Walston Tips and Tricks

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I've used the Walston for a little over 4 years. I have never lost a rocket that I was responsible for except for the Yellow Jacket, which sleeps under the salt at Bonneville. I have found only the transmitter (on a piece of masking tape) when the airframe and the transmitter were separated at ~20K AGL (the airframe came down within sight, but the transmitter floated for about 15 min.), and I have followed a transmitter heading for 26.8 miles (GPS straight-line) to a recovery. Over the years and through several very challenging projects, I have recovered about $500K of flight hardware and payloads. The Walston is very good flight recovery insurance.

I started out with 2 transmitters, wrecked one (repaired by Jim Walston), lost one in the Yellow Jacket (replaced by the owner of the rocket), burned up two (one standard Xmtr and one SuperXmtr, long story) and wrecked another (which has to be replaced). I did some range testing on the SuperXmtr at Black Rock about 6 weeks ago and was very impressed (If I can't find a rocket at Black Rocket with the SuperXmtr, then the rocket should have been launched at a real range with radar.).

The whole trick to success with the Walston is to close your eyes. You're allowed little peeks now and then, especially when you're driving, but I find it easier when my eyes are closed.

Before I get into actually using the Walston, let me cover a few ground rules.

1. The transmitter head has to be fully protected, secure and padded with foam. I have used duct tape to put the Xmtr into a 4"-6" diameter X 25" long parachute compartment, covering the head well and extending the antenna straight along the inside, covering the antenna completely with duct tape, and it has survived well enough. That's the quick and dirty installation. (Don't use masking tape. You will be chasing the Xmtr and the airframe will be somewhere else.) A better installation is along the inside of the payload bay or nosecone, completely isolated from any ejection charges and secured in a small tube (1"X20"). The transmitter is pretty tough for a little blob of epoxied micro-circuits, but why risk damaging the transmitter and not having a signal?

2. The antenna has to be straight. On the pad, in the air, on the ground. Period. If the antenna is not straight on the pad (i.e., it is mounted in such a way as to "deploy" along with the parachute, or it is curled up in the airframe and will remain that way throughout the flight), there is no way to get an accurate range setting for tracking once it is back on the ground (will explain later). The same goes for the ascent phase of the flight. There is no way to get a range setting. After the parachute deploys and the antenna is "out" (and the rocket is usually too high to see without binoculars), that's when the real work begins and you will have no range settings.

3. The Xmtr cannot be housed in any part of the airframe that contains carbon or metal. Duh! If the airframe shields the signal, you've just wasted your money. Carbon-glass will attenuate the signal to the point of being useless, and aluminum/mild steel/titanium/etc. will completely block the signal. The payload electronics and wiring harnesses do not seem to affect the signal enough to be significant, so that's usually where I install the Xmtr. There, or up into the nosecone and down into the payload bay, depending upon how long everything is. You'll need a straight run of about 20" somewhere in the airframe. Surprisingly, the transmitter head itself without the antenna can transmit a strong enough signal to be useful on the ground (Found this out when a friend's rocket sheared off the antenna and I still had a signal. My range settings were all screwed up, but I still had a signal to effect recovery.).

4. The Xmtr should be housed completely within the airframe, before and after deployment of the parachutes. We've tried extending the antenna through the side of a carbon airframe and taping it down the side with Kapton tape, but the signal then becomes very "one-sided" and is very difficult to track. We've tried putting only the transmitter head into the nosecone and letting the antenna hang out free after deployment. Ha! After the less than nominal parachute deployment when the antenna was sheared off, I tracked only the head. We've tried putting only the transmitter head into the payload bay and letting the antenna hang out free after deployment, and had the payload lay down on the antenna in a small ditch, bending it into a U shape and effectively attenuating the signal to a whisper.

Okay, those are the 4 basics: Protected, Straight, No Carbon/Metal, Inside. These four conditions give you the best chance of finding the rocket. Cheating on any one of them significantly reduces your chances.

Now comes the fun part. (BTW, the Boys call me "Good Dog" because I find their rockets. I love a hard find!!)

Lay everything out in front of you. You should have a long blue/black bag containing three receiving antenna rods, a female-to-female BNC cable about 3' long and the receiving antenna handle. You should also have the multi-channel receiver with batteries already installed by Jim (and maybe a charging unit, depending upon the age and model of the receiver). And you should have at least one transmitter with either three little manila envelopes with one tiny battery in each, or if you bought the SuperXmtr, the batteries are already installed.

