your operation and theirs as much as possible, and locate your site such that you can avoid aiming at their antennas, transmitters, generators, etc. I enjoyed a very low noise and successful operation at TX5K in large part because I separated myself as far as possible from the rest of the operation. **Figure 3** shows the 6m operating site approximately 1000' (300m) south of the main HF camp and twice as far south of the 80m and 160m operation. That distance worked for me because I was never pointing toward the HF operations to the north.

A great way to avoid QRM from nearby amateur operations is to operate JT65 in sequence with them. Although more difficult to coordinate with a multi operator HF DXpedition, I have very successfully operated alongside ZL1RS in E51 and 3D2 when Bob was operating 2m EME on JT65B in the same sequence as me. For us, it was no problem at all, since it is standard procedure that DXpedition stations always transmit in the first sequence with their respective JT65 modes.

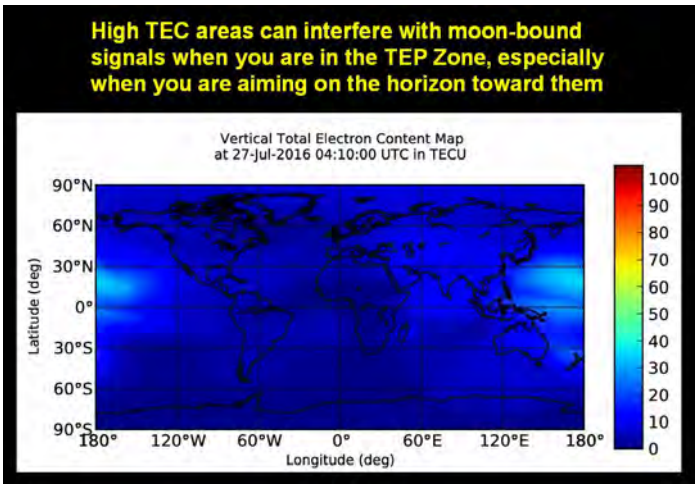
RECEIVER NOISE. For most of us, the local noise that surrounds us where we live is something beyond our control. There are many people who live in urban areas who constantly struggle with high noise levels on 6m, and cannot imagine adding a preamp to make their receivers sensitive enough to copy weak EME-level signals. Certainly, one of the advantages afforded by a chance to set up a portable station is the possibility of finding a place to avoid the high noise that plagues so many home stations on the "Magic Band". Ideally, you will be able to find a DXpedition site that will not require you to aim the antenna toward high power RF transmitters, industrial areas, noisy street lights, power lines or other noise sources that will mask weak signals.

GROUND GAIN. Even if you are not planning to limit your EME operation only to the horizon, you also will want to make every effort to locate the station in as favorable a location as possible for the best possible ground gain. Usually, this means finding a clear, flat area, free of "ground clutter" (hills, boulders or man-made objects such as houses, cars, etc. that can deflect ground reflected signals away from your antenna). The best terrain for ground gain is open salt water, although fresh water (such as a large lake or marsh area) and even flat open ground such as a farmer's field also often works very well. In addition to providing good ground gain, such a location usually provides a nice quiet direction to point during your moonrise and/or moonset. As shown in **Figure 4**, with the extra ground gain on the horizon, the band literally "lights up" with signals!

When I search for a good DXpedition site, I also try to find one with good ground gain, to give my relatively modest portable EME station enough gain to complete with other single yagi horizon-only stations. Depending on the DXpedition location and the distance to the stations I hope to work, the common moon windows may be very short. To try to take full advantage of such short common moon windows, it can be very useful to find a site affording a view out over the ocean on moonrise and/or moonset. Not only does this provide ideal ground gain and a quiet zone in front of the antenna, it can also provide a "bonus" very strong ground gain lobe around zero degrees elevation because of the curvature of the Earth. That can make all the difference if the station you are trying to contact is on the opposite side of the world from you, and is losing the moon just as it is rising for you. From several of my DXpedition locations high above the ocean, I have been able to copy signals when the moon is actually below negative 1.5 degrees elevation.

SEASONAL AND DAILY FACTORS. As you plan your trip, you may also want to look at the times of day for your moonrises and moonsets. For example, if you are going out during a time of year prone to local Es, F2 or TEP, you will want to pick dates affording lunar windows in directions and at times of day least likely to be interfered with by these ionospheric propagation modes. The ionosphere has the most effect when you are aimed on the horizon. So, ideally, you would be able to avoid aiming on the horizon during times of day when you are likely to have ionospheric activity in those

directions. In practice, though, it is really difficult to match up both moonrises and moonsets with the most favorable times of day to avoid ionospheric complications.



When operating from locations in the TEP Zone, I usually find EME conditions best between midnight and dawn my local time, and I try to schedule my trips during times of year between the spring and fall TEP/F2 seasons and the winter/summer Es seasons. Even if I am in a region at a time of year with little ionospheric activity for me, I realize that stations on the other side of the world may have considerable ionospheric challenges – especially if they will be aiming on the horizon. A good example of this is **Figure 5**, showing the SpecJT screen at SM7FJE on one of the days while I was operating 6m EME from KH8.

Generally speaking, any disruption of the geomagnetic field/ionosphere also will have an impact on 6m signals. Even if the MUF is not high enough to produce effective ionospheric propagation at 50 MHz, the chances are quite good that signals can be deflected off their direct course to and from the moon and/or erratically changed in polarity. So, ideally, one would avoid periods of expected cyclical disturbances (such as recurring 28 day coronal holes) or other geomagnetic activity when the Kp is high. However, the exact timing of these types of solar events often are not known with the same accuracy months in advance, the same way that the more reliable Es, F2 and TEP seasons can be predicted. So the best practice seems to be to operate long enough at your DXpedition site to ensure some good days for EME, even if a geomagnetic storm does come along for a couple of days. Also remember that such disturbances will have lesser effect on stations that are elevating their antennas.

WEATHER AND HEALTH. In most DXCC, there generally are more favorable seasons for DXpeditions. Obviously, you don't want to try to operate during a period when flooding, cyclones, hurricanes, water shortages or diseases are expected. Even heavy rains can be a problem because large raindrops on a high-Q antenna can cause it to detune, causing the SWR to be too high to operate the amplifier. Considering local weather also has to be included in the equation. Sometimes the weather and/or health situation can be improved simply through a judicious choice of the regional location for the operating site in that country. That being said, I found my operation from T8GJ to be quite successful during a severe tropical rainstorm that quelled the local line noise, and whose high winds prevented any rain drops from staying on my elements to detune them.

DEGRADATION. In addition to the previously mentioned seasonal and daily ionospheric considerations, there are two additional factors which play a very large role in the success of a 6m EME operation. Luckily, these are related to the moon's orbit, and are very predictable. The first is distance to the moon, and the second is the sky temperature (noise) of space behind the moon.

As you know, the moon orbits the earth once every month, and as it does so, it appears to move up and down in the sky. The moon therefore appears to pass through various spots on the celestial sphere, some of which are quiet, and others that are extremely noisy down at 50 MHz. When the moon moves in front of a noisy place in the sky, trying to copy a weak EME signal is just as difficult as trying to hear someone whispering to you from across the room during a noisy party.

In addition, the moon moves closer and farther away from Earth over the course of its orbit each month. This change in distance alone causes a change in signal strength of about 2 dB. The combination of these two factors is commonly referred to as signal "Degradation". Degradation is typically expressed as an index in dB compared to the ideal situation - in which the moon would be at perigee (closest to the earth) at the same time as the sky behind it was quietest. The Degradation on 6m EME can be quite substantial, so you definitely want to plan a 6m EME operation during a time of month when the Degradation is lowest. These Degradation figures (shown in real time on the JT65A operating screen) are also available in several of the popular moon-tracking computer programs available for use in planning purposes. I also keep a list on my website that shows the days throughout the year with the lowest Degradation.

Unfortunately, the minimum Degradation down at 50 MHz often is not be much lower than a couple of dB, because perigee may not happen at the same time as the moon is in a quiet part of the sky. These two conditions move slowly in and out of sync over a period of years. Typically, the 6m Degradation fluctuates between one or two dB and over 10 dB during each month. If you have been keeping tally, you will notice that there are many factors that can reduce the already very marginal signal strengths on 6m EME! Obviously, when signals are just at the threshold of being detectable under the best of conditions, even just a dB or two makes a very significant difference! For that reason, you want to try to assemble as big a portable station as possible!

COMMON MOON. And of course, in addition to picking days with the lowest Degradation, you also want to make sure that you schedule the operation at a time when you will have the greatest common moon time with the stations you want to try to contact. It doesn't do anyone any good if you go to a rare DXCC on an EME DXpedition if the people who need that DXCC cannot see the moon at the same time as you! This is especially important for smaller stations and/or stations limited to the horizon (either because they have no elevation, or because

they have only very limited common moon window with you because they are so far away from you).

