A-11 Bat Houses and Bat House Poles

Bats are an essential part of homestead living but not within house rafters or barns. This means keeping access to house rafters well sealed from outside intrusion without disrupting air circulation. As to barns, bats are nocturnal which means they like it dark…barns are not. To keep bats where they will do their best for the homestead, they need their own home—a bat house.

Where Bats Roost

Bats are flying mammals and are very temperature sensitive. They seek locations that meet their comfort needs of not too hot and not too cold. In the wild, this is often in the remains of standing dead trees where there's an opening to the innards. During the day bats want to be left alone for rest and sleep. Also, as mammals they will be birthing offspring which requires safety.

Types of Bat Houses

The most common is a sort-of flat box affixed to the wall of a structure or on a pole. These work well when environmental conditions are acceptable. They're simple to build and install with lots of plans available online as well as pre-cut kits. These are good kid projects.

When in an area with variable temperature throughout the day, there's a different type of structure known as a rocket house. It's rectangular around a support post with inner chambers for the bats to find their comfort. Since our homestead is in a valley with trees and slopes, this is the type of bat house that works best for our situation and is the subject of this article.

Rocket Bat Houses

Being ideal for our circumstances has not made it simple to construct and install. Although there are a few plans available online, generally these are short on details along with broad-based assumptions without explanations. To get it right, we made lots of mistakes and had to figure things out the hard way.

Materials

This was the first problem. Online plans call for a combination of dimension lumber and exterior-grade plywood. The dimension lumber recommended is not within the most commonly available sizes and the type of wood (cedar or poplar) is expensive. Exterior-grade 4x8-foot plywood assumes the availability of significant woodworking tools and a working area to get accurate cuts. Also, both of these materials are heavy which further complicates eventual installation.

Better Materials – Having had much success with cedar fence pickets, including affordability, this became the obvious choice. When shopping carefully through the lumber, it's easy to get good quality with minimal knots or imperfections. The downside is cedar pickets are only ½-inch thick which complicates the construction process—they need to be doubled up to accommodate screws.

Special Screws – To layer cedar fence pickets and get a one-inch thickness for assembly, exterior-grade screws are required but the smallest commonly available are 1¼-inch which would protrude sharp points into the roosting chambers. We found a 1-inch variety that's known as a washer-head screw and may need to be special ordered. Stainless steel screws are available but prohibitively expensive for a bat house because a lot of screws are required. The key to screws is that once the bat house is mounted on a pole, servicing it due to failing screws would be very difficult. Quality in screws is essential.

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Bat House Planning

This starts with the end in mind—where the bat house will be located and how it will installed.

Timing

Bats do not stick around during winter and head toward warmer and protected environs. They also tend to return during warm months. As such, bat are seasonal so this becomes a winter project.

Guano

This is bat crap. Interesting in photos of bat houses mounted on structure walls is that they never show what's accumulating underneath. If there's a roof, that could get ugly and smelly with bat crap cleanup. If on a pole in an open area, the guano simply adds to the soil rain washes off anything on the pole.

Location

Having evolved as nocturnal mammals, bats are nearly blind and largely navigate through a sound-sensing mechanism. They project a very high frequency pulse and maneuver accordingly. To find a bat house, the structure needs to be in the open, not nestled onto or within trees. As mammals, bats also need access to water and food such as wildflowers—they eat more than mosquitoes.

Wind – When roosting, bats generally do not like their house to be shaking or swaying. Stout installation mitigates this which can be assisted with wind-break trees, but not surrounding the bat house.

Noise – Bats have very sensitive hearing. Avoid an area that would have regular loud machinery such farm equipment or loud workshop tools. Kids running around, chickens cackling, and occasional lawn mowing is acceptable. Also, proximity to roads is not ideal.

Environment

With bats being temperature sensitive, their roost needs to be adequately warm but not overheated. This means access to morning sun and ideally south-facing, but east and west facing can work when there is adequate access to warming sun. North-facing houses will fail to attract bats. So, the basic environmental requirements are sun, food, and water.

Vertical Requirements

When bats emerge from a roost, they fall before deploying their wings. This means an unobstructed area under the bat house. Minimal fall zone is about 12 feet with 16-20 feet much better.

Pole Planning – This comes before anything else. When done correctly, the rest of a bat house installation is comparatively easy. Think it through and get this rough stuff done first.

Bat House Poles – Unless installed on the side of a structure, a pole is required. The immediate concept is stout steel supported like a flag pole. It doesn't take much imagination to contemplate the challenges of attaching a wood bat house to a steel pole and then keeping it upright, well positioned, and maintained.

Alternative to Steel Poles – 4x4-inch ground-contact posts, like those used in decks and fencing, greatly simplifies assembly of a bat house on a pole. It also creates an unusual means of installing the pole while retaining access to the bat house for servicing and neutralizes issues with installation in odd locations.

Step 1 – Pole Support Design

Through a variety of experiences, we sort of knew what was required but there were scant details available online or in books. We had to learn by doing with a bunch of commonsense. This is why there are a lot of details on how to stand up and secure a tall and heavy vertical pole with a load on top.

