The ATAS-120A and Screwdriver Antennas for Portable Use

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How to Make a Screwdriver

- 1 3/4 fl oz (1 part) Vodka
- 3 1/2 fl oz (2 parts) Orange Juice

My Portable Antenna Wishlist

- Reasonably affordable
- Easy to deploy for portable use solo
- At least 10-40m, 100w CW/SSB
- Efficient enough for coast-to-coast SSB contacts with just ‘okay’ propagation conditions with other modest RX stations
- No additional tuner
- No trees or guyed masts
- Could be deployed easily on pavement

My Inspiration

- AE7Q's ATAS Field Day Rig
  - https://web.ae7q.com/misc/_-doc/public/ATAS-120.php
- AE7Q had already done more or less exactly what I wanted so I just improved on what I thought I could

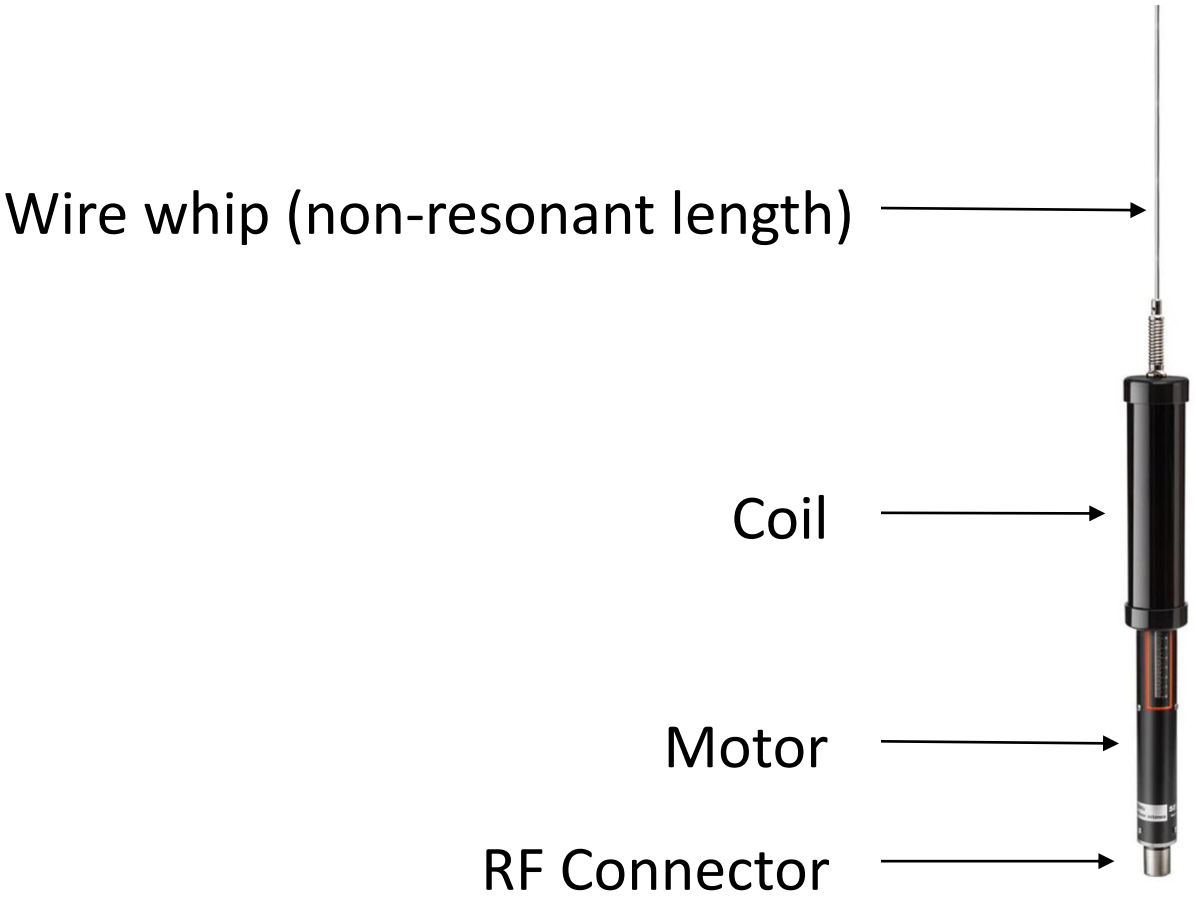
What is a Screwdriver Antenna?

- Motorized, base-loaded, shortened, vertical antenna
- Instead of having to manually adjust a coil tap, an electric motor moves a loading coil up and down using a screw drive in relation to a fixed wiper/tap until a suitable match is acquired
- Mainly sold and designed for mobile HF operation (vehicle mounted)
- Generally requires both power and a motor controller
- Called “screwdrivers” because early DIY models used electric screwdriver internals
- Originally conceived by Don Johnson, W6AAQ (SK)

A Word on Shortened Antennas

- Just because the SWR of an antenna is low does not mean that the radiated power is *anywhere* remotely close to 100% of input
- A **significant** amount of energy is lost in the loading coils and matching networks of shortened antennas
- A generous estimate would be 1-20% ERP over the tunable range of a stock ATAS screwdriver with the higher estimates around 6m and falling off very quickly thereafter
- Only by using high-Q coils (>=300), long whips(>=8ft)/cap hats, and good ground systems can efficiency be significantly improved
- The good news is that it doesn't take much power to communicate when conditions are reasonable **IF** the receiving station isn't plagued by noise

