Audio Target Classification or "ATC"

About "*Quick-Out*" and EPR Techniques.

Greetings, fellow Detectorists, from AHRPS!

I hope this bit of information will be of help when dealing with pesky trash items. This is an overview of some techniques you can use, mainly audible but some visual, to help classify targets as recoverable or not. As Director of ***American Heritage Research & Preservation Society***, it is a goal to do everything possible to help all hobbyists learn more about their metal detector and some of the "art" or "skill" involved in site success. Some of the biggest challenges, when using more modern equipment, is that the rejection capability for some common trash targets is actually more of a problem. This is an updated revision of techniques I have been using and teaching for decades, and is provided through ahrps.org to help fellow detectorists improve their skills.

Now, just a little advance comment on what I refer to as "**ATC**," which is short for "**Audio Target Classification**." I know that most of the hobbyists involved in this great sport are newer to the game and have never used a true, conventional TR-Disc. metal detector. We have very few made or available today. Tesoro doesn't, Fisher doesn't, White's doesn't, and Garrett has a TR-Disc. mode only on their Scorpion Gold Stinger. Even with some recently discontinued models still in use, most owners never use the standard TR-Disc. mode or really understand techniques required for field operation.

When we transitioned from a *'conventional'* or *'traditional'* TR-Discriminate circuit to the motion-based VLF-Disc. circuitry (GEB-Disc., GB-Disc., Disc., and other terms), we gained a lot.

• We gained the ability to hunt without the requirement to maintain that perfect, uniform coil-to-ground relationship.

• We gained the ability to reject the ground signal and trash targets at the same time.

• We gained better depth of detection.

• We gained "ease of operation," so to speak, and there has been a definite trend for manufacturers to provide us with so many "turn-on-and-go" models.

However, with all these gains, we also lost something in the trade-off.

One strength provided by the older conventional TR-Disc. circuitry models was what I refer to as "*true, progressive discrimination*." With the earliest discriminating circuitry we got to enjoy user control over the rejection of common, unwanted trash such as iron nails and other small iron (ferrous) junk, rusty iron bottle openers used to pry off the bottle caps, the old crimp-on style bottle caps that were pried off, small foil associated with chewing gum wrappers, and other similar lower-conductive junk.

I started learning about "metal/mineral locators" in early 1965 and for several years after that we were still popping off those bottle caps to drink a soda. The earliest popular discriminators (early '70s) didn't have rejection levels high enough to reject pull tabs because pull tabs had only been around for a very

few years and were not yet a frequently-found annoyance. It didn't take very long, however, for discrimination circuitry designs to have a broader adjustment range that could be set high enough to reject the original ring-pull tabs.

Back then, screw caps were really only encountered in areas where lowly drinkers hung out. Usually down near the train stations and other places where the bums, transients, hobos, etc., could be found. Remember, too, not to confuse the reference to bottle caps and screw caps.

Bottle caps, as referred to in this hobby, include the old pry-off and modern twist-off caps that are short and have the crimped edge. These are generally made up of iron, steel, nickel or some mixture of predominantly magnetic metals. **Screw caps** are the taller, aluminum screw-off caps associated with wine bottles, initially, and many of today's other beverage containers.

When this hobby was getting its first surge in the mid-1960's thru the 1970's, we were experiencing a lot of very exciting advancements in technology, initially going from the non-discriminating BFO's and TR's to those with discrimination. Then the VLF's (Very Low Frequency or ground cancelling models), and next we had the dual-mode VLF/TR-Disc. models, and finally those with VLF-Discrimination (motion-based). It was important then, as it is today, to adopt a positive approach to success and I preached the "**Beep-*DIG!***" method to cover a site successfully.

With all of those earlier models it was necessary for the operator to adjust the 'tuner' for a slight audio threshold sound. When you searched with a slight threshold audio you could hear the audio null out (go silent) if you lowered the coil of a TR model towards the ground, or get an audio increase if the coil was raised away from the ground.