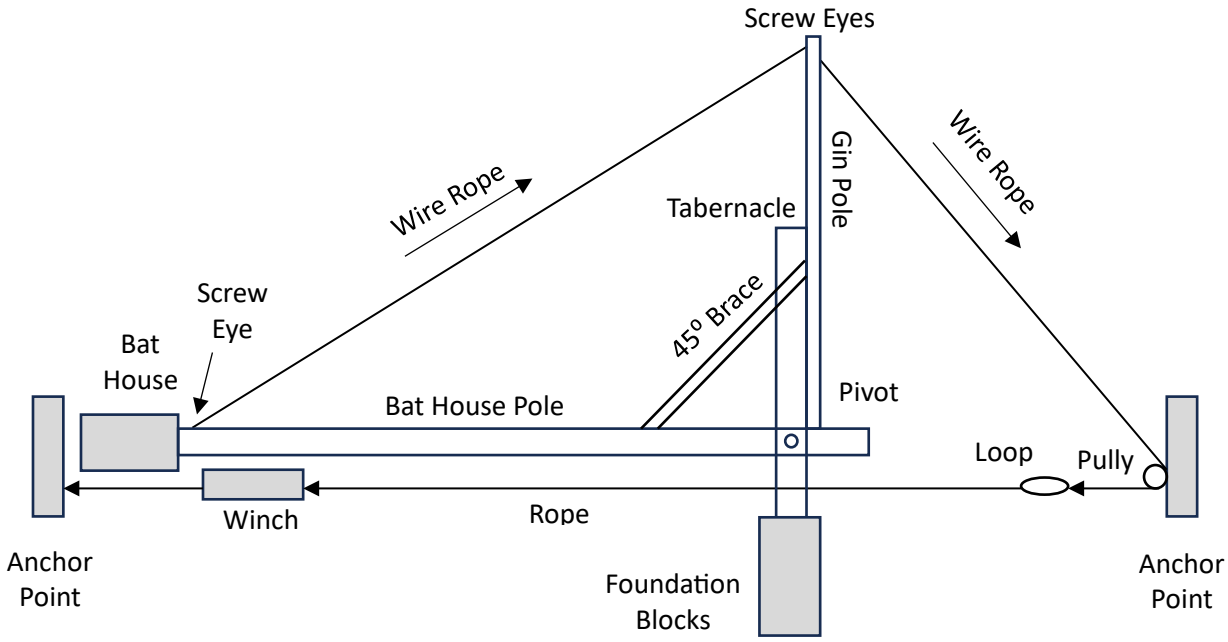
Understanding How This Works

Putting up a stout pole with a bat house on top starts with practical physics. Key is to realize that the bat-house post, with the bat house attached, will be heavy. Short of having a crane to lift this into place, you will likely need a combination of old-time techniques—from barn raising and sailboats.

Gin Pole – This was once used to stand up large pole barns when shorthanded. Ropes were used to keep the large (and heavy) pole under control until it dropped into an excavated hole.

Tabernacle – The mast on small sailboats (think dories carried on large fishing boats) would need to be lowered so the boat could be stowed. This technique is still used for sailboats to pass under low bridges.

Two Parts Work Together – The gin pole distributes weight with the stress pushed down onto the pole being raised. As the pole goes up, it rotates on a pivot through a tabernacle. As the post goes up, weight and stress distributes to the pivot. Then it's just a matter of keeping the newly raised pole under control.



Learning from Others

Working on Ground – We found one YouTube video where a working-alone man (someone was capturing the video) raised a heavy pole with a gin pole technique. His advantage was having flat ground with plenty of maneuvering room. Nevertheless, he showed than it worked.

Working on a Sailboat – In another YouTube video we watched a lone sailor on his boat (about 20 feet) raise and lower the mast also of about 20 feet. He used a gin pole coupled with the various mountings found on sailboats to support a mast. Key was that the gin pole was attached to the mast and he was using the anchor windlass winch. Support for the mast is in what's known as a tabernacle on sailboats.

Step 2 – Tabernacle Support Foundation

Planning Before Construction

The tabernacle structure will be anchored in the ground and as all homesteaders eventually learn, ground is always moving. This means the entire structure from foundation to tabernacle to bat house pole needs to move with the soil as a unified system. This especially applies when mounted on a slope.

Timing – There will likely be several days before the tabernacle will be used. This gives adequate time for the concrete used in the foundation to fully cure hard. Do not push this curing time.

Lumber – Both the tabernacle and the bat house post will be 4x4 lumber at 3½ x 3½ inches. The bat house post must have just enough clearance between the tabernacle posts to rotate from horizontal to vertical. About ⅛-inch clearance is sufficient. Two 8-foot pieces are required—be sure they are clean and square.

Foundation – With the tabernacle posts being so close together, it's not possible to dig separate holes. We found that the holes in cement blocks are the right size to accommodate the posts. Blocks with flat squared ends minimize the amount of concrete. Three blocks stacked renders a foundation about 24 inches deep.

Where to Dig

There are three essential requirements:

1. Room for the 16-Foot Pole – This includes support before raising. When the tabernacle is installed, it will have an eight-foot section of the bat house post already installed. When the bat house is built, it will surround the second upper part of the bat house post. These must two posts must be married together.

Hint: 16-foot 4x4 posts are available but this would be incredibly unwieldly to build around, transport, and would be very heavy to install on the tabernacle. Use two separate 8-foot posts—much easier.

2. Working Room – The completed bat house on an 8-foot post will likely be transported in a cart pulled by an ATV or other means. Maneuvering room for this entire rig of 20-plus feet must be available, including turnaround. There must also be room to support the sistered pole and to remove the transport.

3. Raising the Pole –Two stout anchor points for a come-along winch will be required. Anchoring to the tabernacle does not provide enough room for the winch to pull up the bat house pole. Stout cannot be understated because there will be a lot of strain when pulling up the bat house post.

Experience: Anchoring Points – We first mounted the pully to a mostly mature sapling with a heavy-duty plastic wire tie. It failed almost immediately. Even though doubled up at the second anchoring point on a mature tree, these were quickly abandoned for heavy-duty chains. Even so, the younger sapling was pulled somewhat out from its roots. We learned that anchoring points *must* be overly secure and extremely stout. Anchoring to rolling stock would simply pull the vehicle unless very heavy.

We also intended to anchor the come-along winch to the tabernacle but this was too close considering the length of wire that's needed to be pulled through the pully to raise the bat house pole which would have only gone up about half way. If the pully was mounted about ten feet further away, the tabernacle would have worked. We did not have this option so the winch was anchored to a nearby tree.