An initial assumption often is that there must be very little chance of being able to work another small horizon-only station. However, upon closer examination, one often can find a number of potential common moon windows when both single yagi stations will have ground gain at the same time! Remember that you may have multiple ground gain lobes on both moonrise and moonset (and perhaps an additional "zero degree" lobe due to a negative horizon), each of which provide an opportunity to match up with one or more similar lobes at the small single yagi station. As you explore potential contacts, remember that the moon changes in declination every day, so new common moon windows are opened up with different horizon-only stations each day. I use my free GJTRACKER program to select favorable times for my DXpeditions. You can see an example of such an analysis in **Figure 6**.

This may all begin to sound like an impossible game to win! However, with careful planning, and attention to detail, the chances for success can be greatly enhanced. When everything is finalized, the planned operation schedule needs to be publicized as far in advance as possible, to allow people to plan for the operation. **Figure 7** is an example of such a schedule.

EQUIPMENT FOR 6M EME

I consider my portable 6m EME station to be quite modest, and actually a bit on the small side, compared to what is usually considered to be a viable 6m EME station. However, I often rely on ground gain (on one or both ends of the contact) and larger stations than mine to make up the gain difference. Exceptional conditions, patience, and good operating techniques sometimes even allow me to complete contacts with stations smaller than mine. The major station components are discussed in this section.

The previous photo shows all my luggage for the solo V6M DXpedition in 2015, on the beach awaiting departure from the island on the vessel in the background.

TRANSPORTATION. To avoid the high expenses (and equipment losses) experienced by many DXpeditions, I always prefer to travel with all my equipment. I generally try to transport the most delicate pieces of equipment as carry-on luggage, and check the more rugged gear and hardware as standard luggage.

This of course varies depending on the specific airline regulations for carry-on luggage weights. Be sure to carefully research such regulations before you begin packing, and also look into any excess baggage fees (which may NOT be the same travelling in both directions!). Typically, I can get by with one carry-on plus one fully stuffed computer bag, two checked suitcases and the one nylon bag carrying my antenna and mast.

ANTENNA. If the object is to generate the most gain, a large single yagi aimed at the horizon is the easiest way to do it! Mast bracing and antenna rotating is also most easily accomplished with a single yagi.

I use the M2 6M8GJ yagi with 12.12 dBD gain, which is the largest single yagi I can bring with me on airlines as checked baggage. It is also sturdy enough to withstand very high winds. If you hope to elevate the antenna to track the moon (which is when I make the majority of my contacts), it is very difficult to successfully operate 6m EME with an antenna having any less gain than this. I use a pair of 1/8" diameter nylon lines attached near the front of the boom and a pair attached near the rear, to tie off the antenna at the proper azimuth and elevation.

As shown below and in **Figures 8 and 9**, these lines are attached at the screw eyes where the 6M8GJ boom guy lines are attached to prevent sag in the boom; this way, the tie-down and steering lines do not bend the boom down.

The antenna comes apart into 44" long pieces, and many of them can be telescoped inside each other so the antenna and mast magically fit into a 46" long nylon bag that complies with all airlines as a standard-sized piece of checked luggage. I put

all the non-tubing pieces (such as the hairpin match, ferrite 1:1 balun, Kevlar boom guy lines and turnbuckles, element mounting clamps and other hardware) in labeled Ziplock bags and pack them in a separate suitcase (see **Figure 10**). While some international airlines allow 60 pound suitcases for checked luggage, it seems most limit the weight to 50 pounds, so that is the way I pack all my bags (**Figure 11**).

ANTI-CORROSION PASTE. I suppose it is obvious, but you don't want to forget to use anti-corrosion paste between all the aluminum-to-aluminum, aluminum-to-stainless steel, and feedline to the Driven Element connections. One of the most appealing aspects of operating from a rare DXCC is to be able to find a location next to the ocean with great ground gain. However, the salt spray can quickly degrade the performance of your antenna if you don't make the time to take adequate precautions! A very high exposure environment is shown **Figure 12**.

MAST. I use a 21' long M2 Portable Mast to get my 6M8GJ mounted up around 20' above the ground. Like the yagi, all pieces break down into sections no longer than 44". Like the 6M8GJ, all the mast pieces telescope inside each other. As described in detail on my website, I also built a "Prop" to hold up the end of the mast so I can mount the yagi on the end of it before raising it, and a "Falling Derrick" to help give me more leverage and control in raising and lowering the antenna. The tubing for each of these devices, plus a 44" copper clad steel ground rod (**Figure 13**), along with a few 12" long spiral steel nails and my fiberglass guy line spreader also fit into the nylon same antenna bag, which tips the airline luggage scales at 49.5 pounds, as shown in **Figures 14 and 15**. I feel like a magician each time I unzip the nylon antenna bag and pull out all the pieces, assembling the 43' long yagi on a 21' high mast! People can't believe that all that stuff comes out of such a small package!

The mast is supported by four Dacron guy ropes connected to a bearing plate so the mast and antenna can easily rotate while being held securely upright. The raising of the mast – along with videos of the operation – is explained in detail on my web page. As shown in **Figure 16**, the trick is to make the lengths of the guy ropes equal to 1.414 times the distance from the bottom of the mast to the point where they are connected to the bearing plate, and also place the guy stakes out from the center of the mast the same distance as the height of the guy connections on the mast. In that case, the guy ropes will stay tight as the mast is raised, so the antenna and mast will be firmly held in line and it is possible to smoothly raise and lower the assembly safely without it getting out of control. I also raise the antenna/mast assembly with a halyard tied to a screw eye going through the mast just underneath the antenna – that keeps the antenna from rotating as the line is pulled to raise the mast.

I guy the mast so it can be raised to the northeast or northwest. That way, there are no guy lines directly to the south or north. Depending on the hemisphere where I am operating, the highest elevation of the moon is either due north or due south, so I can more easily elevate in between the guy ropes during the highest elevations.

The mast's guy lines, plastic guy stakes, base plate, top and bottom fittings for the Falling Derrick and the Prop, as well as all the assembly hardware, are packed in one of the suitcases.

AZIMUTH. If the azimuth aiming and readout is manual, one method I have used on DXpeditions is to bury the mast in the ground (resting upon a solid object such as a board or concrete block if the ground is all sand) or set it on a plate, with a protractor around the mast. Lines connected to the rear and front sections of the antenna are adjusted aim the antenna in different directions and secure it during high winds. Although the free space beamwidth of my antenna is quite broad, I try to get outside and readjust the position approximately every 15 minutes.

By placing the mast on a base plate (which can be spiked to the ground to keep it in place), the mast can be easily tipped up with the antenna on it. A very effective mechanism that I have successfully used on a number of EME DXpeditions it to pass the rotating mast through the center of a laminated "aiming circle" printed out on a piece of paper (**Figure 17**). An indicator such as a bent paper clip taped to the mast or a screw affixed to a short piece of angle aluminum can then be used a simple and adequate indication of direction. **Figure 18** shows the azimuth indicator in use at V6M.

ELEVATION. If you hope to operate when the moon is above around 15 degrees elevation, it will be necessary to be able to elevate the antenna to aim it at the moon. There are many low-

tech ways to achieve this during a temporary operation. As shown in **Figure 19**, VP8DMH simply hung the antenna from a lift during his 2011 operation from Antarctica and aimed it by pulling on various lines attached to the antenna. Operating as V36M, K7BV mounted his yagi on a short mast and hung the mast with a rope thrown up over a tree branch, using lines attached to the yagi to elevate and rotate the antenna.

An example of how a single long boom 7 element yagi with elevation could be used to expand available moon windows was illustrated by JA1RJU during his very successful May 2005 operation from KH0. Although the elevation was limited to about 45 degrees elevation, his moon time was substantially increased. The elevation was manual, with very simple, easily transportable indicators, also shown in **Figure 19**.

For my DXpeditions, I use a heavy duty home-made elevation mount that is shown in **Figure 20**. More detailed photos, along with scale drawings and a parts list, are available on my web page. I have tried a few different elevation indicating systems, but the simplest and most reliable indicators have proven to be my hand held inclinometer and the "level ap" on my iPhone. I use lines attached to the yagi to adjust the elevation as well as the azimuth. I place some smaller plastic tent stakes out around the antenna and use those to secure the aiming/elevation/tie-down lines when there are no trees or large rocks available.

FEEDLINE. I take a 50' piece of LMR600 Ultra Flex and a 25' piece of standard LMR600 coax to use as my feedline. I use the Ultra Flex to connect to the yagi and loop around the elevation mount and the bearing plate for the guy lines. Most of the time, I also have to join these two pieces together to reach the amplifier. Although carrying this feedline is heavy, the total 75' length is under 0.75 dB overall feedline loss, which meets my rule of thumb for effective 6m EME operation.

TRANSCEIVER. I have used my K3 (with the PR6 preamp) very successfully on my 6m EME DXpeditions from E51EME, 3D2LR, 5W0GJ, E6M, TX5K and KH8/W7GJ. My frequency with the K3 was very stable, and the built-in computer interface was very handy. During my solo V6M operation in 2015, I was very pressed for space, so I used my KX3 with an external preamp and a separate computer interface as described on my web page. Although I seemed to copy stations very well, there were complaints from some that my signal drifted and was difficult to decode. There are a number of innovations available to make the KX3 stable enough for JT65A operation on 6m. However, since I needed a 100w transceiver to drive my new amplifier, I have (at least temporarily) set my KX3 aside.

