

FOR-176

Building a Bird Nest Box with a Bird's Eye View: A DIY Nest-box Camera

Steve Higgins - Biosystems and Agricultural Engineering, University of Kentucky, James Ash - Biosystems and Agricultural Engineering, University of Kentucky, and Matthew T. Springer - Forestry and Natural Resources, University of Kentucky



Figure 1. Bird houses over great nesting habitat for many species in Kentucky.

Watching nature from a backyard can be a fun and rewarding experience. Enhancing the experience can be accomplished by creating habitat and building structures to attract wildlife. Do-it-yourself (DIY) individuals may enjoy the “bird’s eye view” provided by a Wi-Fi camera mounted on the inside of a side-view nest box. This optimum viewing angle can provide the opportunity to see adult birds construct their nest and feed their hatchlings without disturbing their natural behavior. This publication outlines the design, construction, assembly, and installation of a side-view nest box, which is a project that can provide years of enjoyment, satisfaction, and learning opportunities.

NEST BOX DESIGN AND CONSTRUCTION

Design

The design of this bird box follows the standard dimensions for a nest-box base of 4 by 4 inches (Figure 1). However, the side-view design creates more horizontal space (approximately 4 by 6 inches) for hatchlings, especially large broods. The angled camera placement provides a side-view perspective, which is ideal for observing nesting activities compared to a top-view camera.

The design provides an access hole with a diameter of 1.5 inches, which can accommodate several different species. In Kentucky, the types of birds that may be attracted to a backyard bird box include tree swallows, chickadees, titmice, and house wrens. These are beneficial birds to any backyard as they consume large numbers of

Figure 2. Bird house with metal plate fixed to entrance hole to protect it from squirrel damage and reduce the size of the entrance.



insects. Typically, adult birds bring in fodder for hatchlings approximately every 90 seconds. The access hole is positioned approximately six inches above the nest floor, which is ideal for protecting the eggs and hatchlings from predatory birds reaching through the opening.

Both the access hole size as well as the nest-box size can be altered to attract different bird species. Table 1 shows the entrance hole sizes needed to attract select Kentucky native bird species. Repairs and alterations can be made to the entrance hole to change the size and repair damage from squirrels chewing on the wood at the entrance.

Fabricating and fixing a metal plate to the box entrance can change the size of the entrance hole if desired and will help protect it from future damage from squirrels (Figure 2).

Table 1. Common cavity nesting birds and the size hole needed to attract them to your nest box. Larger holes may still attract birds who use smaller holes but smaller holes will prohibit larger birds from using the structure. You should target the hole size to the species you would like to nest in the box.

BIRD SPECIES:	CAVITY HOLE SIZE:
American Kestrel	3 in
Carolina Chickadee	1-1/8 in
Carolina Wren	1-3/8 in
Downy Woodpecker	1-3/8 in
Eastern Bluebird	1-1/2 in
Great Crested Flycatcher	1-9/16 in
Hairy-Headed Woodpecker	2 in
House Wren	1 in
Northern Flicker	2-1/2 in
Prothonotary Warbler	1-1/4 in
Purple Martin	2 in

Red-Bellied Woodpecker	1-3/4 in
Red-Breasted Nuthatch	1-1/8 in
Red-Headed Woodpecker	1-3/4 in
Tree Swallow	1-1/2 in
Tufted Titmouse	1-1/4 in
White-Breasted Nuthatch	1-3/8 in

Materials

Weather-resistant materials should be selected to increase the lifespan of the box. The most weather-resistant woods, in descending order, for nest-box construction are red cedar, redwood, bald cypress, and red or white oak. Weather-resistant materials are usually more expensive because they last longer than materials that are less weather-resistant. Pine wood is an example of a less-expensive choice of wood, but it is not as durable as other options listed above. Treated wood (plywood or boards) is more durable when not in contact with the ground but should not be used as a building material, as it releases toxins over time.

Prepare the materials using the enclosed drawings
 Assemble the pieces as shown

Hardware and Appearance

The pieces should be assembled using wood to wood deck screws for the wood part. The wood should be predrilled for the fasteners (#9 x 1-5/8) to reduce splitting the wood. The wood used to construct the box does not need to be planed or sanded to make a functional box. Nor does the box need to be painted. After about a year of exposure, the wood will season and change colors to more of a natural grey. If a caretaker prefers to paint the wood, only paint the exterior of the box. Please note that aged wood is more natural and may be more appealing to birds and

they may not appreciate a painted finish.