Digging the Foundation Hole

This will need to be about two inches larger than the cement blocks with the bottom as level as possible—use a torpedo level. A lot of soil will come out so have some means of transport. It helps to use a bucket to receive clumps from the post hole digger and then dump into the cart. Eventually there will be hand work to get the bottom of the hole level and clear. Keep checking depth with a tape measure. The top of the cement blocks should be about one-inch below the surface after adding a one-inch bed of concrete under the foundation blocks—in general about 24-25 inches deep.

Inserting the Foundation Blocks

Foundation Bed – Cut open a sack of cement and drop about one-inch into the hole, leveling with hands. Keep this cement dry until the first block is well situated.

Lifting the Blocks – These are too heavy to be lowered by hand with the tight clearances within the hole. Using an assistant, lift the blocks one at a time with a tie-down strap and lower carefully into the hole centering around the sides of the hole. Check the top of the first block with a torpedo level to be sure it's horizontal in both directions. Keep shifting until it's right and pull out the strap. Stack the remaining blocks.

Surrounding Cement

Requirements – About three 50-pound sacks of quick-dry cement will be required. Have five on hand. It's important for all of the wetted cement to have contact to create a unified foundation.

Water – Dry cement activates with water. Have several jugs or buckets of water at hand.

Putting It In – Lay the opened sack flat near the foundation hole and wet down the foundation bed. Drop handfuls of cement into the hole on each side with splashes of water as inserted. Wet all sides thoroughly. Avoid dropping any cement into center holes. Fill up to the outer top of the cement blocks.

Curing the Cement – This part is done. Remove all remaining cement to a dry location for several days. The foundation is now complete. Next is to build the tabernacle assembly.

Step 3 – Building the Tabernacle

Strategy

All three parts of this assembly must be put together as a unit. When done, it will be partially disassembled for transport and installation. An assistant will be needed.

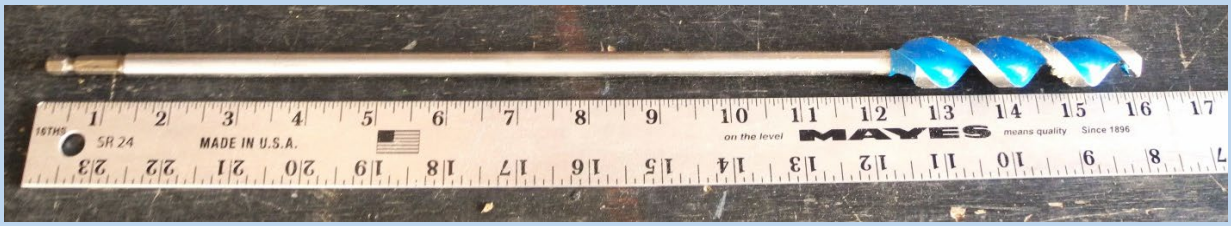
Materials – Three clean and straight 4x4 posts and several brace pieces for keeping the unit square. For the brace pieces, 3½-inch wide deck board works well. Double check the separation between holes in the foundation cement blocks before cutting the brace pieces.

Pivot Rod – After initially considering ½-inch there was significant improvement with ⅝-inch. These are generally available in 12, 24, and 48-inch lengths. 24-inch works best. This needs to married with stop nuts and two washers; washers between the tabernacle and bat house posts are unnecessary.

Tools – Clamps and shims to maintain clearance between the tabernacle posts and bat house post.

Special Drill Bit – All three 4x4 posts will need to be drilled at the same time to ensure the pivot rod works. 11 inches (3½ x 3) is beyond the length of normal spade bits so an extended bit is required with about a 16-inch shaft. Go ⅛-inch larger to ¾-inch from the ⅝-inch pivot rod so that it moves easily in the hole.

Hint – Specialty bits from Spyder are excellent for this application. A long spade bit would lack the precision necessary to get a straight 90° drill hole. This is a ¾-inch bit that's 16-inches long. Cost about $17.00.



Assembly

Lay out the three 4x4 posts on saw horses. Position the bat house post about 27 inches from what will be the base of the tabernacle in the foundation blocks. Double check this dimension on site in both foundation block holes. Keep in mind that the bat house post will rotate so there must be clearance for the leading edge of this post to clear when swinging into place. Also double check the outside clearance within the cement block holes to be sure the assembled tabernacle will fit with clearance on all sides.

Transfer the bottom on-site measurement to the base end of the tabernacle posts.

Position the two tabernacle posts with the third bat house post in the middle using shims to establish and maintain about a ⅛-inch gap. Ensure that the base of the tabernacle posts are even. Clamp the three posts together in at least three locations while keeping the shims in place.

Measure the distance between the tabernacle posts and cut one brace piece to fit. Square it up to the posts a few inches above the 27-inch mark and attach with four 2½-inch screws into each post.

With an assistant, flip over the assembly and attach three additional brace pieces at about 12-inch intervals from the top of the tabernacle posts. Keep checking for the ⅛-inch clearance before attaching each brace.

Place two scrap 4x4 pieces on the ground and lift the assembly from the saw horses rest on edge on the 4x4 pieces. Place a sacrificial scrap piece under where the pivot hole will emerge when drilling.

Measure and mark for the pivot rod hole at about 24 inches up from the base of the bat house pole.

Drilling the Hole

Vertical Accuracy is Important – Straddle the assembly and position the assistant to the side about six feet away and 90° to the assembly. Watch for alignment in line with the assembly while the assistant tells you the tilt of the drill bit away and toward you. Before starting, be sure the signals, including hand gestures, are clearly understood because the handler will be concentrating on the drill cutting.

When Drilling – Treated 4x4 posts are often somewhat wet which could clog the drill bit. Every few inches, pull out the running drill bit to clear debris. Be patient and control the drilling. When all the way through ream all three pieces to clear any remaining debris. Test fit the pivot rod to be sure it freely moves through and around inside of the hole. Remove the pivot rod, clamps, and shims.

Sisters

Return the assembly to the saw horses to attach three sides of the sisters that will join the two bat house poles.

These will be 24 inches long and cut from 3 ½-inch and 5 ½-inch wide deck boards. This gives a finished look.