Thanks to a generous donation by K7CW, I now have a Yaesu FT-857 transceiver with the internal stable TXCO option, which I used from T8GJ and V6M in 2016. It can be run with the AGC off, and without the DSP noise blanker. Also, it seems to be able to provide a flat enough passband to be able to watch for weak 6m EME signals.

PREAMP. I have a Mirage KP-1/6M RF-switched preamp that I use between my transceiver and amplifier to insure the lowest noise figure for my transceiver. Like my transceiver, it operates on 12 VDC.

COMPUTER INTERFACE. Of course, one of the attractive features of the K3 and K3S transceivers is the built-in computer interface. However, when traveling by myself (or with one other person), space is very much an issue. Therefore, on my more recent Dxpeditions, I have used the Yaesu FT-857 transceiver, which requires a separate interface. It seemed to work very well on JT65A with my RIGblaster Plug & Play interface, and I had no problems with this configuration at T8GJ and V6M.

GPS RECEIVER. I use an inexpensive Columbus V800 GPS Data Logger receiver to set the clock in my computer. It connects via a USB cable. It can produce some birdies if left plugged into the computer, so I disconnect it during EME operations. I put ferrite filters on both ends of its cable to try to clean it up, but I can rarely get a satellite signal indoors anyway. So, I usually update my laptop by carrying it and the V800 outdoors prior to each EME session, and update the computer clock that way. Usually, the laptop time stays accurate enough over the course of an EME session. If I see that the DT on most of the stations I am decoding appears to be more than a second different from -2.5 seconds, I will usually simply adjust my DT in WSJT to more closely match the decoded DT times.

TIMEKEEPING SOFTWARE. I have been very pleased with the performance of the free BKT Time Sync GPS receiver software developed by IZ2BKT to set the computer clock. Version 1.7.0 also provides an accurate grid locator display in case you are activating different grids or want to make sure you are setting up on a specific grid line.

AMPLIFIER. In the past, I have had good success using the M2 6M-1000 amplifier, upgraded to a pair of 600w transistors and modified for low drive to be compatible with the 3 watt JT65A output from the KX3. I have run it around 1000w output on JT65A mode on previous DXpeditions. However, I blew up one of the output coupling capacitors after 3 days of operation at V6M in 2015 when the 110 VAC power lines dropped too low for my amp and power supply, and the voltage spikes resulting from the amp repeatedly kicking on and off caused both the amp and power supply to fail.

I have recently replaced that amplifier with a new M2 6M1K2, which comfortably provides 1000w output on JT65A mode. One of the reasons I decided to use the FT857 (which is rated for 100w on 6m) is because the 6M1K2 requires 75w to 100w drive for maximum output.

COOLING. Remember that JT65A has a 39% duty cycle, with full power "key down" transmit periods of 46.8 seconds. The amplifier and power supplies have to be able to handle this load and stay cool under this rigorous operation – often in very hot climates. When possible, I try to put the amplifier on the floor, where the air is coolest, and always use a powerful house fan to keep the air moving around the amplifier and power supplies (see **Figure 21**). In order to facilitate good air circulation, I usually support both the amplifier and power supplies on stands that permit free air circulation all around them.

POWER SUPPLIES. Switching power supplies are great for DXpeditions because of their light weight and ability to provide steady DC output voltage even at reduced line input voltages. To provide 12 VDC for my preamplifier and transceiver, I use a Powerwerx switching power supply, which provides the option of running on either 110 or 220 VAC. The 50 VDC for the 6M1K2 amplifier is provided by Meanwell RSP-2000-48 power supplies, which also can be powered by either 110 or 220 nominal AC voltage.

I have replaced my damaged RSP-2000-48 with a pair of new units running in parallel, to guarantee adequate DC current even at reduced line voltage. The two RSP-2000-48 units, generously provided from the UK by GW4WND at ***The DX Shop***, were each specially programmed to be able to provide full DC current output for 60 second periods, even down below 100 VAC input line voltage. An advantage of using two such units is that I can use extension cords to run them each on separate circuits if necessary, to divide the load so as not to tax the individual circuit breakers or building wiring.

Although I always look for sources of 220 VAC when I am on DXpeditions, I make sure that all my equipment can operate on either 110 or 220 VAC. I take short length extra power cords with me to enable me to plug all my devices into the multiple outlets on the power cords. Because I often don't know ahead of time what voltages I will be able to find, I avoid taking any extension cords with lights or power outlet strips with 110 VAC surge protectors.

Before I go to a country, I make sure to wire at least one of these short power cords with a plug that will be compatible with the outlets I expect to encounter, since there may not be time to go shopping or access to a hardware store at some of these remote locations. Whether 110 or 220 VAC is available, all my other equipment plugs are standard USA 110 VAC plugs so they can plug into my power cords.

LAPTOP COMPUTER AND SOFTWARE. I currently use an HP Pavilion DV6 laptop running the Windows 10 64 bit operating system. One very handy feature is the built-in pointing pad so that an external mouse (which can be noisy) is not required. Although it is quite large and bulky, it is quiet, has plenty of USB ports as well as a high resolution 15.5" (diagonal) screen that enables me to watch a number of open windows at the same time. It has been very useful to display the Real Time map from GJTRACKER in the background, while running WSJT with its multiple screens in the foreground.

The built-in sound card works well, and provides the option to set the sampling rate at 44100, which is the ideal setting for the 11025 rate around which WSJT was originally designed. I have been running JT65A on the most recent version of WSJT10, which incorporates the newly developed and slightly more sensitive FT decoder. I keep the main WSJT window up while I intently watch the SpecJT waterfall. I also keep the ASTRONOMICAL DATA window open so I can keep an eye on the moon elevation of the stations I am copying.

TOOLS AND EXTRAS. I always carry a small tool kit to assemble the station and antenna. I rely on a hammer or rocks at the site to pound in ground stakes and the ground rod. I also carry extra audio cables, short coaxial jumper cables and a bag of extra connectors and adapters in case something has to be reconfigured. I also always bring along a small tube of pure silicon grease (from auto parts stores, to waterproof spark plugs) to use on the contacts and threads of all coaxial connectors before wrapping them in plastic electrical tape. I also bring along brightly colored survey tape to flag my guy lines and feedline to prevent anyone (including me at 3 am!) from damaging my setup or themselves. And personal items such as sunscreen, bug repellant, mosquito repellant clothing, first aid supplies and drugs to combat sickness from food or water poisoning are also always packed.

FILTERS. One final note about DXpedition equipment concerns filters. To ensure that the portable operation does not interfere with local TV or other communication services, it is advisable to include a good low pass filter on the transmitter. In addition, if HF amateur transmitters are being operated nearby at the same time as 6m EME activities are planned, it will be very important to make sure they also are equipped with low pass filters and good grounds. It also is very helpful always to have a good supply of ferrite beads to clip over audio leads going into and out of the 6m radio, interface and computer, and on all leads coming out of all power supplies to make sure that RFI being generated at your own station does not increase the noise level of your EME receiver. I always test for self-generated noise before I begin EME operation somewhere, and often find that additional ferrites need to be added and/or the physical orientation or proximity of the power supplies need to be adjusted to reduce the noise level (see **Figure 22**).

OPERATING PROCEDURE

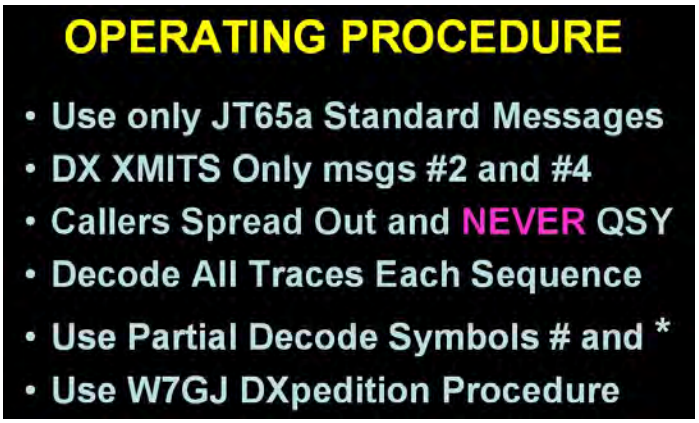
SEQUENCE. There are various strategies that can be employed by an EME DXpedition station. The fact that all EME DXpedition stations always transmit in the first sequence certainly helps alleviate QRM on the DXpedition station. I find that the built-in sequencing in WSJT is effective on JT65A without requiring a separate sequencer unit.