The Door and Hinge

The door, for the nest-box used in this publication, operates using a 12-inch piece of stainless-steel piano hinge. Holes (0.186 inch) should be drilled in the hinge following the dimensions in Figure 3. The hinge should be attached using brass or stainless-steel cabinet screws. **NOTE:** Make sure that the screws used to mount the hinge do not match the kerf cut for the camera partition. One deck screw can be used to secure the door.

Another option for the door is to omit the hinge and use four deck screws to secure the door. This option will increase the amount of time for nest-box maintenance and camera adjustments, but the omission of the hinge reduces building cost.

Skylight

A skylight is not necessary in the design but it can offer another option to view the contents of the box with less disruption. The skylight can be constructed by making a 4- by 4-inch piece of plexiglass and placing it over the 2.25-inch diameter hole drilled in the roof board. It can be attached using brass or stainless-steel cabinet screws with clear silicone caulk used to create a weather-tight seal. The outside face of the plexiglass should be sanded with 220-grit sandpaper to make the plexiglass more opaque. A benefit of scuffing the plexiglass finish is that it reduces direct light. However, when the plexiglass is wet, such as during precipitation events and when light intensity is less, the plexiglass will become more transparent and allow more light to enter. It may also be a good design to place a cloth cover over the skylight to limit direct light access, which will help to better regulate temperatures as well as limit viewing. A thin piece of cloth or rubber attached with a staple should be sufficient.

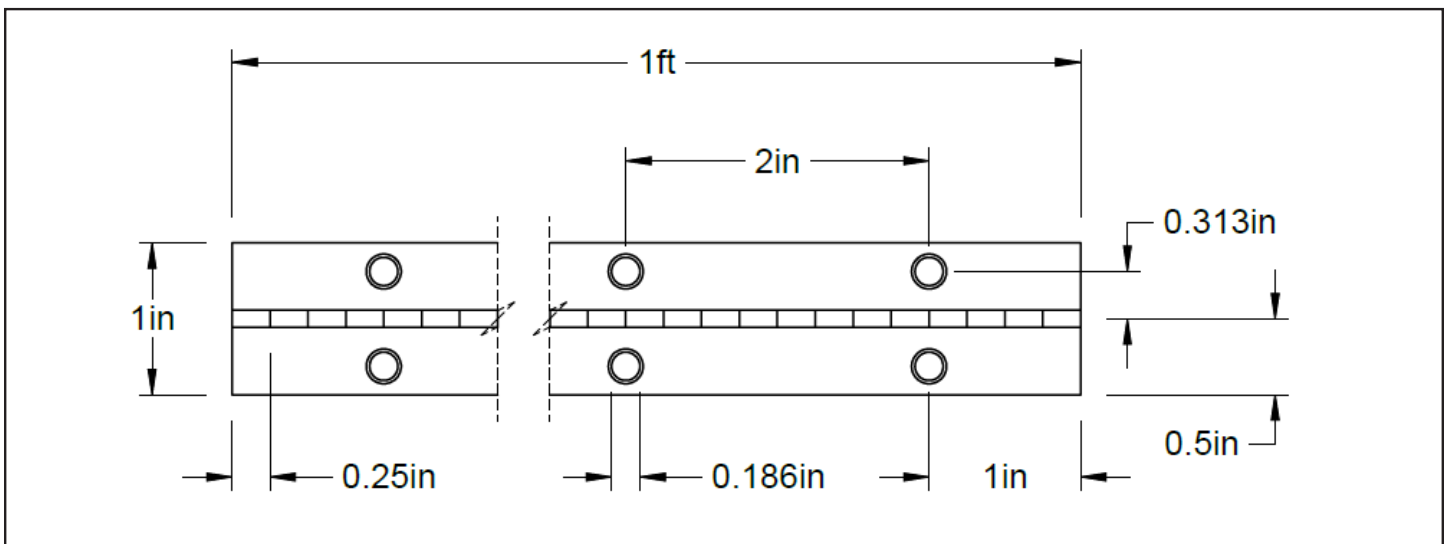


Figure 3. Hinge Detail



Figure 4. Notches were created at the top of the door and frame to accommodate the installation and removal of the camera and antenna cords.