Attach these on three sides positioned as a tray that will receive the upper bat house pole. After the two pole parts are married in place with the sisters at the installation site they will be bolted together.

The tabernacle assembly is complete. Pull out the bat house pole and set aside.

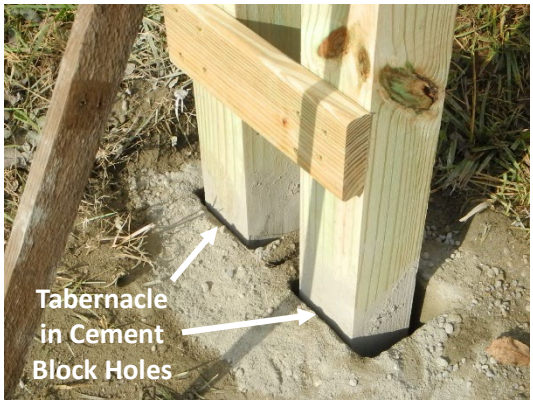
Step 4 – Installing the Tabernacle

Verify Correct Position

With your assistant, carry the tabernacle and bat house pole to the site. Lift the assembly into the cement block holes. The assembly must be inserted with the lowest brace piece facing in the direction from which the bat house pole will be rotated to vertical. This will be the stopper when it swings into place.

Verify Vertical

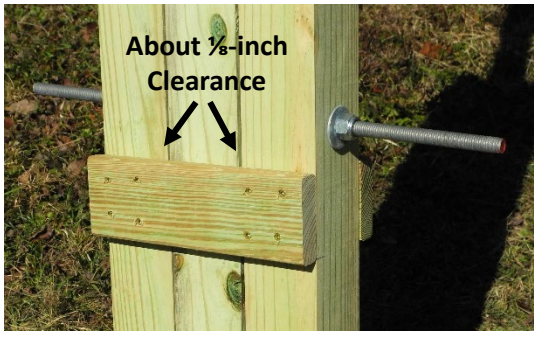
Have two thin bracing scraps on hand with a torpedo level and pre-insert one securing screw in one end of each piece. With assistant holding the assembly basically vertical with the torpedo level, attach the braces and jam into the soil with a foot stomp. Make sure of vertical from both sides of the assembly so that it remains stable.



Bring the remaining dry cement and jugs or buckets of water to the site.

Maintain Vertical

Using the same procedure as with the outside of the cement blocks, begin filling the inside of the blocks with the tabernacle posts. Keep dousing the dry cement with water while checking several times to be sure the tabernacle posts are staying vertical. Fill up and over the top of the cement blocks with a slight slope around the posts to shed rain water.



Attach the Bat House Pole

Position the bat house pole with the sister tray up. With the pivot rod in one hole, lift the pole and shove the rod through the other two holes. Align the pivot rod to be about even from both sides of the tabernacle. Lift the bat house post to verify how it swings up to vertical.

Secure the Pivot Rod

With the assistant, work both stop nuts with washers close to the tabernacle posts. Adjust the stop nuts until the bat house post swings freely. Raise the pole and attach a bracing piece opposite the previously installed lowest brace. The bat house post will not move.

Let It Cure

This part of the project is now complete. While the cement is curing, it's time to build the bat house.

Hint: Dry cement in a humid environment generally does not store well and will harden into a solid chunk. If you or someone you know can't use it, let it go. If it's still completely dry and unopened in undamaged sacks, try to return it for a refund. Experience has shown that this project needs about 4½ 50 lb sacks.

Step 5 – Planning for a Bat House

Experience: Learning by Doing – The following details are for a rocket-type bat house. There are numerous plans with dimensions and tips for flat-type bat houses but only sketchy information for rocket houses. We used the clues and figured it out the hard way with lots of mistakes. This information will hopefully make building a rocket bat house a lot smoother.

Concept

A rocket house is built around and attached to a 4x4 inch post with the ideal height at about 30 inches tall. Security of the post and the dimensions of their house fulfills the needs of bats.

Materials

The few available online designs call for dimension lumber that is not commonly available. The alternative would be exterior grade plywood but this would become very heavy. An alternative might be OSB paneling, which would be lighter and stronger, but this would need extensive protection from the constant presence of mammalian bats and weather. Cutting OSB paneling accurately also requires an extensive workshop.

Suitable Alternative – Cedar fence pickets are lightweight and stand up to outdoor conditions extremely well. The downside is they are only ½-inch thick which means they need to be doubled to create a buildable thickness. Prep work for weathering is also minimal compared to plywood and OSB paneling. With all of the cutting and mistakes, expect to use about 20 six-foot cedar fence pickets.

Outer Wood Protection – The bat house will be situated high up on a pole so whatever is used for protection had better be the best available. Also, with bats being temperature sensitive and especially from the cold, keeping the bat house reasonably warm with a dark color helps. We used black.

Quality Counts – Paint on a high and remote location is always questionable but solid-color wood stain generally holds up much better for many years. The toughest stain formula we've found for working around rubbing animals is made by Cabot—if you can find it. If not, check various reviews from professionals and make an informed decision because not all are suitable for all applications.

Screws – Four sizes are required. All must be exterior construction grade.

1-inch / Washer Head / Many / About 200 each	1¼-inch / Few / About 25 or less

1¾-inch / Many / About 100 each	2-inch / Many / about 100 each
2½-inch / Many / About 50 or more	Staples / Stainless Steel / T-50 ½-inch

Washer Head Screws – These are often used in cabinet making to keep the screw head from embedding into the wood. Even so, we have had these screws in place outdoors for years with almost no damage from weather. The GRK brand is also rated for application with treated wood and exterior work. Sometimes the 1-inch screws need to be special ordered.

Mesh – When bats land at a bat house, they hold with their claws on rough surfaces and crawl inside. Black plastic mesh that's UV rated works well and is simple to install. One 15-foot 24-inch wide roll should suffice and it easily cuts to fit with scissors. Do not use metal mesh which would rust and deteriorate.