CALLING FREQUENCIES. As with CW and SSB DXpeditions, it also really helps to have the callers on JT65A spread out in frequency. Adequate caller spacing is perhaps most important when "shorthand messages" such as RO and 73 are being sent, since those messages can be visually mistaken if the sync traces of adjacent stations are aligned at the same spacings as the alternating tones of the shorthand messages. Ideally, I prefer if callers can space themselves out every 200 Hz, which is greater than the total bandwidth of 170 Hz required for a JT65A signal. Although I rarely have access to the internet when I am on a DXpedition, most of the callers DO have access to the internet and can coordinate among themselves and spread out their calling frequencies from -1000 to + 800 around my transmitting frequency. My eyes are glued to the SpecJT waterfall throughout every receive sequence, searching over that range for callers' sync traces.

It is very important that, once callers decide on a frequency, they STAY on that frequency and keep calling every sequence. I try to decode every caller's sync trace I spot during every sequence, but I can only work one station at a time. It is a great step toward completing a contact if I can receive calls from a station and make a note of that station's calling frequency.

DECODE SENSITIVITY DIFFERENCE. Most newcomers to 6m EME start out by running JT65A skeds with individual stations. They are accustomed to being able to decode very weak callsigns when they have selected "Deep Search" decoding mode. Or, since they are just monitoring one station, they can accumulate calls from partial decodes in the smaller "AVERAGE" window. That works well on a schedule, when both stations are calling each other. However, when a station "eavesdrops" on another schedule, it will become apparent that signals must be 4 or 5 dB stronger for reliable decoding! In fact, such JT65A signals basically have to be the same strength as required for decoding random text messages, which is around -24 or -25 dB, depending on how steady the signals are. And when I am decoding multiple stations every receive sequence, I can no longer rely on individual stations to accumulate in the AVERAGE display.

I often receive comments from stations that they saw my sync trace when I am on DXpedition, but they had "great difficulty for some reason" decoding me. The reason most probably is because I almost always am calling somebody else, rather than calling CQ or them. If you see my sync trace and are getting partial decodes from me with the proper DT and DF, you almost always will be able to decode my reply if I do answer YOU! Of course, the polarity is usually not optimum for both stations to copy each other best at the same time, so the secret to making the best use of the moon time is for the DXpedition station to call CQ and reply to stations who are capable of copying at that particular time. So how can you know which caller in a pileup might be able to respond right away to your reply?



W7GJ DXPEDITION PROCEDURE. The standard procedure for making a contact on EME has remained unchanged for over 50 years, and K1JT has preserved that protocol in the sequence of standard messages that need to be exchanged in his EME version of JT65. I follow the standard EME contact protocol when I am on DXpedition, but with one slight variation. Usually, stations will be calling me with just callsigns (standard message #1). However, one of the really powerful things about JT65A is that I can receive both standard messages #1 and #2 with the same sensitivity. Therefore, there IS a way for me to know who is able to copy me at any given time!

If stations see my sync trace on SpecJT and receive a partial decode during my previous transmission, I want them to call me during that next sequence with callsigns and OOO reports (standard message #2). In this case the reports do not mean that the caller has received both calls from me (they obviously have not decoded both callsigns from me because I have not answered them yet). As the DXpedition station, I am the only one who can truly send message #2, in the standard contact procedure. Instead, their sending message #2 tells me that they have partially decoded me, and it tells me that if I were to call them right away with calls and reports (message #2), they would most likely be able to decode me and reply with RO (message #3).

NOTE: This approach only works if the callers are honest and go back to message #1 when they stop seeing my trace and receiving partial decodes from me. If I try to reply to a station who says he is copying me and he fails to reply with RO after a few sequences, he goes to the bottom of my list!

And here is the really useful thing about JT65A! If a caller is sending just callsigns (message #1), and the signal is not strong enough for me to get a full decode with the callsigns, the partial decode will end with an asterisk (*). If a caller is sending callsigns and OOO reports (message #2), a partial decode will end with a pound sign (#). Therefore, if you have been steadily calling on a certain frequency, and I have previously decoded you sending both callsigns on that frequency (even though you were not copying me at that time), I can tell when you ARE copying, by the # sign after a partial decode on that frequency – even if the polarity is not right for me to copy you strong enough for a full decode at that particular time. So, if I see a # behind a partial decode on your frequency, I know I should answer you right away! In an ideal situation, if I am not currently in the middle of another contact, I would reply to you with calls and OOO reports (message #2). If you are still seeing my trace, there is a very high likelihood that you will decode me and be able to reply immediately with RO (message #3). The shorthand messages of RO, RRR and 73 are very sensitive and can be decoded even when signals are very weak, so hopefully I will be able to copy your RO and be able to reply quickly with final RRR. I always send final RRR until I see 73 from the station, at which time I will call the next station.

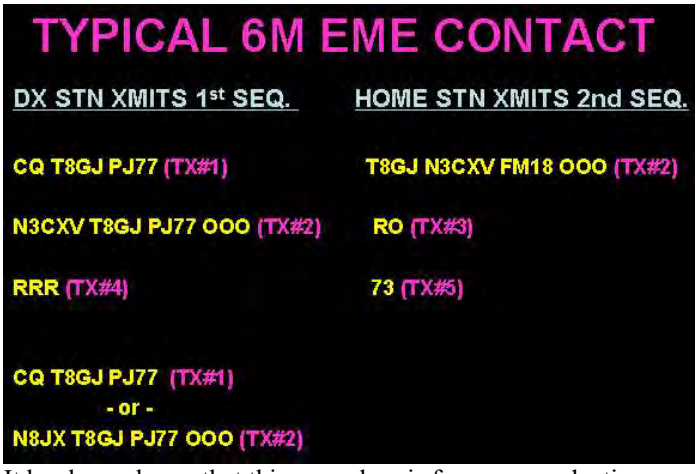
In the very rare case in which stations have faded in and out and there are two stations sending me RO from two different QSO attempts, I will send both calls and RRR to one of the stations. I hate to do that, because it is several dB harder to copy than just the shorthand RRR by itself, but I will do it if necessary to make sure that the contact is correctly completed with the right station.

In operation, visually decoding the RO and 73 messages on the SpecJT waterfall allows the DX station to focus on decoding other stations and preparing to reply to other callers. I still like to go back and double check at the end of the receive sequence

to make sure the COMPUTER decodes the shorthand messages, though, since my eyes can be fooled by multiple callers spaced closely together at the same frequency differences as the shorthand messages.

The problem remains, of course, that with horizon-only capability, the DX station has little time available to wait for the polarity to rotate in order to complete a contact when propagation is not reciprocal. The DX station probably needs to give each station a good 15 or 20 minute try before going off to call CQ or try to answer other random callers. He can always return to the original station later if he is copied again. If the DX station has elevation, he is not nearly as limited by a few narrow ground gain lobes, and has the luxury of more time to operate (and possibly even accumulate callsigns in the AVERAGE window, provided there are no other callers for a few sequences).

As experienced JT65 users are well aware, the visual aspect of receiving EME signals is an equally critical element in effectively operating the station. Often, it is seeing the presence of calling stations during a receive period that provides the operator the extra time to decide where to set his narrow FREEZE filter to be ready for a decode at the end of the receive period, so he can set the correct message for his next transmit period appropriately. Or, by seeing a trace, the DX station can move his cursor onto that trace to decode it – and not rely on the fact that it may be out of the filtered receive bandpass previously set for the computer. Obviously, if he simply visually decodes the final 73 shorthand message from one station, he can quickly set up to decode and answer another caller instead, thereby being able to decode and reply to a new station before the next transmit period begins. If no callers seem to be copying me – and I am only receiving calls without reports - I will just pick one of the decoded callers with the least amount of moon time left and call him until I either complete with him or I decode someone else who IS copying me at that particular time. As the DXpedition station, I usually only send standard messages #2 (calls and OOO reports) or #4 (final RRR), and rarely call CQ. No wonder people often don't decode my signal and only see my weak trace on the SpecJT waterfall!



It has been shown that this procedure is far more productive than setting up any schedules or randomly answering different callers without knowing whether they are copying anything or not. I have summarized a typical DXpedition contact using the above proven procedure.

Callsigns and messages are of course quickly selected automatically by simply double clicking on the caller's trace or decoded callsign. It is the combined use of the visual waterfall display, along with skilled selective sequential decoding of traces that will enable the DX station to receive the most information, and decide whom to answer to quickly maximize the number of EME contacts.

I also make sure to keep an eye on the moonrises - and especially moonsets – of areas where I expect 6m EME callers to be trying to contact me. I learned this lesson the hard way on my first 6m EME DXpedition, when I stopped copying signals and hiked down the road to the nearest internet café in E51 to update my stations worked list. It was there that I learned the moon was just coming into the main lobe for horizon-only stations in Scotland, and they were on the air anxious to work me! Needless to say, I never made that mistake again!

NEW SOFTWARE. Currently, EME options are being incorporated into WSJT-X, and I will be experimenting with that for possible use on future DXpeditions. Currently, with WSJT10, it is necessary every sequence to try to manually decode every particular trace seen on the SpecJT waterfall, and then record all the information – including the DF, DB, and messages being sent from various callers - manually in a paper logbook. Once WSJT-X fully implements the functionality for EME modes, it is quite possible that running JT65A for EME under WSJT-X will allow the DXpedition station to automatically see all callers, their frequencies and their messages after each receive sequence. The ability to automatically decode and display the frequencies of all callers at the end of each receive sequence is a very useful and attractive development. Early testing shows that JT65A in WSJT-X at least as sensitive as WSJT10.