Roof Trim

One piece of trim is needed to create a ridge cap, which can be fabricated using a piece of siding trim or any metal capable of being bent to an angle. It can be attached using a few trim nails tacked to hold it in place.

Camera

A Wi-Fi wildlife camera purchased from the garden supply section was installed and setup following the manufacturer's directions. Notches were created in the top of the door and jam to route the cable into the nest box (Figure 4). Most cameras will be powered by 120v electricity. Therefore, nest-box siting should be relative to the location of an outdoor power outlets. Exposed extension-cord connections should be placed in an outdoor weather-protection device. Cameras have many options and can be Wi-Fi or Bluetooth. Most of these types of cameras come with an app for your phone or device that is used to view the live camera feed. The camera can also be used with a dedicated computer to record the data. Cameras using memory cards should be avoided since changing the card will disturb the nest.

Camera Partition

The purpose of the camera partition is to isolate the camera from the bird area but mostly to hide the power and antenna cords for the camera, which may resemble a snake to adult birds. A one-eighth inch thick plexiglass piece (4 by 6.25 inches) was used to create the partition.

One side of the plexiglass should be sanded with 220-grit sandpaper to make the plexiglass opaque. The camera partition is held in place using the kerf cut in the side boards. Other materials that could be used for the partition include sheet metal, plastics, and cardboard. A hole should be created in the plexiglass to expose the lens of the camera. Removing the partition provides easy access to the camera.

Mounting

The best time to mount the finished bird box is when it is done. However, if you are a planner, the best time to mount a bird box is in the spring before nesting starts (February) or in fall in preparation for spring. The preferred mounting post for a bird box is a smooth metal post, because it is harder for predators to climb. Applying grease to the bottom foot of a metal post can deter predators and ants from climbing. A more effective method that is a bit cleaner involves the use of a metal wrap-around baffle under the bird house to help deter climbing by predators—snakes, squirrels, and raccoons—for longer. A four-by-four treated post is another good option for mounting bird boxes, because they are readily available and relatively inexpensive. A street signpost makes for a good mounting post, since it has been predrilled with mounting holes and is sturdy, but it is more expensive than other options. Avoid mounting bird boxes on privacy fences and utility poles. Privacy fences are used as perching areas for other birds, which may inadvertently enter the territory of nesting birds and disturb them. Squirrels, which are predators, use privacy fences as travel ways, which may entice them to invade a bird box. Utility poles are owned and controlled by companies that discourage the mounting of obstacles, which may cause injuries to their employees.

Height

Suburban neighborhoods typically have cats that have overlapping territories, which are patrolled regularly. Therefore, a bird box should be mounted at least 5 to 6 feet above the ground. This makes it harder for any predator to invade the box, while making it accessible by the caretaker to inspect and maintain.

Orientation

Birds may not care which direction an entrance hole faces, however orientation will affect certain environmental aspects. An opening that faces east or northeast will avoid the hot afternoon sun. An orientation of south or southeast will provide light in the morning and through the day. In most areas of Kentucky, storms originate from the southwest, which should be avoided. In addition to the entrance, the orientation of the skylight is also important. To that end, the skylight should face east or northeast to reduce direct sunlight from entering, which aligns the entrance to the south or southeast, respectively.

Electrical Connections

Cameras that can be mounted in this nest box may operate using a solar panel, whereas others require 120-volt electricity. Electrical connections should be protected by housing them in an outdoor-rated electrical enclosure.

MAINTENANCE

In spring, a caretaker should periodically observe the activity outside the box as to which species of bird is considering it as a nesting site. If starlings, house sparrows, wasps, or hornets take up residence, remove their nesting material. The fun starts when desirable birds inspect the inside of the box and begin building the nest.

After the hatchlings have fledged, leave the old nesting material in the box until the following Spring. There is a chance that birds may use the box and the old nesting material during winter to seek refuge from the cold.

Before nesting season starts, around late February of each year, clean the box of debris, make sure the drainage ways are open, make any repairs or adjustments, and power the camera.