The threshold audio would also null if you swept the coil across a particular object that was rejected with the discrimination circuitry. What you listened for was a nulling response to alert you that you were encountering unseen trash, and you paid close attention to any increased audio response which would suggest you swept over a potentially good target.

Nulling = rejected target, and a **Beep =** desirable target (potentially).

In 1982 & 1983 we got our first motion discrimination models from Fisher and Tesoro that were based on a slow-motion, 2-filter type operation (compared with the more rapid 4-filter designs we had become familiar with), and it also brought us the first quality-built models with a slow-motion, SILENT-SEARCH discriminate mode that was quiet in nails and small iron.

In the next few years we had better 4-filter models that were motion-based discriminators, but required an audible threshold (such as the improved White's 5900 & 6000 Di Pro SL series) that allowed a slower, more moderate (comfortable) speed sweep. We also saw more manufacturers enter the market of quick-response, slower-sweep, silent-search, motion discriminators, such as Bounty Hunter, Fisher, Garrett, Gold Mountain Technologies, Tesoro, White's, and others.

Using a silent-search model creates a dependence on hearing a positive response. Since the silent search models do not let you hear the trash targets that are present but rejected, the operator needs to understand how to deal with the AUDIO response.

Threshold-based models also require the operator's knowledge of how to interpret a target response, *audibly*, in order to *classify* the target as potentially good or bad. Most popular metal detectors today also feature some form of visual Target ID, and some provide an audio Tone ID that can assign a lower audio for iron-based targets. A savvy operator who learns how to do some ***audio target classification*** will benefit because proper technique to *classify* a target will usually give a better visual classification (TID display) to support the audio information.

I learned early on, when evaluating the motion discriminators against the true, progressive TR discriminators, that motion-based circuitry had a definite problem with many iron or magnetic-based targets. This can include some nails, but it is especially noticeable when dealing with those blasted rusty *bottle caps*! You know, the ones that often respond like a coin or button or token or some other 'good' target.

It might help if I explain my personal opinions about using Discrimination and Target ID. Discrimination WAS an early circuitry adjustment function that allowed us to REJECT unwanted trash. The good-performing TR-Disc. models did/do this quite well because, when searching, we could hear a null, or rejected audio response, to *CLASSIFY* a target as being discriminated or unwanted.

When we use visual Target ID circuitry, with both TR-Disc. and motion discriminating models, we are able to see what the possible or probable target identity might be. Many early Target ID models also happened to rely on threshold-based operation. Thus, the TID would be a little more informative in that it would have the ability to provide a visual response that complimented the audible response. If the threshold nulled due to being swept over a rejected target, not only would we hear the nulling audio but we would see a TID registry that would be associated with a rejected target. An audio 'Beep' would be complimented with an up-scale TID visual response.

One problem with so many detector models offered today is that they rely on silent-search operation in the motion Disc. mode and you never hear a nulling audio. It doesn't exist! A second weakness of motion discriminators is that quite a few trash items that would have been cleanly rejected with a conventional TR-Disc. model, *such as the bottle caps*, some iron washers, etc., will produce an audible 'beep' response! While the audio response might sound good, you will usually have an up-scale TID that doesn't lock-on very well, or is jumpy between a good and bad (non-iron or iron) response.

So, what SHOULD *NOT* respond due to discrimination, or what should register with an '*iron*' Target ID, might sound and look good. I am especially referring to the various magnetic-based metal targets such as *bottle caps* (old or new) and some other rusty iron or magnetic stuff.

Remember, any up-scale TID is a bonus. The main thing we want to do, audibly or visually, is **CLASSIFY** bad targets as being probably bad, and good targets as probably good.

Thus, about 1981, I coined the term **ATC** (**A**udio **T**arget **C**lassification), and to properly classify many of these ferrous-based targets into an iron rejected class there are two techniques I've used and taught that are easy to use. These I named "***Quick-Out,***" and the more effective "**Edge Pass Rejection,**" or "**EPR**" for short.

ATC and these two techniques come from a chapter in some short publications I've worked on.