CONCLUSION

In conclusion, I can't over-stress the importance of effective planning and some actual pre-trip practice with the JT65A software and the particular equipment assembled for the DXpedition. With good planning and preparation, you can enjoy the results of "Ultra Long Path" contacts – even when others are complaining about the 6m band appearing to be "dead". Whether you are planning a DXpedition for meteor scatter, VHF contesting, or HF, I hope you will think about adding 6m EME capability as something special to fill the time when the moon is beckoning. Here's wishing you a healthy amount of good luck in making some very special "Celestial Magic" on the 6m band!

On 6m EME, the Magic never ends...

FIGURE 1 – ADDITIONAL PHOTOS FROM VARIOUS 6M EME DXPEDITIONS

M^2 6M8GJ yagi used with manual elevation and azimuth at T32C in October, 2011. Pictured are 6m EME operators Michael DG1CMZ (L) shaking hands with Mike G3WPH (R) after the first 6m EME QSO.

FT5XO 6m antenna (M^2 6M7NAN "Trip Yagi"), March 2005. (Photo courtesy of W7EW)

Quiet location with excellent ground gain, as proven by 7P8NK in August 2004. (Photo courtesy of VA7DX)

6M7JHV yagi during the J68AS DXpedition June 2005. (Photo courtesy of W8QID/J68ID)

7 element yagi at LA8AV/OH0JFB June 2004. (Photo courtesy

of OH0JFB)

FP/N6RA 6m antenna (M^2 6M7NAN "Trip Yagi"), June 2005. (Photo courtesy of N6RA)

Pair of M^2 6M5X yagis at K5N EME grid DXpedition to grid DL88, with elevation. (Photo courtesy of K5QE)

(Photo courtesy of ZS6A)

FIGURE 2 – W7GJ DXPEDITION PLANNING CHECKLIST

DXCC

Accessible and relatively affordable to reach
Needed by EU and NA
6m license can be obtained

SITE

Enclosed and protected from the weather
Safe and secure
Rural and quiet
Free from local QRM
Reliable AC power 24 hours every day
Good ground gain on moonrise and/or moonset
Access to food and water
Periodic access to internet possible

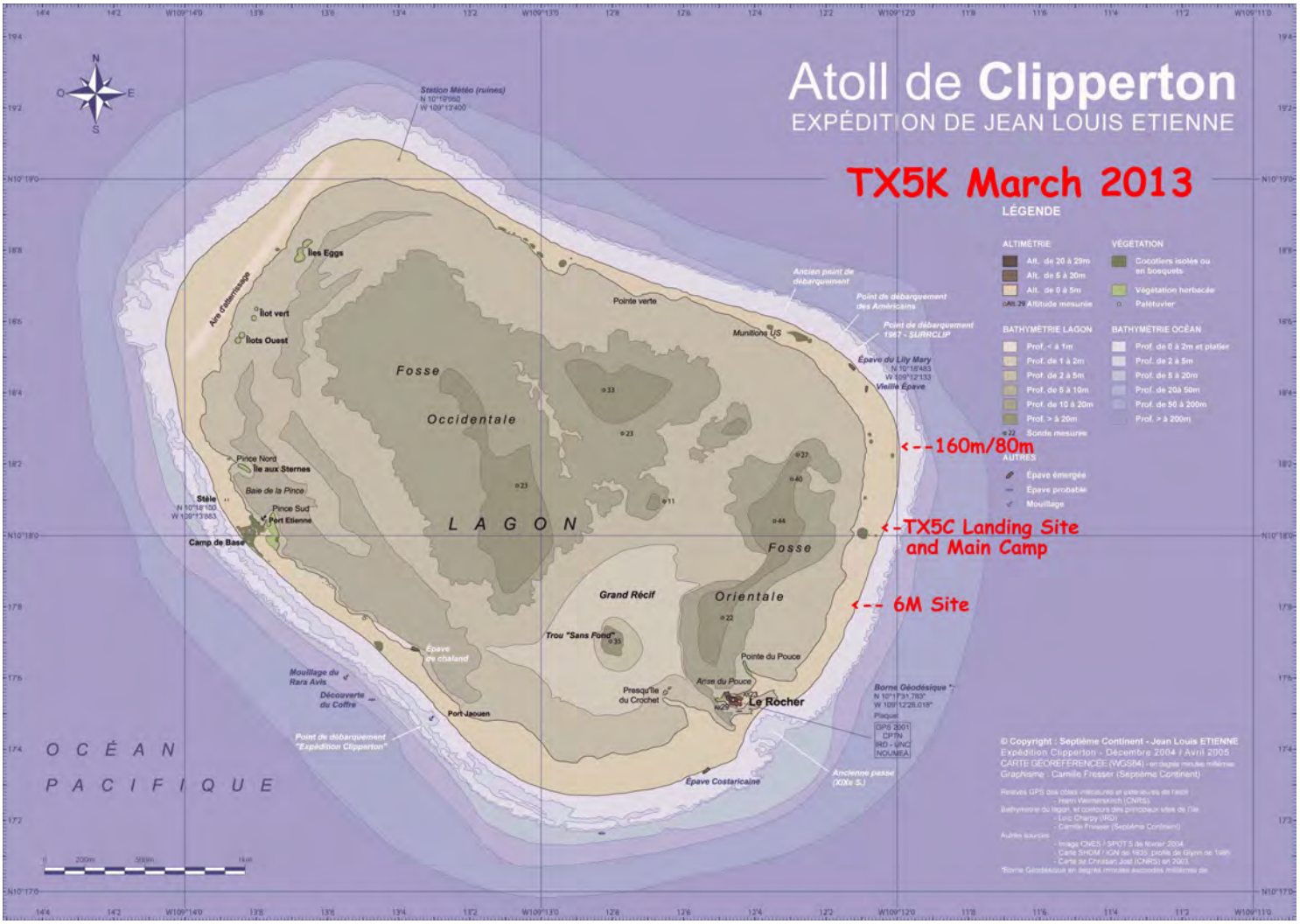
TRIP SCHEDULING

Low Degradation
Common moon windows
Low ionospheric disruption season
Low ionospheric disruption time of day for horizon shots
Good weather and acceptable health risks
Announce schedule well in advance

EQUIPMENT

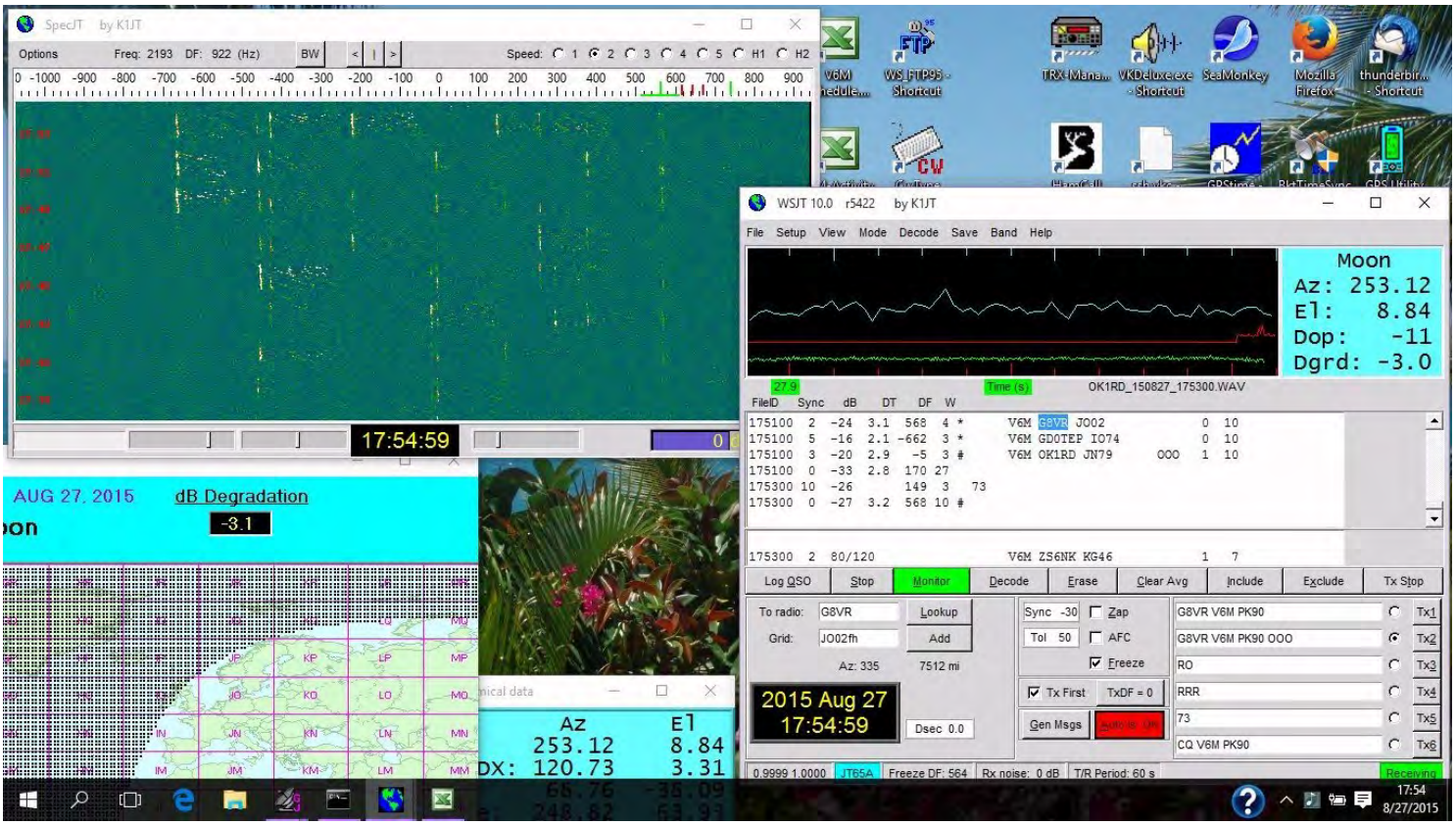
Transport details
High gain yagi
Low loss feedline
Highest power amplifier practical
Switching power supplies
Suitable power cords and plugs
Good stable transceiver
Receive preamplifier
Fast laptop computer with high resolution screen setup with JT65A for EME software
GPS receiver and software for setting computer clock
Aiming circle for manual azimuth
Optional elevation mount
Device for measuring antenna elevation
Ferrite filters for all leads
Essential tools, extra connectors, cables, silicone grease, plastic tape, survey tape, first aid, bug repellent, etc.

