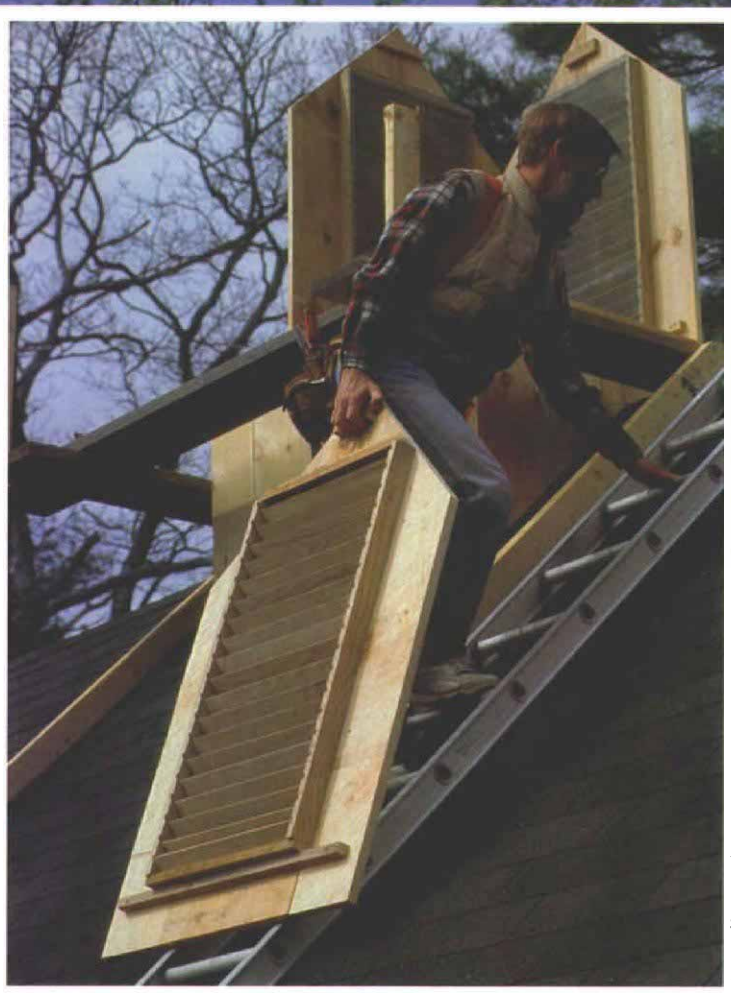
Building a Cupola

The proper proportions and long-lasting materials make a structure that looks good and helps ventilate house, barn or shop

by Ken Textor



Cheaper than a crane. After building the top section of the cupola on the ground in his shop, the author had to haul each prefabricated piece carefully to the peak of his boat-barn roof for reassembly. He found that some sanding and cutting had to be done during assembly.