Mites and blowfly larvae may occur in the nesting box. Birds have evolved with these species and often they cause no issues whatsoever to the nestlings. It is not recommended to treat these infestations as even small amounts of chemicals, insecticides, or diatomaceous earth can harm nestlings, even if added outside of nesting season. For more information on bugs and other nest box maintenance issues, Cornell Lab of Ornithology has great recommendations on their Project NestWatch website.

LEGAL ISSUES AND CITIZEN SCIENCE PROGRAMS

Many of the birds that will use this house are federally protected under the Migratory Bird Treaty Act of 1918. This act protects all native migratory birds, and per the U.S. Fish and Wildlife Service:



Provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg or any such bird, unless authorized under a permit issued by the Secretary of the Interior. Some regulatory exceptions apply. Take is defined in regulations as: pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.



Basically, the law protects all native migratory birds from non-regulated killing of individuals, harming them, or destroying their nests. The last part is the pertinent part to this publication as you will want to ensure you do your utmost to keep birds from abandoning their nests or young. This means you will want to limit the amount you disturb the nest once it is initiated by the birds. The advantage to this system is that you can enjoy watching the nests and young grow and develop without them even knowing it. However, it does mean that if your system fails while a nest is present, you will want to try and wait to fix it until the birds have fledged and left the nest on their own accord. Simple issues such as a loose wire could potentially be fixed with minimal disturbance, but caution should be used especially when birds are close to the size they typically leave the nest. Some of the extra resources listed below have many more details on monitoring nests without overly disturbing them.

Given your newfound ability to watch nests succeed, or unfortunately sometimes fail, you will be able to gather important data scientists can use to manage these bird populations. If you have interest in aiding scientists in monitoring and managing bird populations, there are several programs you may be able to participate in if you are willing to do a bit of work on the front end to learn the methods. Some follow specific species of birds while others may be focusing on certain habitat types, but there are several options that you should be able to find one that fits your personal situation. The two largest organizing bodies of these programs are the Smithsonian Institute and the Cornell Lab of Ornithology. Links to information on these programs is found below in the “References and Suggested Reading” section.

References and Suggested Reading

- Guidelines and Resources for Nest Monitoring from Smithsonian Institute: <https://nationalzoo.si.edu/migratory-birds/nest-monitoring-guidelines>
- Cornell Project Nestwatch: <https://nestwatch.org/>
- United States Fish and Wildlife Service Migratory Bird Treaty Act Information: <https://www.fws.gov/law/migratory-bird-treaty-act-1918>
- Tom Barnes. 1999. Eastern Bluebirds Nesting Structure Design and Placement FOR-52.
- Wayne H. Davis and Phillippe Roca. 1995. Bluebirds and Their Survival. University Press of Kentucky, Lexington, Kentucky.

Cooperative Extension Service

Agriculture and Natural Resources
Family and Consumer Sciences
4-H Youth Development
Community and Economic Development

MARTIN-GATTON COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT

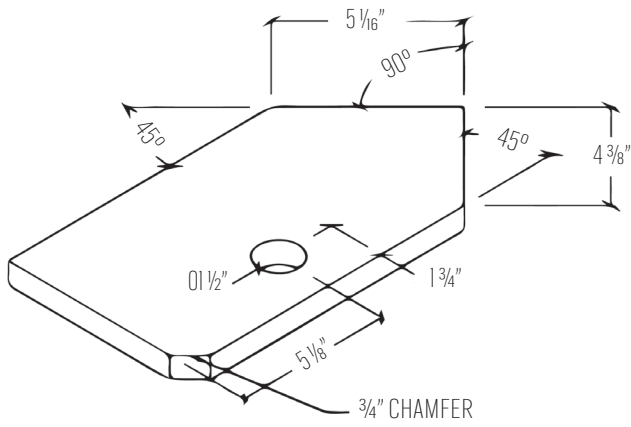
Educational programs of Kentucky Cooperative Extension serve all people regardless of economic or social status and will not discriminate on the basis of race, color, ethnic origin, national origin, creed, religion, political belief, sex, sexual orientation, gender identity, gender expression, pregnancy, marital status, genetic information, age, veteran status, physical or mental disability or reprisal or retaliation for prior civil rights activity. Reasonable accommodation of disability may be available with prior notice. Program information may be made available in languages other than English. University of Kentucky, Kentucky State University, U.S. Department of Agriculture, and Kentucky Counties, Cooperating.