Wrapped around the head of the Xmtr will be a white label on the packing bubble wrap. The channel and frequency of your transmitter will be written on there. Look on the bottom of your receiver for the same info. After you remove the bubble wrap from the transmitter head, you will notice that Jim has also identified the frequency of the transmitter on a little white label under the epoxy. At this point, I usually take a black permanent marker and write the channel letter/number on the other side of the transmitter head (I can hardly see that tiny writing.). Notice that the antenna unscrews from the base of the transmitter head. This is handy for replacing ejection charge charred antennas or

ones that have been sheared off. (Note: I have broken two transmitters just above the screw. Padding the head for possible hard landings is a really good idea. Extend the padding down the antenna a little too.)

You've got a good 200 hours on the little batteries on the Xmtr and about 82 DAYS on the pre-installed batteries on the SuperXmtr. Go ahead and install the batteries (or remove the magnet from the red dot on the SuperXmtr). Ha! You've just discovered how hard it is to get all three little batteries stacked up and slid into the battery holder. Do them one at a time, starting with the outermost one first. The wide flat side of the battery goes against the bracket, the next battery slides in with the same orientation, and then the third battery can be wedged into the remaining gap also in the same orientation as the other two. Observe polarity! Jim usually includes a couple black plastic sleeves to slide over the batteries after you get them installed. That's necessary to keep them in through hard landings, but I always lose them in the wind at the site, so I use a wrap of masking tape.

Before you turn on the receiver, take the transmitting transmitter into the other room and tape it to the wall. If you have the SuperXmtr, take it outside and tape it to a tree or the fence on the far side of the yard (or maybe in your neighbor's yard). Now look at the bottom of the receiver again and notice the ATTENUATOR switch. Put this in the "On" position. Now set the receiver to the same channel as the transmitter in the other room, turn the GAIN knob the whole way counter-clockwise (down) and turn the receiver on. Wow, isn't that a lovely sound? You've just found your rocket. Ha! That was just a test.

If you don't hear anything, slowly turn the GAIN up until you can hear the little one second chirp from the transmitter. If you still don't hear anything, check the channel selection and the battery orientation in the transmitter. Call Jim if all else fails. (Note: the tone of the chirp can be adjusted with the tuning knob on the right, from a deep CHIRP to a high little chirp. The little birds at Black Rock make the exact same little chirping noise. I usually have to tune to a slightly different chirp to keep on track.)

Okay, you've got a chirp. Hey, look, no receiving antenna! Turn the GAIN down as far as possible and assemble the receiving antenna. The antenna and the antenna rods are color coded; the shortest one goes at the end without the handle, the one with the BNC connector goes in the middle (and the little screw rod goes into the tiny hole) and the long one goes in the last hole. Tighten the knobs gently, connect the BNC to both the receiving antenna and the receiver (male connector on bottom near Attenuator switch). Wow, big signal!

Adjust the GAIN until you have a comfortable chirp. Hang the receiver around your neck, hold the antenna by the handle, CLOSE YOUR EYES and go find the Xmtr. (Don't do this around your spouse or children. They tend to play tricks with the Xmtr. A moving Xmtr is harder to find and one in the dryer gives a really faint signal.)

Notice that when the receiving antenna is parallel to the transmitter's antenna, the signal is strongest. Turn the receiving antenna perpendicular (spelling points here) to the transmitter's antenna. The signal is weaker. This is important to notice. In the field with

the rocket still in the air after deployment, this signal difference can tell you if it is spinning in flat without a chute or is hanging under the drogue/parachute. In the field with the rocket already down, this signal difference can tell you if the rocket is hanging in a tree, stuck in a bush or the mud (and is standing up easily seen), or is laying down hidden by the terrain and vegetation. There are other signal variations that I'll tell you about later, but you'll need to know how to "hear" what your rocket's orientation is first.

Notice also that when you sweep from one side to the other in an arc, if you sweep too fast, you'll miss the chirp. Be a minute hand on a clock. Go Slow. Listen for the strongest chirp. DON'T OPEN YOUR EYES YET. Now, sweep on past that point until you hear the chirp at about half volume. You may peek now to see where the antenna is pointing. Remember that landmark. Close your eyes, sweep slowly back to the strongest chirp, and keep going until you hear the same half volume chirp. Peek to remember the landmark. Do this a couple times until you have two firm landmarks at the half volume points. Open your eyes and choose a point halfway between the two landmarks and head in that direction.