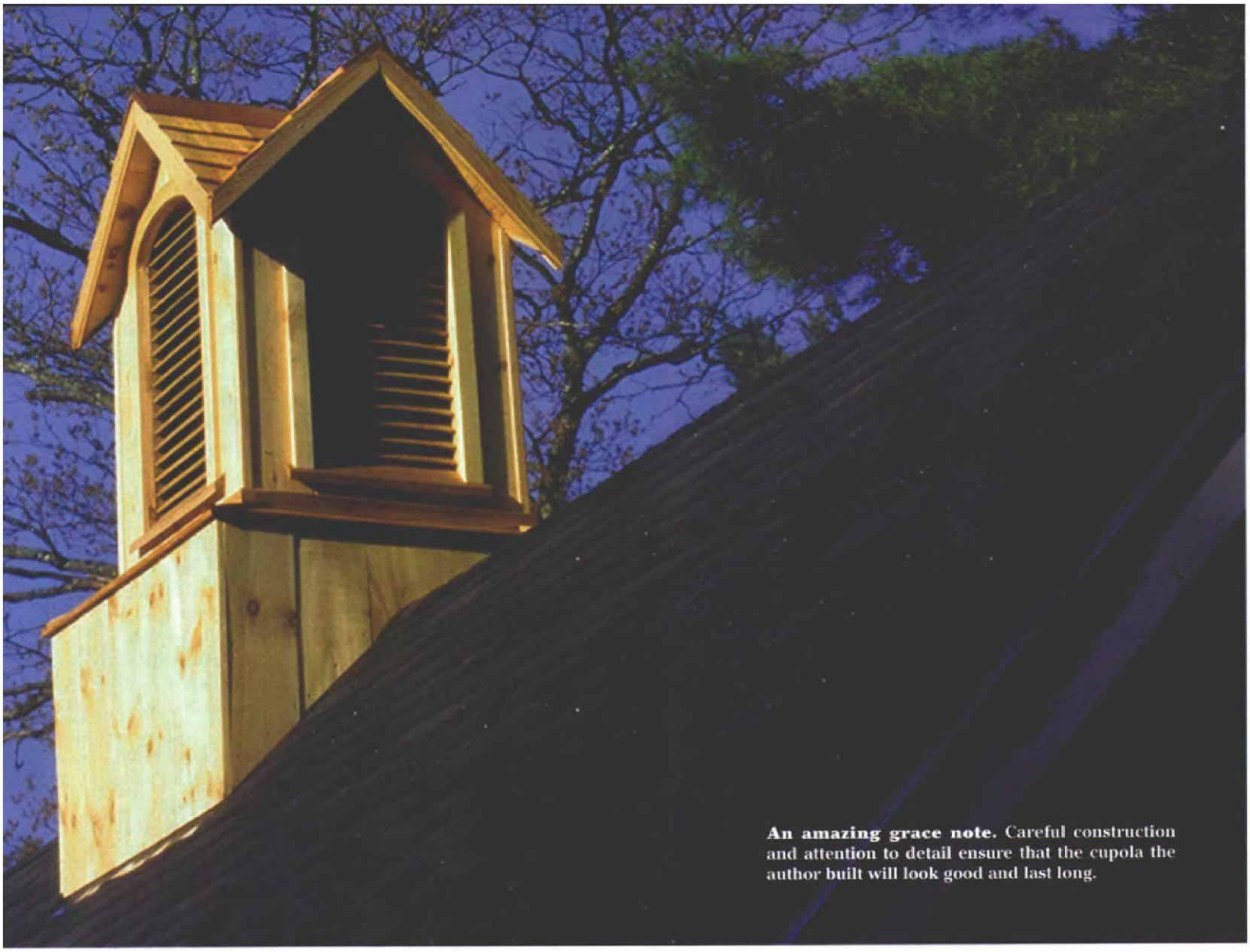
From the beginning, my cupola was as much a practical solution to a ventilating problem as it was a grace note to my boat barn (photo above). You see, I own four wooden boats, which range in size from 12 ft. to 30 ft. As wooden-boat owners know, maintaining these handsome old vessels outdoors can be a royal pain in the stern, especially in a climate such as Maine's. Drying winter winds make recaulking nearly an annual event. So building a 22-ft. by 38-ft. boat barn made a lot of sense.

Even in Maine, there are hot summer days-sometimes for weeks at time-so good ventilation in the boat barn would be imperative. Gable-end vents would be inadequate. Additional ridge and soffit vents wouldn't be aesthetically pleasing. Fans seemed unnecessarily expensive. Finally, it seemed a cupola was the best way to go. But where would I get the plans?

After all else failed, I went to the source—I searched dozens of libraries, pestered architects and even checked in on the Internet, all to little avail. Then 1 did what I do when a building problem has me stumped: I see how someone else did it. I drove around the countryside, where 1 stopped and stared at every cupola I passed. I took pictures, asked puzzled farmers if I could go into their barns, measured, sketched and noted.

Some general rules began to emerge. From the outset, I found it would be difficult to build a cupola too big but easy to build one too small. I suspect this is due to underestimating the appearance of the vast plane of the roof compared with how the roof looks with a cupola in the middle of it. A cupola may look big enough on the ground, but put it up there on a 10-square roof against a big blue sky, and it looks small.