Attaching Mesh – Easiest is with stainless steel staples, T50 / ½-inch work well. Regular interior-type staples will rust to pieces within six months. These are sometimes carried in big box stores but check before running around. If needed, special order online with the 1-inch screws.

Weather-Seal Caulk – Use roofing caulk. This is a very durable rubber-based formula used to close gaps around roof flashing, gutters, skylights, and windows. One tube should suffice for this project.

Tools

Drill and Driver	Clamps / Multiple Sizes	Staple Gun
T-15 Star Bit / For 1-inch screws	18-inch Ruler	Table Saw
Saber Saw	Hole Saw / 1½-inch	Exterior Solid Color Wood Stain
Paint Bruch / 1 or 1½ inch	Tape Measure	Cradle / For post support
Caulking Gun	Sacrificial Putty Knife / Plastic	Sacrificial Rags

Work Area

The bat house will be assembled directly on the remaining 8-foot bat house 4x4 pole. As it's being built, the assembly will be turned over multiple times. Initially the heavy part will be the 4x4 until the bat house is added piece by piece. The bat house itself will get larger which means the post will need support. Scrap 4x4 pieces about a foot long work well. Overall, the assembly will be about 10 feet long.

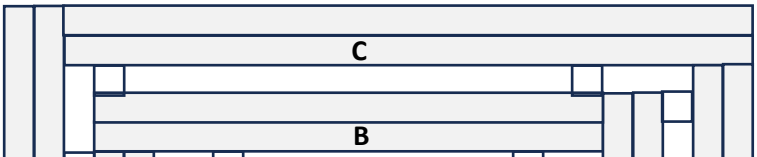
The building process will require additional work space for assembling the sides of the rocket house and there needs to be access to the two adjoining work sides. This will likely mean swinging the post back and forth to clear this part of the work area and while rotating.

As the bat house comes together, it will need to spin to the next working side. Lift the assembly to the edge of the support blocks, carefully turn, and then reposition to continue working.

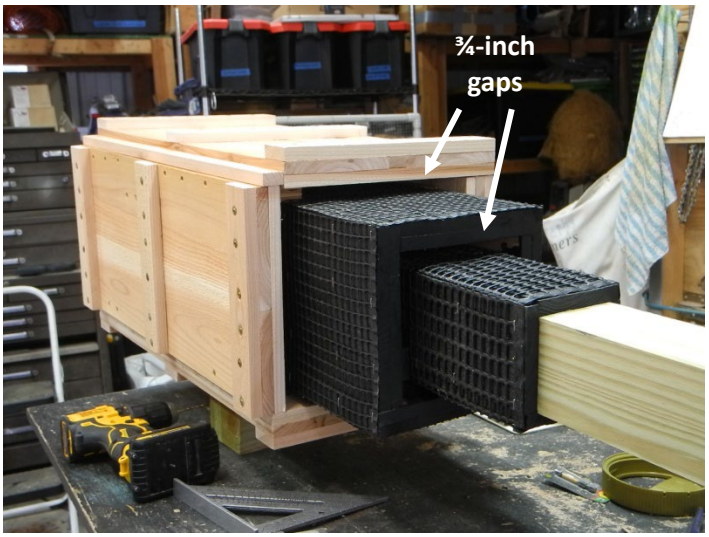
Efficiency – As the bat house is assembled different screws will be required. It helps to have these jugs open and within reach to expedite the building process.

Step 6 – Building the Bat House

The bat house will be assembled in layers starting at the pole. There will be three layers.



A	4 inches wide / 36 inches long / Single layer
B	6½ inches wide / 30 inches long / Double Layer
C	10 inches wide / 24 inches long / Double layer
D	¾ inch thick spacers / 1½ x 4 inches / 3 per side



Spacers

Most bats prefer ¾ inches of roosting space. These can be cut from ¾-inch thick exterior grade plywood or trimmed down from 2x4 pressure treated scraps. These must be strong because the outer layers of the bat house are secured to the inner layers through these spacer blocks. 1 x 4 inches.

Width Dimensions

Cedar fence pickets are 5½ inches wide. As determined in building up from the bat house pole, this means that boards will have to be ripped to accommodate the required widths. Save the cut off pieces.

B Layer – These will be screwed together in mirror image using the 1-inch screws. This way the 1-inch piece will be attached to the 5½-inch piece.

C Layer – It is not possible to overlap these pieces. 10-inch pieces must be cut and secured laterally to the long facia pieces. On the show side, three additional 1½-inch wide pieces are screwed in place. This secures the most vulnerable outer shell of the bat house. See the above photo.

A – First Layer

This surrounds and is secured directly to the 4x4 post with 2-inch screws. Only one layer of cedar fence pickets is required. Position these pieces about 18 inches up from the top of the bat house post. Insert two screws about every four inches because the rest of the bat house will be built onto this layer.

Spacers – As each side goes on, attach the spacer blocks. The top and bottom blocks will be about 2 inches from the underside of the next layer. Secure with 2-inch screws about ½-inch from the long ends. The next screws will be in the blind more toward the middle of the blocks. On the opposite side attach the spacer block about 11 inches from the top. Turn the assembly and repeat.

Paint – At the bottom edge, two coats to each side plus about 3-4 inches up from where the next layer will be attached. Turn the assembly and repeat. Return to the first side after two coats. Take a break if not dry.

Mesh – Cut a length of mesh to 36 inches and about 4-inches wide. Trim off barb ends from the joints. Hold the mesh in place with clamps and cut out the small areas for the spacer blocks. Staple flat about every four inches while avoiding screw heads. Turn the assembly and repeat.