ATC …Helpful Tips for Non-Metered and Metered Detector Operation

It should be acknowledged that each brand of detector has some operating characteristics that are unique to their design. Even with a single brand there are variances between some models. Therefore, not all of the following suggestions will apply to all detectors, although most will assist anyone who searches with a motion discriminate detector. Some detector models and coils will just do better with these techniques than will other models and coils.

This really can benefit ANY operator of a good motion discriminate detector. Most of these tips and techniques stem from my field use of non-metered detectors through the years, relying on the ***audio*** response only, but they can benefit those who use metered Target ID detectors as well.

I started hosting metal detecting seminars in 1981 in which I incorporated several terms, such as ***A****udio* ***T****arget* ***C****lassification*, or ***ATC***. We all know that a detector's visual target identification is only somewhat accurate, and in-field use might only fair from 15% to 35% accurate for typical coin and jewelry hunting. Desired targets might be too deep, at odd angles, mixed with one or more additional targets, or have some other masking problem to prohibit the TID circuitry from being correct all the time.

Let's not forget the number of 'copy-cat' targets that are out there as well. The good news for those who want to learn is that there is more ***audio*** information available than they might realize. Most of us are coin hunters so we search for coin-like target signals. All of us, regardless of the type of detecting we engage in, might be interested in knowing how to help **classify** some targets to help in the dig/no-dig decision making process.

Here are some **ATC** tips I hope will be of help.

SIZE & DEPTH ESTIMATION: In a metal and target-free area, place a small, medium, and large coin on the ground. Using the Disc. mode, with your discrimination set at a point to *just reject* a surface nail and any manual ground balance adjustment made, sweep over each target at about 2"-3" and "listen" to the response. Then, raise the search coil while making consecutive passes over the target, noting what the audio sounds like as the distance is increased.

Note the maximum distance (depth) you can achieve. Do this with rings, too, and you'll note similar results, except a little less depth, perhaps. Repeat the testing using various types of junk you might encounter, such as a crushed aluminum can, aluminum screw cap, etc. Note that most coins and jewelry produce a similar response depth (coil height), but some trash targets, like crushed cans or tall screw caps, are detected farther away.

So, if you get a good, repeatable signal when searching, simply raise the search coil while making a few sweeps across the target to compare the response with your "best possible" in-air response. If you can get a test coin at "X" inches in an “air test”, yet you can raise your coil 2" to 8" or more than that over a located target, then it is generally a larger object and not a coin-sized target. You have now used a form of ***ATC*** to **A**udibly investigate a detected **T**arget and then **C**lassify it as either a potential coin-size target or too large to be a coin-type/size target.

NARROW vs WIDE TARGET SIGNAL: This popular method of checking a target is done in a conventional, threshold-based, All Metal (or momentary All Metal Pinpoint) mode. Once a target is detected and isolated, the search coil is moved to the side so the coil's edge is past the target. Switch to the All Metal or Pinpoint mode and slowly move the coil towards the target noting where the leading edge of the coil is when you hear a response to the target. Then, do the same from the other side of the target, again noting where the leading edge of the coil is when a good signal is heard.

The operator visualizes these two marked spots where the leading edge of the coil was when a signal was heard and, if they are almost over-lapping or within an inch or so, it is a narrow target signal. A coin-like target signal.

If you get a noticeable increase in audio starting when the coil's leading edge is out from the pinpointed spot by a couple of inches or more on either side, it is either a larger target, such as an aluminum can, or an iron-based (magnetic) object like a round washer, etc.

This simple technique to **A**udibly analyze a **T**arget and **C**lassify it as a potentially coin or ring-sized object, or perhaps larger, unwanted junk, has been in use for decades, but it is still a valuable technique that is quick and easy to use with either a metered or non-metered detector. This same audio technique is used to "shape" a located target as well, such as an elongated object.

PROBLEM TARGETS and "*QUICK-OUT*": A good, old-fashioned TR-Disc. type detector will easily reject a bottle cap, rusty or not. Other very low-conductive trash can be rejected very cleanly with a TR- Disc. model because that circuitry design is what I refer to as a *"true, progressive"* discrimination. Nails, old iron bottle openers, hair pins, and perhaps the most annoying of all, the crimp-style bottle cap, can all be rejected quite easily.