Lexington, KY 40506

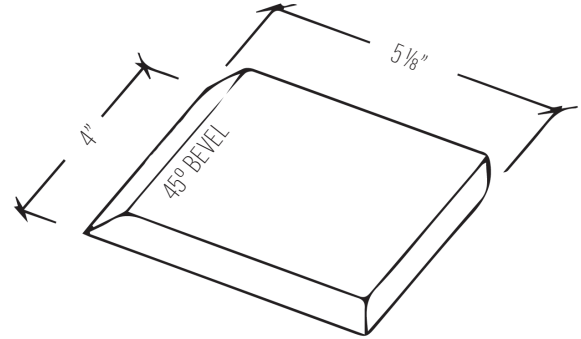


Disabilities accommodated with prior notification.

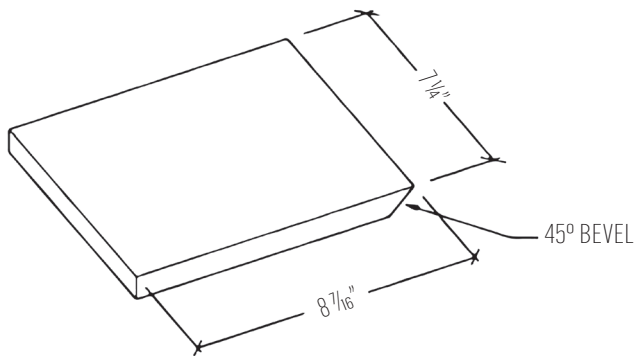
PARTS REQUIRED



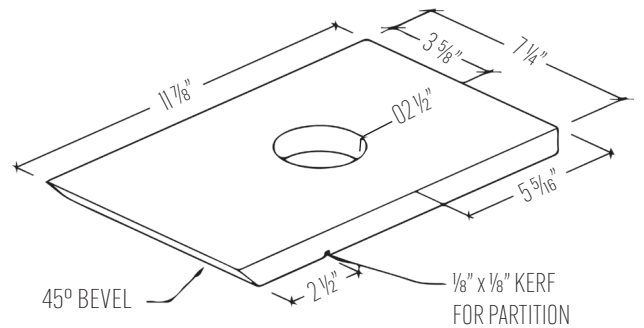
① FRONT PANEL



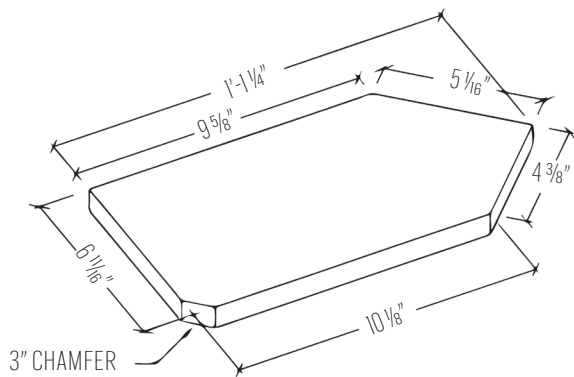
② RIGHT VERTICAL PANEL



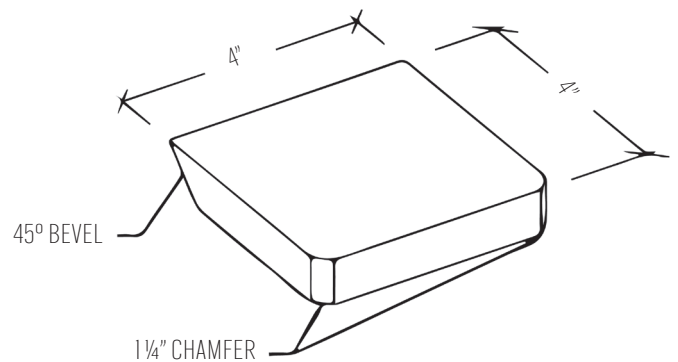
③ ROOF LEFT



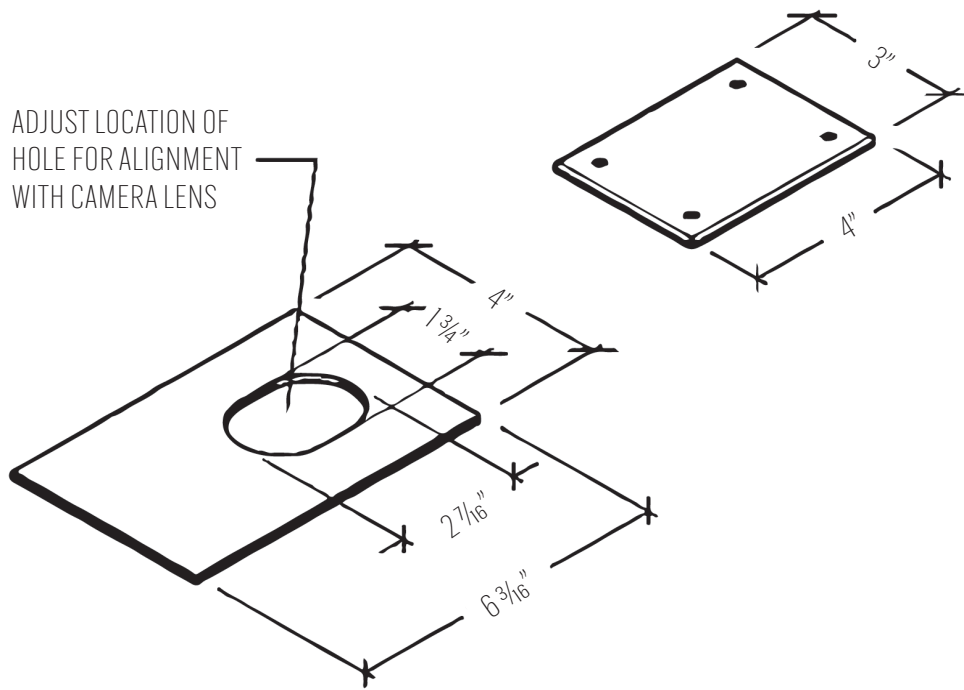