Keep doing this until you're within a few feet of the transmitter. You will have to adjust the GAIN down as you approach the transmitter to hear the differences in the signal strength. When you can't adjust the GAIN down any farther and the signal seems to be of equal volume all around you, you're standing on the transmitter. You can open your eyes at this point. (I found the second stage of Thunder Child on foot under a full moon without a flashlight in the rolling scrubbies north of Trego. She'd gone to 23,214 ft AGL and had drifted 6 miles from the launch point. It was two hours after launch when I found her. Finding the Jeep again was much much harder.)

Yes, I know that Jim's put a sliding light bar on the receiver to give a visual indication of signal strength, but when you're 10 miles out or the airframe's laying in a ditch, the light bar is not a sensitive as my ear. Most of the time, I can hear the signal but there's only a flutter on the light bar. Learn to use your ear.

What you've just done is what you will do in the field. Don't use your eyes to track. Use your ear to hear the half points. Use your eyes to remember the landmarks and to drive with. Actually, my best tracks are when I have a driver/tracking partner who gets me in the Jeep where I point. And who remembers to bring water and a flashlight (and the Pringles). Chet Geyer's been tracking with me since the first flight of LongShot. We can find anything with a transmitter, but he dislikes being called a good dog. Go figure.

Okay, let's walk through a typical launch and recovery.

The transmitter is on, in the airframe, on the pad, ready to rise. You're at the range head, receiver hung around your neck, ATTENUATOR "On", the transmitter's channel is selected, the tuner is set to a chirp that doesn't imitate the indigenous wild birds, and the GAIN is set to give you a signal about halfway up the light bar (Ok, you can use your eyes here.) You're holding the receiving antenna pointed at the airframe parallel to the transmitting antenna in the airframe (This usually means straight up-and-down for a <10

degree launch angle. For greater angles, the receiving antenna will be tipped slightly to get the antennas parallel.)

How far away from the airframe are you? 500 ft, 1000 ft, more? Know how far away you are. Look at the GAIN setting. Remember it. Put a pencil mark on the receiver by the white mark on the GAIN knob, if you need to. This is how strong the signal will be with the same settings when you are at the same distance with the antennas parallel when the airframe is finally down. This helps you know how close you are to the airframe when you are on the track. I'll discuss this more later.

The countdown has started, your tracking partner is ready with the Jeep, water and the Pringles (and the Alan Parson's tape "On Air" or Mike Oldfield's "Songs of Distant Earth" is cued up in the tape player), your finger is on the ATTENUATOR switch ready to turn it off at motor burnout, the receiving antenna is still pointed at the airframe, your eyes are open, fixed on the rocket, the receiver is giving you those lovely little chirps. YOU ARE ON POINT.

The rocket rises. The chirps grow fainter as the rocket goes out of sight. At motor burnout, you flip the ATTENUATOR switch off. Aaaah! The chirps are back again, lovely and strong. The rocket coasts on up to apogee, you're following the flight path with the receiving antenna, you've got "Chalk!" and deployment. STOP right there. Look down at the GAIN setting. Are you still on scale? Does the signal strength max out the light bar? What was your projected altitude? With those same settings on the receiver, you may hear that same signal strength from the transmitter when you are at that same distance, especially if the airframe is hanging in a tree.

You now have two sets of receiver settings with matching distances. One is with the ATTENUATOR on and one is with it off. When the airframe is down, these will aid greatly in knowing approximately how far away the rocket is. And how to best get there. On foot is the last resort, especially if the terrain is rough and uphill, or the ambient temperature is over 90F.

Okay, stay on the signal with the receiving antenna. This is critical when there are winds aloft. Do a slight slow sweep, side-to-side, up-and-down. Even if no one can see the airframe with binoculars, you can know where it is approximately in the sky. Follow the signal the whole way to the ground. THE SIGNAL WILL DISAPPEAR instantly or suddenly get very faint when the airframe is down. This is normal. What landmark are you pointing at with the receiving antenna? Remember it.

Before you go charging off in the Jeep, adjust the GAIN up and do a really slow sweep in the general direction of the landmark with the receiving antenna parallel to the ground, perpendicular to the ground and at a couple angles in between. Did you get it back? With the GAIN turned all of the way up, do you have enough signal strength to attempt a half-point chirp sweep? If you have a usable signal, you've found the rocket, and the rest of the track is boring but necessary. Go get the rocket. Good Dog.

Let's say that you don't get a signal. The rocket has disappeared. GPS is handy here. Get a GPS fix on your location and head towards the landmark about 1 mile. Stop, turn the Jeep off (vehicle engine noise interferes with the signal reception), walk about 20' away from the metal Jeep towards the landmark, and try to pick up the signal again. Slooow sweep, GAIN at max, ATTENUATOR off, several different receiving antenna orientations, ear pressed to the receiver's speaker, eyes closed, receiving antenna held above your head at arms length but with the handle parallel to the ground. Nothing. Okay, stand on the bumper of the Jeep. Same sweeps. Don't fall off, the tracking partner is a joker and rocks the Jeep. Nothing. Back in the Jeep, making sure to poke tracking partner with one of the receiving antenna's ends, go towards the landmark another mile.