B – Second Layer

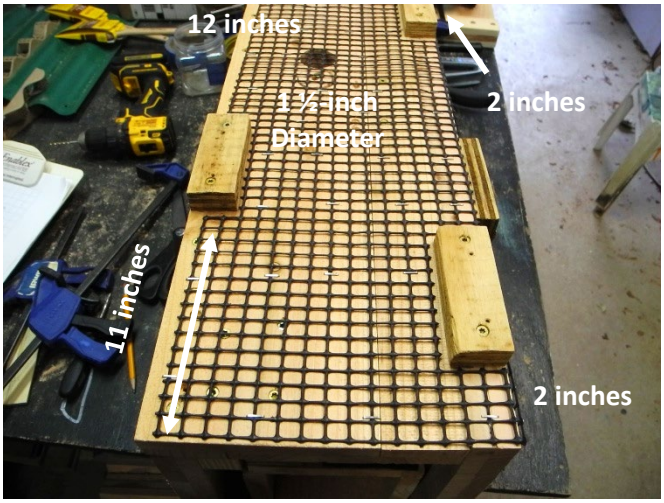
Assemble the panels in mirror image with 1-inch screws. Watch for cupping on the boards (cedar does this when it dries). Cedar wood is soft so check carefully and clamp accordingly to get it flat before inserting screws. It helps to position a cupped board with the cup down and flared edges up. This is much easier to get the boards flat for screws. Repeat for all four sides.

Note – Sometimes a cupped board will crack lengthwise when clamped down. Discard this board.

Pass Thru Holes – About mid-way on the panels, use the hole saw to cut the openings the bats will use in seeking their best temperature comfort. Clean up any splintery ends with sand paper. Double check for screws on both sides and move these as needed.

First Side – Position this on top of the assembly and hold in place with clamps. Key is to keep the top edge even to the first layer for when the roof is attached. Double check with a speed square. Ensure the edge of the panel piece is aligned flush with the edge of the spacer blocks on the next side of the assembly.

Attach to Spacer Blocks – Use 2-inch screws spaced about 1-inch from the long ends of the spacer blocks. Use the 18-inch ruler from the top to get an approximate location on the middle spacer block.



Next Sides – Turn the assembly and attach to the spacer blocks. Return the assembly to its previous position and secure to upper edge to the side edge of the first side with 1¾-inch screws. Repeat for all sides. With cedar fence pickets being somewhat rough cut, everything may not be absolutely flush and square. Just get it as close as possible—the bats won't mind.

Paint, Spacer Blocks, and Mesh – Repeat like for the first layer. Cut the mesh around the pass-thru holes.

C – Third / Outer Layer

This is where the rubber meets the road from all previous assembly. There may be some accommodations needed so don't fret it too much. Working with rough-cut lumber can be less than perfect. Assemble the four side panels as shown below.

Vent Openings – On two of the panels, use a ½-inch spade bit to drill two holes about 8-9 inches from the bottom and about 5 inches apart. Before drilling, double check for any screws and move these out of the way. Mark straight lines between the holes and cut out the pieces. Clean up any splintery remains. These panels will be mounted on opposite sides of the bat house and will be positioned east and west.

Attach the Panels – Install the first panel as described above. Turn the assembly for the next panel.

Outer Weather Seal – Open a tube of roofing caulk and run a bead down the joint that will receive the next panel. Press down the second panel to get all gaps filled and attach to the spacer blocks. Turn the assembly back to its previous position and secure the edge with 1¾-inch screws. Clear excess caulk with the putty knife. Turn and repeat for all four sides. The caulk will make up for any alignment issues.

Paint – Two and maybe three coats of solid-color wood stain on all sides and inside the vents.

Step 7 – Bat House Roof

Like all mammals, bats are not comfortable in wet environs and especially where they roost. This means the roof must be as weather tight as possible. Although the roof is small, the same basic procedures apply as when assembling a shed roof.

Design

The roof is two separate components that work together. First is to seal up the top of the bat house with a wood platform and a second cover to shed rain so that it has limited opportunity to enter the enclosure.

Roof Cap – Construct a double layer square roof to extend about two inches from the final outer shell of the bat house. Each layer of this should be at 90^{o} to significantly limit water intrusion. Use 1-inch screws.

Rain Cover – This goes on top of the roof cap and should ideally extend about four inches wider than the roof cap on all sides. Some sort of impermeable roofing material should be used for this cover. Good options include sheet metal and polycarbonate roofing. Shingle roofing would add extra weight to the bat house structure—always a consideration when it has to go vertical.

Rain Cover Support – Add two 1½ x 1½-inch rails to the extent of the roofing material. Place these at opposite edges of the roof cap and attach these rails to the roof cap with 2-inch screws.

Paint – Cover all sides of the roof cap and rails with two coats of the same solid-color wood stain.

Roofing Attachments – If using polycarbonate roofing, attach the wavy runners at this time.

Installation

Positioning – The roof cap assembly will be clumsy and difficult to handle with no practical way to support it for installation. Subtract the measurement of the outer shell of the bat house from the dimension of the roof cap and divide this by two to get the position of the roof cap to the bat house. Locate scrap lumber pieces to match this dimension, place these under the leading edge of the bat house, and remove the 4x4 support block. The roof cap will rest on the workbench and will be centered on the bat house structure.

Closing It Up – Add a thick bead of roofing caulk around the top edge of the outer wall and reposition the roof cap. Attach the roof cap to the outer bat house walls with 2-inch screws and clean up the caulk that squeezes out.

Getting Ready to Move – Other than the rain cover, the bat house is now complete. Clean up the work area and ensure a clear passage from the work table to the transport cart for the structure and pole.

Hint – Do not install the roofing material until the entire assembly is on site to avoid damage and provide much needed hand holds when positioning the two 4x4 posts for installation.

Step 8 – Moving the Bat House Structure

Site Preps

Post Cradles – Two will be needed: one for the installed post on the tabernacle and second for the bat house post. These need to be at about the same plane for assembly within the three sides of the sister supports—expect to make on site adjustments. These cradles can be saw horses of a rolling lumber stand

like used with a chop saw. Support the cradles so they are approximately level. Make sure there is plenty of maneuvering room for when the bat house structure arrives on site.