FIGURE 3 - TX5K 6M OPERATING SITE SEPARATED FROM HF CAMPS



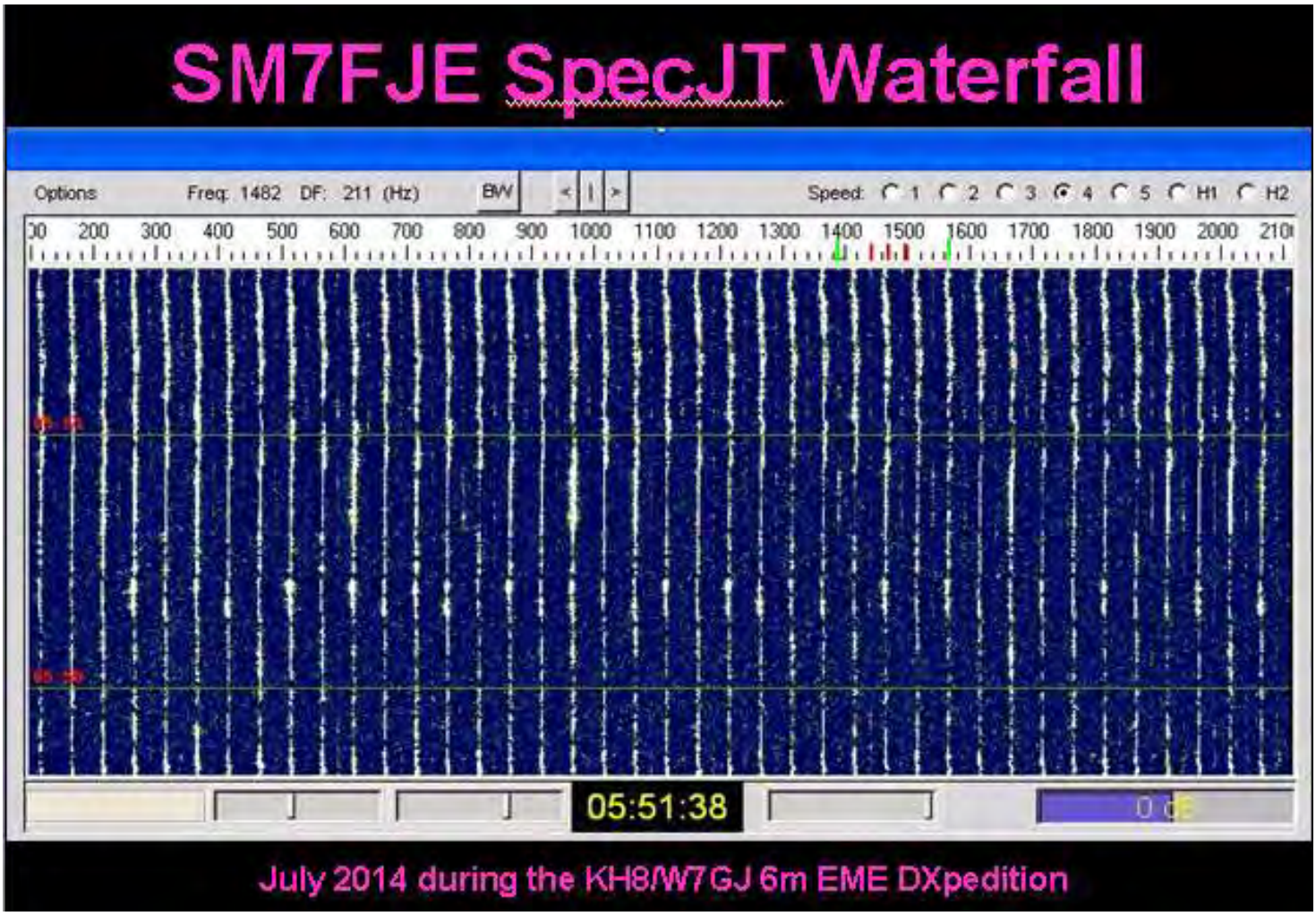
(*Photo courtesy of W7GJ)*

FIGURE 4 - MOONSET AT V6M AUGUST 27, 2015



(Photo courtesy of W7GJ)

FIGURE 5 - SPECJT WATERFALL SCREEN AT SM7FJE



Spurious QRM signals from Russian TV via Es during KH8/W7GJ 6m EME operation
(Photo courtesy of SM7FJE)

FIGURE 6 - GJTRACKER SAMPLE PLANNING

AUG 18,2016 44 ° 41' 15" N MOON POSITION RANGE: 224,228 MI
THURSDAY 65 ° 47' 30" W (PREPARED BY GJTRACKER V3.0) A +9 DAYS 15.99'SD
JD: 2457618.5 VE1JF NOTES: ,,
DX: 8,299.9 MI (VE1JF in FN74cq) (T8GJ in PJ77hq) APPROX 50 MHZ DB

UTC	NOTES	W	AZIMUTH	ELEV	DEC	AZIMUTH	ELEV	POL	SKY °K	DEGRADATION
0915	FM		249.6	2.9	-11.5	101.8	0.5	55	5322	3.2
0930	FM		252.3	0.5	-11.4	102.3	4.0	55	5305	3.2
0945	FM		254.8	-2.0	-11.4	102.8	7.5	55	5287	3.2

AUG 19,2016 44 ° 41' 15" N MOON POSITION RANGE: 222,292 MI
FRIDAY 65 ° 47' 30" W (PREPARED BY GJTRACKER V3.0) A +10 DAYS 16.13'SD
JD: 2457619.5 VE1JF NOTES: ,,
DX: 8,299.9 MI (VE1JF in FN74cq) (T8GJ in PJ77hq) APPROX 50 MHZ DB

UTC	NOTES	W	AZIMUTH	ELEV	DEC	AZIMUTH	ELEV	POL	SKY °K	DEGRADATION
1000			251.0	7.1	-7.6	97.6	-0.8	55	4226	2.1
1015			253.6	4.7	-7.5	98.1	2.7	55	4226	2.1
1030			256.3	2.2	-7.5	98.6	6.3	54	4226	2.1
1045			258.9	-0.3	-7.4	99.1	9.8	55	4226	2.1

AUG 20,2016 44 ° 41' 15" N MOON POSITION RANGE: 220,983 MI
SATURDAY 65 ° 47' 30" W (PREPARED BY GJTRACKER V3.0) A +11 DAYS 16.22'SD
JD: 2457620.5 VE1JF NOTES: ,,
DX: 8,299.9 MI (VE1JF in FN74cq) (T8GJ in PJ77hq) APPROX 50 MHZ DB

UTC	NOTES	W	AZIMUTH	ELEV	DEC	AZIMUTH	ELEV	POL	SKY °K	DEGRADATION
1100			255.4	9.2	-3.2	93.4	1.5	54	4157	1.9
1115			258.1	6.7	-3.1	93.8	5.1	54	4157	1.9
1130			260.7	4.2	-3.1	94.3	8.7	54	4157	1.9
1145			263.3	1.7	-3.0	94.8	12.3	53	4157	1.9
1200			265.9	-0.9	-3.0	95.3	15.9	53	4157	1.9