The more modern motion discriminators, however, have some difficulty with a lot of rusty iron just, but the biggest headache for many coin-hunters is that blasted, *annoying bottle cap*! I am NOT referring to the taller, higher-conductive aluminum screw caps, but to the older pry-off and current twist-off bottle caps with the scalloped, crimp-on edge. Often, you will get a rather good-sounding *audio* signal from a bottle cap in the discriminate mode.

If the response is from what appears to be a fairly shallow target, say surface to 3" or so, then you can try the All Metal/Pinpoint mode test for Narrow Vs Wide signal. Generally, the rusty bottle caps will produce a wider signal than a coin-type target. If you still question the target, pinpoint precisely and then use a technique I refer to as "***Quick-Out***." This is where the operator uses a short but quick sweep across the well centered target and notes the ***audio*** response.

Give a more "brisk" sweep across the target dead-center. (**Note:** *It should be a SHORT and BRISK sweep to avoid covering multiple targets.*) Quite often a bottle cap, or other problem target with magnetic properties, will be "kicked-out" with this quick-sweep technique. It works best on targets that are within the typically shallow range, perhaps from surface to 3" or so, depending on the mineralization, the target, the coil size and coil type, and the detector.

Note, however, that some slow-motion discriminators do not work well with a faster sweep speed in rocky ground or very mineralized sand so "***Quick-Out***" might not work too well.

As stated, it will *often*, but *not always*, audibly reject these problem targets, but it only takes a couple of quick passes to try and "classify" the target this way. Although the audio response might still be there, a metered display might be more jumpy or have instability.

"EDGE PASS REJECTION": Like ***ATC*** and "***Quick-Out,***" I coined another term to refer to techniques I've used since about 1979/80 with motion discriminators. ***E***dge ***P***ass ***R***ejection, or "***EPR***," can be used with the "***Quick-Out***" technique, if necessary, for really challenging situations.

Lay a couple of coins and a few bottle caps on the ground, spaced far enough apart so as not to interfere with a coil's sweep. Use a newer crimp-style bottle cap, an older one, and one that is rusty. Then, sweep the coil over the coins, dead-center, at about a 2"-3" height using a 'normal' sweep speed.

Note the good audio signal. Continue to sweep over the target coin as you draw the search coil back towards you and listen for any audio change. You'll see that most of the time a coin will continue to signal well until it is positioned just in toward the center from the edge of the coil (just an inch or so).

Next, advance the coil and note that the same is true in from the back edge of the search coil. A coin-type target, in a typical coin and trash target depth range, will respond well when it is just in from the outer edge of the coil by about an inch or so. I refer to this as the outer 'EDGE' area of reaction on a good, non-ferrous type target.

Repeat this test with the various bottle caps on the ground. Dead center, with a slow, comfortable sweep, you will probably get a good audio response. However, you will note that as you back the coil off while sweeping and get *nearer* to the '**edge'** *where the coin still sounded off well*, the problem trash item will usually be rejected! Advance the coil while crossing the junk target and note that same result occurs from the back edge of the coil. *Where the coin was still responding the trash is often rejected!*

On some really difficult targets, like a few pesky bottle caps, combining the brisk "***Quick-Out***" and "**EPR**" will "*classify*" them as undesirable ferrous trash targets. Please remember .... the sweeps across the targets in question should be *brisk* and *short* so as not to cover additional near-by targets. In some sites, (such as drive-in theaters, or picnic grounds, or fairgrounds) these techniques are very helpful, especially when using a smaller coil, such as a 4" to 7" size, to handle trash.

Once again, those who use any form of visual TID will benefit from this technique as it will tend to make the "jumpy" or "bouncy" target read-out register and lock-on properly as an iron object. Perhaps a bit jumpy when you try "***Quick-Out***" directly over the target, but on the more problem bottle caps you use that together with "**EPR**" and these two techniques will almost always provide the operator with an accurate or proper "iron" classification of the junk target. Coin targets, on the other hand, will usually not produce the lock-on iron reading.