Anatomy of a Screwdriver Antenna



Considerations for Base/Portable Installations

- Due to the lack of an RF ground when installed on the ground, the antenna requires a ground system to achieve a match
- Requires a stand
- When used with an adequate ground system, screwdriver antennas can be much more efficient than when installed on a vehicle
- When used as base antennas, longer more efficient radiators can be used

The Yaesu ATAS-120A

- Pros
  - Cheap relative to other screwdriver antennas
    - Lowest price - HRO $340 (11/6/22)
  - Lightweight-ish
    - <10lb with tripod and radial ring
  - Short
    - Less than 6’ with the coil fully engaged
  - 70cm/2m/6-40m
  - Match happens at the feed point
  - No controller or separate power required when used with compatible radios
- Cons
  - Only works with FT-450, FT-857, FT-991, FT-891, FTDX-10, FT-710-AESS without an external controller
  - Requires a good radial ground system to be efficient enough to meet my goals
  - Requires some DIY (not a con for me)
  - It’s not a dipole on a tower

ATAS-120A Compatibility

- If you don’t have a compatible radio I would probably choose a different screwdriver antenna with a separate auto tuner/controller
- Ameritron SDC-104x/SDC-105
  - This is your best bet to get an experience as close to an ATAS-120A with a different screwdriver antenna/radio combination
- If you absolutely have to use an ATAS-120A with an incompatible radio…
  - MFJ-1925

Radials in a Nutshell

- Generally speaking, the greatest ground loss happens in the first wavelength (nearfield) and critically in the first 1/2 λ (reactive nearfield)
  - Why?
    - Reactive nearfield strength diminishes by the inverse cube law
- As such, radial density is more important than length to a point
- I've found that the ATAS-120A needs 32 x 1/8 λ radials to work acceptably well on 40m over average soil conductivity conditions
- Would 120 x 40m long radials be mathematically better?
  - Yes
  - Appreciably so? Depends on if that little bit makes the contact happen
  - Practical, absolutely not

Radial Attachment Ring

Radial Bundles

Tripod Base

Park Rig

Hardware Store/Orvac/HRO Parts List

- Cablexperts UG-3634 (SO-239 4” Female Barrel)
- LP UHF-15-DGN (90° SO-239 → PL-259)
- Seamless Steel Spacer (5/8” x 7/8” x 1-1/2”)
- Metric Fender Washers (M16) (What I could find ~5/16” ID at Ace)
- Blade Tab w/ #8 Mounting Hole (Also sold as Noble #747D at Orvac)
- 10-12 Female Quick Disconnect (fits 4 x 14AWG conductors)
- 14-16 Female Quick Disconnect (fits 2 x 14AWG conductors)
- #8 6/32 x 3/16” Screws (Ace)
- #8 Toothed Lock Washers (Ace)
- UL1007 300V 16GA Stranded Black 1000’ (Orvac)
- Proline Telescoping Boom Microphone Stand (Guitar Center)

Did I accomplish my goals?

- Takes about 10-15 minutes to completely set up in the park
- Tunes 70cm-40m just fine and works efficiently enough for my goals
- It is free standing, I set up on pavement frequently
- Motor works fine even with a 30’ feedline, no additional hardware
- Entire antenna setup cost less than what other known brands charge for an auto tune screwdriver
  - Total ~$550 Including antenna, wire, tripod, and hardware
- I’ve made many continental SSB contacts with the portable setup

Proof

2022-10-05	HP3EFS	40m	7.190	SSB	Panama	PN	2977 mi	Mingo Cruz Delija	★
2022-10-03	W4CXT	40m	7.190	SSB	United States	FL	2106 mi	Terrence Iverson	★
2022-10-03	N4POD	40m	7.190	SSB	United States	TN	1893 mi	JEFFREY S BUFFIN…	★
2022-09-22	K9RM	40m	7.190	SSB	United States	IN	1787 mi	CHARLES J ARVO	★
2022-09-22	NK4T	40m	7.190	SSB	United States	AL	1731 mi	WAYNE L HESTER	★
2022-09-14	W6O	20m	14.272	SSB	United States	MO	1444 mi	Dale L. Pruitt	★
2022-09-14	WB5N	20m	14.328	SSB	United States	TX	1348 mi	DAVID L SARKOZI	★
2022-10-05	KE7NLU	40m	7.185	SSB	United States	MT	876 mi	ERIC	★
2022-09-17	N7ZUF	20m	14.291	SSB	United States	WA	875 mi	Jay F Lopes	★
2022-09-14	WØKPH	20m	14.234	SSB	United States	CO	788 mi	KATHLEEN P HICK…	★
2022-10-05	WYØMNG	40m	7.191	SSB	United States	WY	779 mi	Jayson J Mitchell 349	★
2022-09-14	WD5JOE	20m	14.239	SSB	United States	NM	685 mi	JOE R MALONE	★

Taking it a step further…

I have been playing with wires cut a few feet short of 1/4 λ instead of the short whip and had a drastic improvement in efficiency

2022-10-03	**VK5PAS**	40m	**7.190**	SSB	Australia		8192 mi	Paul SIMMONDS

I requested a paper QSL for that one!

Additional Related Resources

- Dave Casler on Screwdriver Antennas for Base Use
  - https://www.youtube.com/watch?v=vSU7L3-SliA
- Radial System Design by Rudy Severns, N6LF
  - https://www.antennasbyn6lf.com/files/radial_system_design_and_efficiency_in_hf_verticals.pdf
- HF Mobile Antenna section in ARRL Antenna Handbook
  - Chapter 21