AUG 21,2016 44 ° 41' 15" N MOON POSITION RANGE: 220,329 MI
SUNDAY 65 ° 47' 30" W (PREPARED BY GJTRACKER V3.0) A +12 DAYS 16.27'SD
JD: 2457621.5 VE1JF NOTES: ,,
DX: 8,299.9 MI (VE1JF in FN74cq) (T8GJ in PJ77hq) APPROX 50 MHZ DB

UTC	NOTES	W	AZIMUTH	ELEV	DEC	AZIMUTH	ELEV	POL	SKY °K	DEGRADATION
1145			257.4	13.8	1.4	88.5	0.3	54	4626	2.3
1200			260.1	11.3	1.4	88.9	3.9	53	4644	2.3
1215		N	262.7	8.8	1.5	89.3	7.5	53	4644	2.3
1230		N	265.3	6.3	1.5	89.8	11.1	52	4644	2.3
1245		N	267.9	3.8	1.6	90.2	14.7	52	4661	2.3
1300		N	270.5	1.2	1.6	90.7	18.4	52	4661	2.3
1315		N	273.1	-1.3	1.7	91.1	22.0	52	4661	2.3

Checking common moon window from T8GJ with VE1JF in easternmost North America during lowest Degradation. (Printout courtesy of W7GJ)

FIGURE 7 - SAMPLE OPERATING SCHEDULE INFORMATION SHEET FROM 2016 V6M DXPEDITION

V6M in PK90va

PROPOSED OPERATING SCHEDULE ON FALAOP ISLAND, ULITHI ATOLL, YAP, FEDERATED STATES OF MICRONESIA

(Revised 18 Januaruy, 2016)

50 MHZ DB DEGR.		1.8	1.5	1.7	2.0	2.6	4.0	4.5	4.7	5.4	
UTC TIME	LOCAL	Mon	Tue	Wed	Thu (NM)	Fri	Sat	Sun	Mon	Tue	UTC TIME
AND DAY	NEXT DAY	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	AND DAY
0000Z	1000							TEARDOWN	DEPART		0000Z
0100Z	1100	ARRIVE	0100 NA MS	0130 NA MS				TEARDOWN			0100Z
0200Z	1200	SETUP			0230 NA MS			TEARDOWN			0200Z
0300Z	1300	SETUP				0300 NA MS	0330 NA MS	TEARDOWN			0300Z
0400Z	1400	SETUP						TEARDOWN			0400Z
0500Z	1500	SETUP						TEARDOWN			0500Z
0600Z	1600	SETUP						TEARDOWN			0600Z
0700Z	1700	SETUP						TEARDOWN			0700Z
0800Z	1800	SETUP						TEARDOWN			0800Z
0900Z	1900	SETUP						TEARDOWN			0900Z
1000Z	2000	SETUP						TEARDOWN			1000Z
1100Z	2100	SETUP									1100Z
1200Z	2200										1200Z
1300Z	2300										1300Z
1400Z	0000										1400Z
1500Z	0100										1500Z
1600Z	0200										1600Z
1700Z	0300									LEAVE YAP	1700Z
1800Z	0400	1830 MR									1800Z
1900Z	0500		1815 MR								1900Z
2000Z	0600			2015 MR							2000Z
2100Z	0700		W7GJ		2130 MR	2145 MR					2100Z
2200Z	0800						2230 MR				2200Z
2300Z	0900										2300Z
2400Z	1000										2400Z

NOTES: **A cell with dots in it indicates periods when the moon on Falalop is over 50 degrees elevation - please try to work me before the moon gets so high! I may not stay on for those difficult periods if I don't see callers.**

FIGURE 8 – 6M8GJ ELEVATED HIGH TOWARD THE MOON AT 3D2LR

(Photo courtesy of W7GJ)

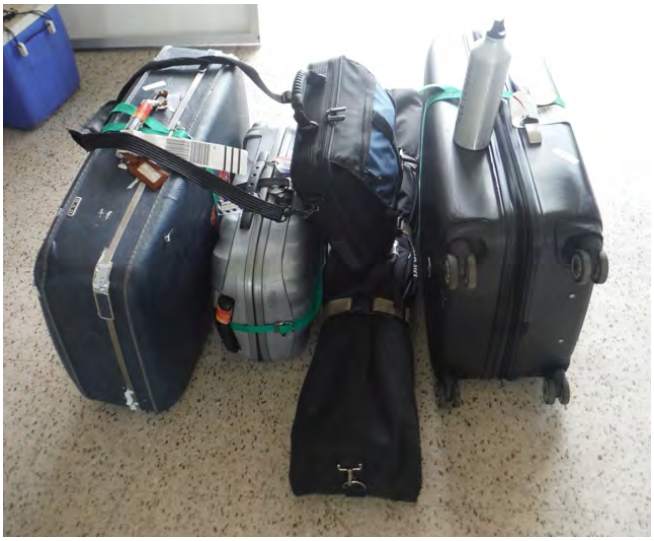
FIGURE 9 – 6M8GJ YAGI ELEVATED AT 5W0GJ

(Photo courtesy of W7GJ)

FIGURE 10 – HARDWARE ORGANIZED FROM BOXES IN SUITCASES AT KH8

(Photo courtesy of W7GJ)

FIGURE 11 – SUITCASES AT T8GJ AND V6M IN 2016 *(Photos courtesy of W7GJ)*



Clockwise from top left: All luggage at the Ulithi airport, including antenna/mast bag, laptop computer, small silver carry-on and the two larger suitcases; carry-on with 6m amplifier, two 50 VDC power supplies, 12 VDC switching power supply, FT897 and most interconnecting cables, satellite transponder, bag of coaxial connectors & adapters and tool kit; suitcase with the coaxial cable, headphones, RIGblaster computer interface, water filter, preamp and clothing; connecting coax cables, guy ropes and stakes, ground strap, and clamps, elevation mount, all antenna and mast hardware, anti corrosion paste, paper towels, extra extension cords and the 6M8GJ driven element and 1:1 ferrite balun. The checked bags are all carefully packed to each weigh in under 50 pounds.

FIGURE 12 – BATTLING THE SALT SPRAY AT TX5K

(Photo courtesy of LouPhi Locke)

FIGURE 13 – GROUND ROD ON THE ANTENNA AT T8GJ 2016

(Photo courtesy of W (Photo by W7GJ)

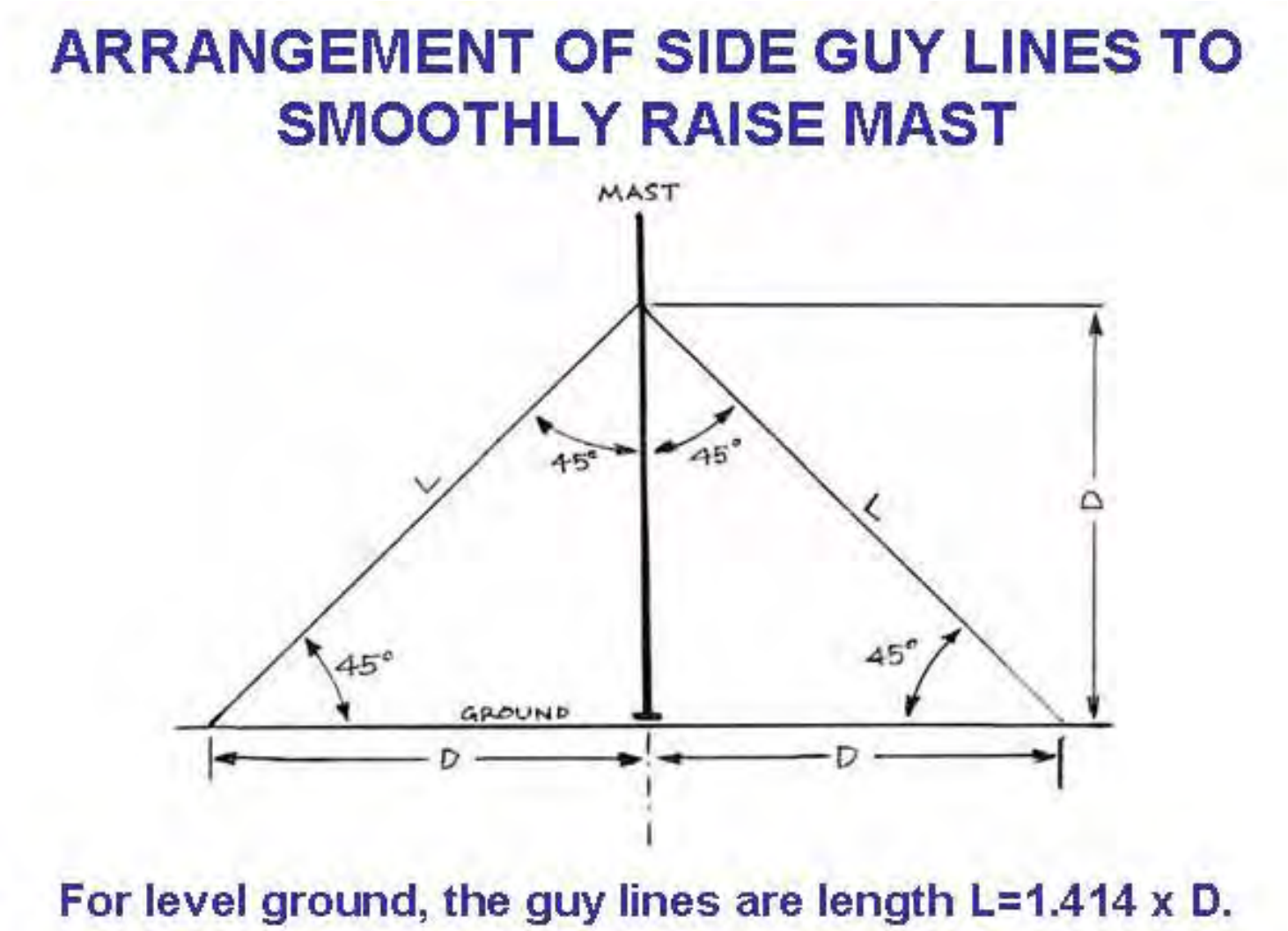
FIGURE 14 – ANTENNA, MAST, & OTHER TUBING PIECES READY FOR INSERTION INTO THE NYLON TRANSPORT BAG