④ ROOF RIGHT



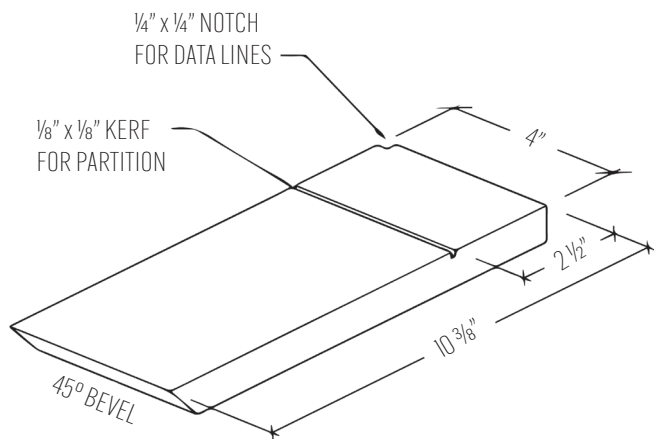
⑤ REAR PANEL



⑥ BOTTOM

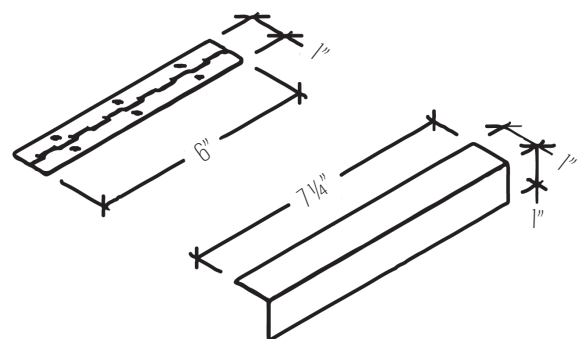


7 SKYLIGHT / CAMERA PARTITION



8 LEFT VERTICAL PANEL

NOTE:
Use stainless steel, brass, or galvanized hinges and screws.
Roof cap can be made from any exterior flashing material. Roll long sides if possible to prevent sharp edges.