Moving the Assembly

Transport – Although possible to hand-carry the assembly, it is much easier and safer to use transport with a cart. Position bath towels at the front and rear lip of the cart to minimize damage. On the workbench, turn the bat house so that the vent slots will be in the east and west facing directions. Place the bat house inside the cart with the pole extending backwards. Have one person driving while a second person walks behind to control the post from shifting.

Arrival On Site – Identify the best possible path to position the bat house post in line with the tabernacle post. This may not be ideal so just get it close. Be sure there's an exit path for the transport and cart.

Assembling the Full 16-Foot Post

Position the Tabernacle Post – Remove the securing brace from the side away from where the two posts will be assembled into a single unit. Drop this post to its cradle.

Position the Bat House Post – It helps to keep this assembly supported by the rear lip of the cart while approximating the alignment with the tabernacle post. Adjust the cradles to get proper alignment with the two posts butted together inside the three-sided sisters. Secure these with heavy-duty clamps.

Joining the Posts – Insert six 2½-inch tack screws into the bat house post on each of the three sides. Clamp the fourth enclosing sister to the posts and secure with six 2½-inch screws. These will not be enough.

Securing with Bolts – This is accomplished with 7-inch galvanized ½-inch bolts. Drill one hole each through the sisters and posts in opposing directions and wrench tight the bolts and washers. See the photo about sisters. The full post for the bat house is now complete.

Attach the Roofing

Reposition the Pole – Lift the entire pole structure and have an assistant position one cradle so the bat house will clear the rear lip of the cart. Move the transport and cart out of the way.

Finish the Roofing – Attach the rain shed cover to the roofing supports on the roof cap structure. This part of the project is now complete. Move all unnecessary equipment and material out of the way.

Lesson Learned: Weight of the Assembly – Until everything was attached, we could only estimate whether or not the pole and bat house could be simply pushed up into the tabernacle. It was too heavy at least and too clumsy at most. Fortunately we were somewhat prepared to use a gin pole system.

Step 9 – Assembling a Gin Pole System

Experience: Learning by Doing – There were no details available for how to do this in a homestead environment. All we had was a sailboat sketch, a few brief videos, and recollections from past readings. After sorting out the basic physics we made our own sketch. A few false starts later we got it right and up it went—quickly and easily in about 15 minutes with two people.

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Materials

Braided Steel Cable / Coated / ¼-inch / 50 feet		Cable Clamps / ¼-inch / 4 each
Screw Eyes / ¼-inch x 6 inch / 4 each / full thread with nuts		Pully / 2-inch / 125 lb capacity
Chain / Medium Heavy Duty / 18-24 inch length / 2 each		¼ x 2-inch bolts and nuts / 2 each
Gin Pole / 2x4 / 8-feet	Brace / 2x4 / 6 feet / 45^{o} cuts	Bottom Brace / 2x4 / 8 inches
Turnbuckle / 6-inch / Hook ends	Turnbuckle / 4-inch / Hook ends	2½-inch screws

Tools

Drill and Driver	Spade Bit / ¼-inch	Box or socket wrench
Come Along Winch / Rope type	Pusher Pole / 2x4 / 6 feet	Steel Cable Cutter

Preparing the Rig

Gin Pole – At one end, drill and insert two screw eyes in opposite directions through the narrow side.

Bat House Pole – Drill and insert one screw eye below the bat house and facing the tabernacle.

Attach the Cable – At the gin pole make a loop through the screw eye facing the bat house with a cable clamp. Allow about 4-6 inches of excess cable in case it slips. Wrench the clamp extremely tight. Run the full cable to the screw eye below the bat house. Do not secure.

Raise the Gin Pole – Clamp in place at the top of the tabernacle and at the pivot rod.

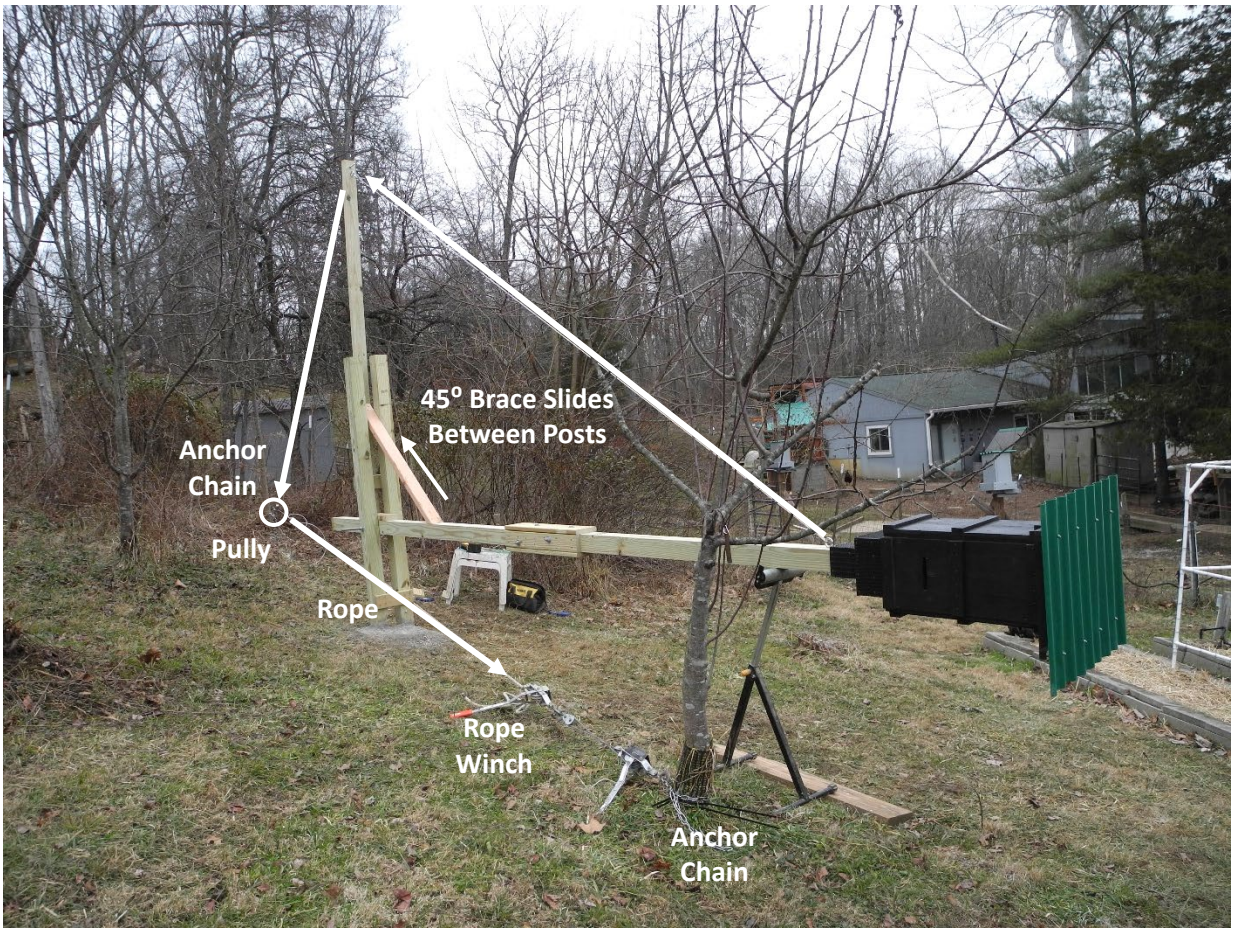
Cut the Cable – At the bat house, pull the cable snug through the screw eye but not too tight and cut.