(Photo courtesy of W7GJ)

FIGURE 15 – TRANSPORT BAG WITH ANTENNA AND MAST COMPONENTS AT KH8

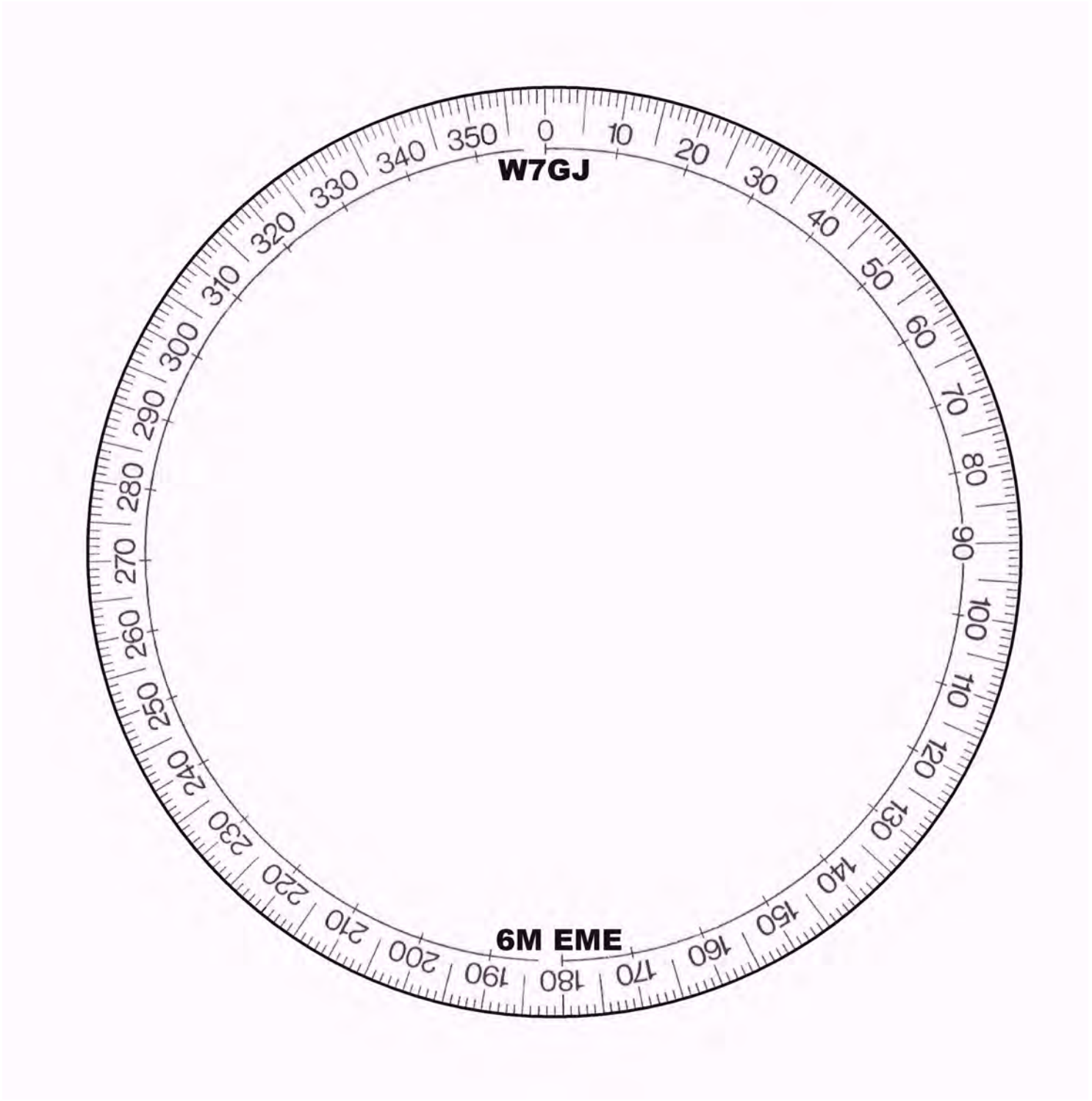
(Photo courtesy of W7GJ)

FIGURE 16 – ARRANGEMENT OF SIDE GUY LINES TO SMOOTHLY RAISE MAST



Side guy lines of length L are attached to the mast guy at height D. D is also the distance from the center of the mast to the guy anchors. For level ground, the guy lines are length L=1.414 x D.

FIGURE 17 - TEMPLATE FOR MANUAL AIMING CIRCLE



(Photo courtesy of W7GJ)

FIGURE 18 – AIMING CIRCLE IN USE AT V6M IN 2015

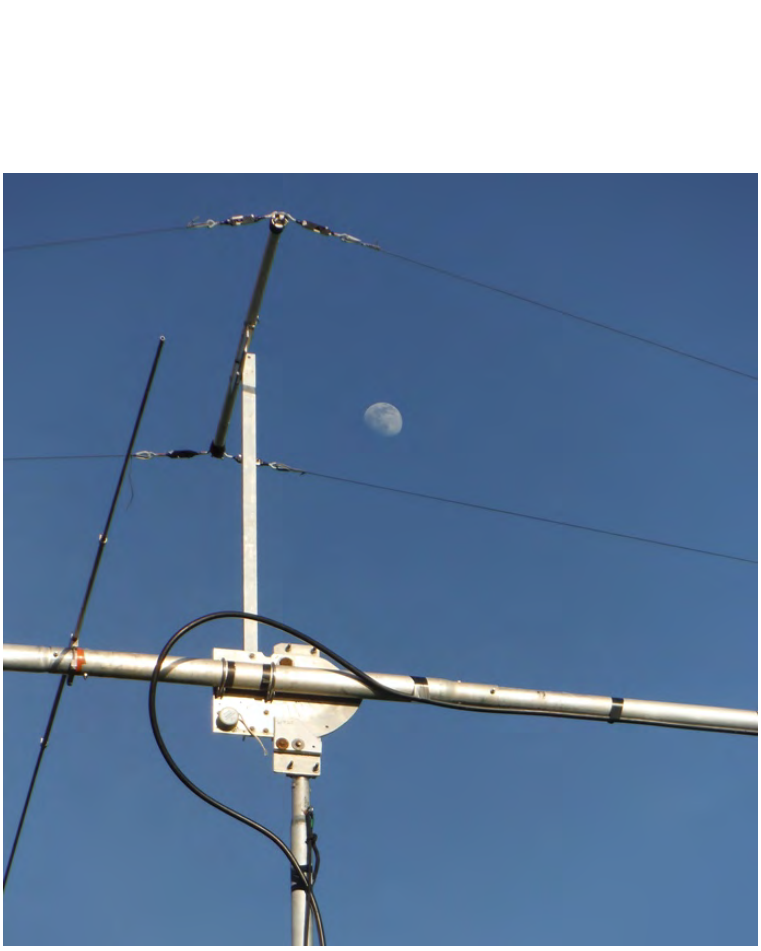
(Photo courtesy of W7GJ)

FIGURE 19 - SOME MANUAL ELEVATION TECHNIQUES

M2 6M8GJ yagi suspended from a lift at VP8DMH in Antarctica in 2011 (Photo courtesy of M0PRL)

Manual elevation and indicator on 7 element yagi at KH0/KH2K in 2005 (Photos courtesy of JA1RJU)

FIGURE 20 - CLOSEUP OF W7GJ MANUAL ELEVATION MOUNT AT V6M, AND HIGH ELEVATION AT TX5K



(Photos courtesy of W7GJ)

FIGURE 21 – KEEPING AMPLIFIER AND POWER SUPPLY COOL ON THE FLOOR AT 5W0GJ IN 2011

(Photo courtesy of W7GJ)

FIGURE 22 – LIBERAL USE OF FERRITE FILTERS AT T8GJ IN 2016

(Photos courtesy of W7GJ)