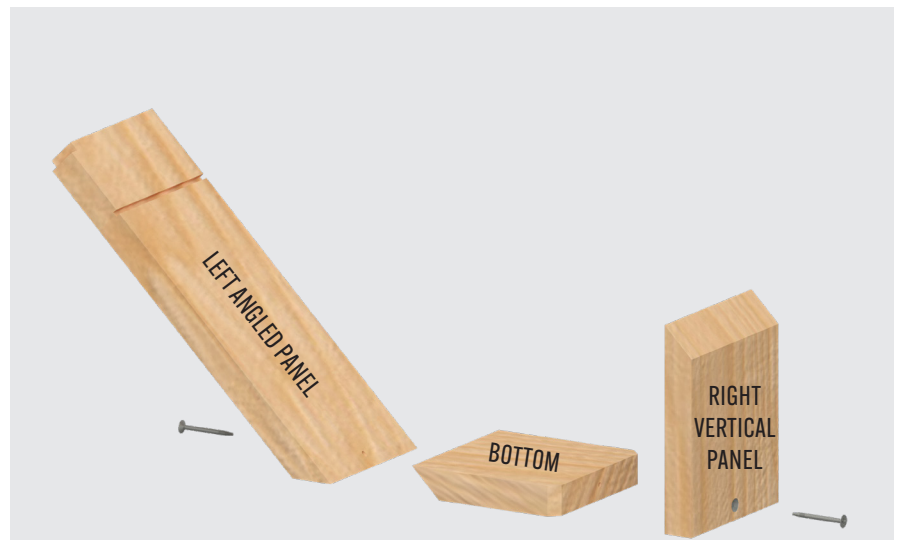


9 HINGE / ROOF CAP

ASSEMBLY

STEP 1

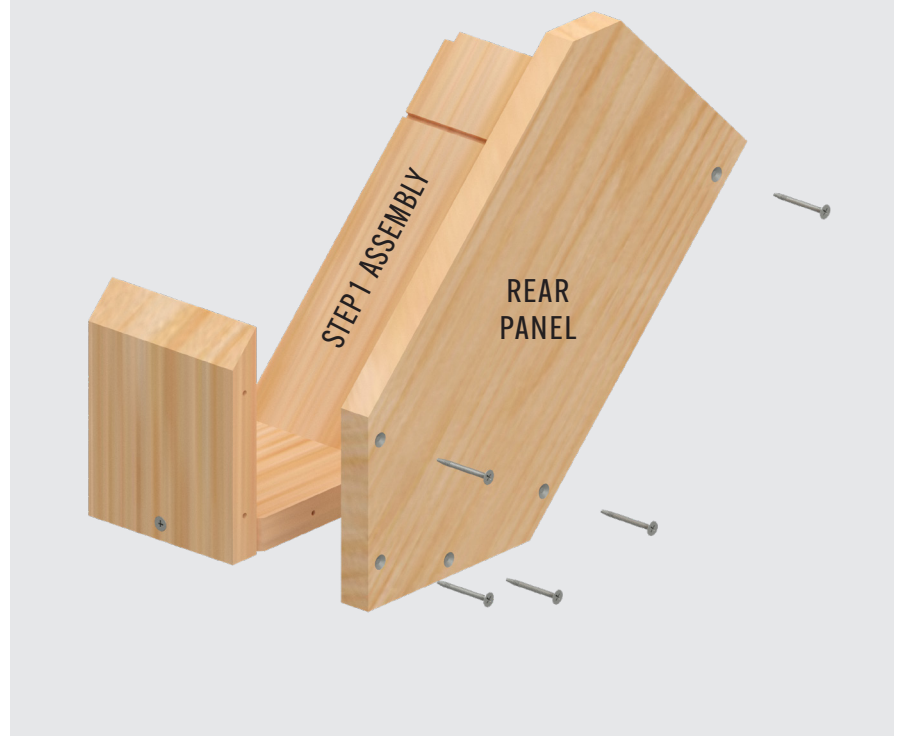
Attach left and right panels to bottom with 2" exterior flathead screws.



STEP 2

Attach rear panel to back side of Step 1 assembly using 2" exterior flathead screws.

Pre-drill holes before attaching panel.



STEP 3

Attach right and left roof panels to Step 2 assembly using 2" exterior flathead screws.

Predrill holes before attaching roof panels.

STEP 4

Set door in place and attach with one screw on upper right side near roof panel.

Place hinge along bottom left side and attach with stainless pan head screws.

Predrill holes for screws.

STEP 5

Place camera partition into precut slots.

Secure skylight over roof hole with stainless pan head screws.

Apply silicone to bottom perimeter of skylight before attaching to roof.