Same drill. Engine off, GAIN max'ed, slooow sweeps, ear pressed to the speaker, eyes closed. What's that? In the hiss of the max'ed out GAIN there is a silent "hole" of the same repetition rate as the signal's chirps. Stupid light bar is just fluttering, but you've got something. Sloow sweep to try to find the maximum signal strength of the "hole". Got it. Open your eyes, where the receiving antenna is pointed is another landmark. Remember it. Back in the Jeep, poke tracking partner again for good measure, go another mile.

Same drill, but this time you have a faint but usable signal. Eyes closed, slow sweep, find the first signal half-point, open eyes, get the first half-point landmark, eyes closed, slow sweep back through the strongest signal, find the second signal half-point, open eyes, get the second half-point landmark, split the difference, get a landmark heading, head that way a mile or so, and repeat until you've got visual on the rocket. Good Dog.

Notice that the track was done in relatively small increments, 1 mile max. This is terrain dependent. Sometimes you won't be able to straight-line towards the signal. Going too far may lose the signal because of a gully, hill or creek bed. Sometimes the original landmark heading can be triangulated from the side. Sometimes there is an impassible watercourse that even the Hummer tracks backed away from and you have to go around. Getting up on a hilltop is good for picking the signal up again. Slow sweep 360 degrees.

Notice also that you've turned the GAIN down as you've gotten closer to the rocket. Once I have a usable signal, I set the GAIN to about 8 on the light bar, and slow sweep for the half-point chirp with my eyes closed, check the light bar to see if I'm at about 4, get the first half-point landmark, and then do the same for the other side. You'll find that your ear is more sensitive than the light bar (which I sometimes suspect is possessed). When you are max'ed out on the light bar with the GAIN all the way down, turn on the ATTENUATOR and readjust the GAIN for an 8. Remember the pre-launch setting? If you're close to that on the GAIN adjust, you're about the same distance from the rocket as you were at the range head.

Okay, now to the fine points.

Reflection or distortion of the signal due to the surrounding terrain. Large vehicles (i.e., RVs, Ryder trucks), buildings, power lines, railroad tracks, canyons, cliff faces (and with the SuperXmtr, granite mountain ranges) and big hills can all reflect or distort the signal.

Be aware of what's around you and get as clear of these features as possible. A signal reflected and distorted by power lines is the worst. You will hear a double chirp, a warble or a strong chirp and an echo chirp. Most of the time, these odd signals come from two different directions. Do really slow sweeps, change the orientation of the receiving antenna, use your ear instead of your eyes, get your best signal heading, follow it and try again. The signal will eventually resolve into a true heading.

In Flight Events. If the airframe does not separate at apogee and deploy a chute, the rocket will be coming in intact and HOT, straight down and screaming. You can actually hear this in the increase in the repetition rate of the chirps. They doppler. They get closer together as the rocket screams in and abruptly stop when the rocket is down. You will not have time to get a heading on the incoming rocket (like to dodge or get under cover), but you will know when it is down while everyone else is still scanning the skies with binoculars. (I have picked up signals from transmitters that were underground but I had visual well before hand and the signal was pretty sad.) The transmitter is usually a crumbled pile of parts, but Jim is pretty good at fixing my disasters.

If the airframe separates at apogee but does not deploy a chute, it will flat spin in. The signal will still doppler, but the funniest thing is that it goes loud-faint-loud-loud-faint. The signal will still die as soon as the rocket is down, but these are easier to find and usually the transmitter is okay (Remember the padding?).

If the airframe separates at apogee and has a drogue deployment, the signal will doppler slightly and may do the loud-faint-loud-faint-faint signal level change. When the main chute deploys, the signal again resumes its normal repetition rate. Depending upon how much it is swinging or twirling under chute, you may still get the loud-faint-l-f-f-loud signal level change.

Isn't it amazing what you can learn with your eyes shut? My biggest problem with using the Walston is that the Boys usually go tearing off as soon as they see that I've got an initial heading on the track, and unless the rocket is really well hidden by the terrain, they get there first. The Good Dog didn't get to find the rocket (and she pouts sometimes).

Hey, have a good time with your Walston, learn lots, show others how to use it, keep your eyes shut.

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