Attach the Winch Cable – Lower the gin pole and attach the remaining cable to the opposite screw eye the same as with the first cable. Let this cable dangle loose and do not cut.

Types of Come-Along Winches

Cable Type – This winch wraps a heavy-duty steel cable around a spool. As such, the length that it can pull is limited to the size and capacity of the spool. Generally this type of winch is reserved for heavy pulling over short distances. The distance from an anchor point is often extended with additional cable or straps.

Rope Type – This winch grabs a heavy-duty rope across a serrated cog that simply feeds to ground without a spool. The rope is firmly attached to the winch and is generally about 20 feet long with a heavy duty hook which can also be extended with additional cable or straps, but only to the extent of the rope.



Secure the Gin Pole – Place the rig back in position with clamps. Secure the base of the gin pole to the tabernacle pole with the 8-inch 2x4 block; two 2½-inch screws into both poles. Position the brace pole on its angles and attach with two 2½-inch screws into each pole. The gin pole is now secure; remove clamps.

Tighten Bat House Cable – Pull the cable as tight as possible through the cable clamp as a loop through the screw eye. Keep it snug as the clamp is wrenched down as tight as possible.

Position the Winch Cable – Assemble one section of chain at the anchor point with the ¼-inch bolt. Hook the 6-inch turnbuckle to the chain and to the pully. Pull the winch cable through the pully and create a loop near to the pully with a cable clamp, again extremely tight. No need to cut the remaining cable.

Position the Winch – Attach the second length of chain in the same manner to the opposing anchor point. Stretch out the rope and clip onto the winch cable loop and to the chain at the second anchor point. Tighten up the rope in the winch so that it's snug and doesn't slip. The pole is now ready to go up.

Note – The length of the rope required is based on the distance between the winch cable loop and the winch anchor point. If not long enough, add length with a heavy duty strap with hooks that are the same size and strength as those on the winch. As the rope is winched, it passes through the rig and not onto a spool like with a cable winch. The downside is that the tension on the rope makes releasing the winch cog difficult. With this set up, simply release the clamp at the winch cable loop to relieve the pressure.

Step 10 – Raising the Pole

Safety

Two Person Job – One person works the winch incrementally while the second person keeps bracing the structure with a pusher pole jammed into soil as it goes. The gin pole will ride through the tabernacle poles and will be held at its base on the tabernacle pole. Concentrate on safety while monitoring that the cable clamps are holding. Always have an exit in case something goes wrong.

Going Vertical

Anchor Points – As tension goes onto the cables and rig, make sure these remain securely fixed in place. If one of these fails the whole rig comes crashing down.

Winch and Push – Work as a team with clear communication. The pusher needs to keep an eye on the alignment of the bat house pole to the tabernacle poles to void binding and making slight adjustments as the pole goes vertical. This is an easy process of wiggling left and right. This takes about 15 minutes.

Finishing Vertical – When the pole gets almost completely vertical, stop the winching. The tabernacle pole may bind slightly before settling evenly within the tabernacle posts. Keep pushing with the pusher pole while a brace piece is screwed into tabernacle posts. If reluctant, clamp a bracing piece at the top of the tabernacle posts with strong clamps to guide the bat house post into position. Seccure this brace piece with 2½-inch screws. The gin pole has done its job and is now finished.

Clearing the Rig – Unclamp the winch cable to release tension on the rope winch. Set this aside. Unclamp both of the cables from what was once the top of the gin pole. The cable that's now at the top of the bat pole will remain in place. Unhook the anchor chains and set everything aside. Remove the gin pole base block and the 45^{o} angle brace. Set this aside with the gin pole.

Step 11 – Finishing the Project

Final Pieces

Tabernacle Brace Pieces – Attach additional braces on both sides of the tabernacle posts at about 12-inch intervals from the top of the posts. Four 2½-inch screws into each post. Leave a central opening around the screws in case bolts would be needed in the future. Check during the next strong wind event.

Bat House Cable – Attach the remaining screw eye near the base of one tabernacle post. Open the 4-inch turnbuckle and hook on the screw eye. Snug the cable and attach a cable clamp. Tighten the turnbuckle to pull the cable tight against the bat house pole.

Gin Pole and Braces – It's arbitrary as to whether these should be retained but simple photos would bring it all back into focus if ever needed in the future. Save the screw eyes.

Clean Up the Site

The project is done. It was tough, creative, and definitely innovative to those who've never done this before. It's ok to brag a little.

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