One final note. These techniques will work with both Concentric and Wide-Scan or Double-D coil types, but can be more uniform and consistent with a Concentric coil. D-D designs tend to have a bit more challenge with some trash, especially iron-based junk.

DISCRIMINATE CONTROL ADVANCING: This is a somewhat popular technique, but one which I seldom use and caution against. With this method an operator will set the discrimination low to allow the detector to respond to most targets and then, upon getting a signal, they make MANY continuous passes across the target as they slowly increase the discriminate control to note where the target "falls out" and then decide whether it is maybe a good or bad target.

I do not like this method for several reasons, one of which is because it's quite time consuming. Earlier explained techniques are done with only a flip of a toggle switch or push of a button to go into All Metal (to determine a Narrow Vs Wide target response), or with only a couple of quick sweeps over the target in the motion Discriminate mode.

The Disc. control-advancing method often requires two hands, a lot more time, and with some makes and models there can be some other 'changes' that take effect other than simply increasing the detector's Discriminate level. I do not care for this method to attempt to audibly classify or identify a located target because some detectors will not produce a 'proper' audio response when the control setting is being shifted at the same time the coil is in motion. I've used several makes and models in evaluating this technique and I found that you can hit a point of rejection during the adjusting/sweeping combination that is actually below or before the true rejection point.

I contend that many circuit designs are not friendly when it comes to feeding in ground signals and targets signals while also altering the rejection adjustment. I guess you could say those circuits are just not as good at 'multi-tasking' as others might be.

Additionally, you have to consider what your goals are at any given site, and what your tolerance level is in the first place. If you want to locate thin gold jewelry, gold pendants, gold rings, US 5¢ coins, and other potentially desirable low-conductive targets, just set your discrimination level to reject an iron nail on the surface and get to work having some fun!

Using manual (audio) target discrimination or a TID display (visual) to tell you what is good or bad is not always going to be accurate. Oh, it might help in some instances, but it won't be totally 'accurate.' The only 100% accurate form of Target ID and good/bad discrimination is *your eyes!* Locate and recover any potentially good target and *look* to see if it is a keeper or not!

If discrimination is increased too much, you will lose gold rings and jewelry as well as the nickels. With many detectors you will also lose some depth. Then, too, the more discrimination you use the more you have to be aware of your sweep speed. To test this, bury a penny at 3" to 5" and sweep over it in the Disc. mode set at the minimum setting. See how slowly you can sweep the coil as well as how fast you can sweep and still get the coin. Then, sweep slowly as you increase the discriminate control until the coin is just rejected then back off just until you get a good signal. Give it a faster sweep as you had with the discriminate level set at minimum. If you are in very mineralized ground you may have lost the target. Naturally, it depends on the detector used.

IN CONCLUSION: There will be other audio sounds you'll learn with your detector in conjunction with your chosen set of headphones. "Bleeps" or "Blurps" are interpreted differently by each of us so I can't suggest how *you* would describe *your* good verses bad target sounds, but the audio responses are there, and you can learn them. Each detector has its own personality, but I am certain that by employing some of these techniques I have used and taught for three decades you will be able to better handle some of the problem junk items you encounter.

ATC methods help you "***classify***" a lot of bad targets, both audibly and visually. Simply put, you "classify" targets as potentially good (non-ferrous) or bad (iron or magnetic-based metal junk). I hope this will enable you to enjoy more outings, recover a little less trash (when *YOU* feel it is desirable to do so) and find more goods targets for the time spent afield.

Best of success, and if you have any questions, feel welcome to e-mail me. I feel this info can help you learn more about your detector and perhaps how they are supposed to work. Employing these ***Quick-Out*** & **EPR** techniques will help the detector's circuitry do a 'proper' job of rejecting some of the ferrous-type trash that was compromised in the design of motion discriminate function compared with TR-Disc. performance.

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