In any case, 1 soon found that the best-looking cupolas were at least 1 in. wide for every foot of roof ridge. So 1 figured that with a 38-ft. roof ridge, my barn should have a cupola at least 38 in. wide. Also, most of the cupolas I liked were square. The vertical measurement on good-looking cupolas seemed to be 1 times or



An amazing grace note. Careful construction and attention to detail ensure that the cupola the author built will look good and last long.

1.5 times the cupola width. I made vertical measurements from the roof ridge, not from where the cupola base meets the slope of the roof.

I decided to keep the design simple—The next step was to figure out what cupola design would be most appropriate for my barn. Because cupolas are a favorite subject of many painters, I found numerous models from which I could adapt ideas. The possibilities seemed endless, from a simple roofed box with vents to an elaborate Victorian wedding-cake design.

I quickly settled on something somewhere in the middle, but more toward the roofed-box end of the scale than toward the ornate. And because my design would complement our home and existing outbuildings, which all have 12-in-12 roof pitches, I went with a four-gable cupola that would have a 12-in-12 pitch roof.

Many cupolas I saw were made of one wide box in which the cupola and roof meet and a slightly smaller box on top, which meant the cupola was built in two parts. Because I usually work alone, 1 thought it would be easier to get such a large object 20 ft. in the air if it were in pieces. This option also allowed me to split the difference on cupola dimensions. In calculating one-box cupolas, some builders evidently multiplied the ridge-line footage by 1.25 in. instead of 1 in. By making each side of my lower box 1.25 in. times 38 and each side of the upper box 1 in. times 38, I figured the entire structure should look just right.

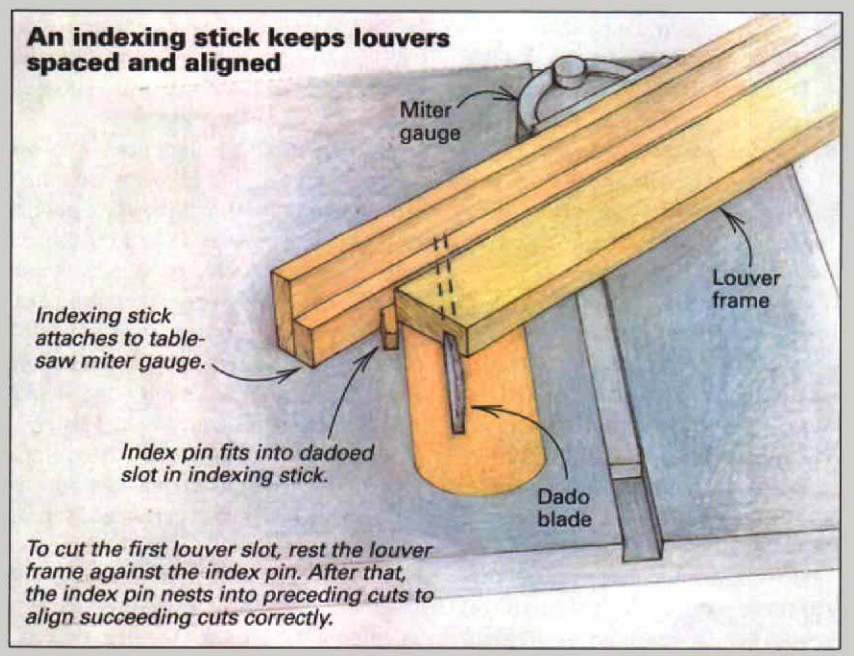
The choice of materials is critical—For materials, I went with white-pine shiplap siding to echo the siding on our two barns. I chose white-cedar shingles for the cupola roof to echo the siding on our main house and ell. I decided to make the louvers (sidebar p. 90) of sassafras, a strong, rot-resistant material that's frequently used in boat building. The remaining trim pieces also needed to survive a lot of wetting and drying, so I cut these pieces out of western red cedar. This type of cedar was more readily available in the sizes I needed than local white cedar.

Careful flashing and framing make a cupola that lasts—Building the lower box for the cupola gave me a better appreciation why so many of the cupolas I saw were either underbuilt or leaky, or both.

The dimensions for my cupola's lower box were determined and fit nicely with the framing of the barn roof. With the barn-roof rafters 16 in. o.c., the lower box would sit securely on rafters 48 in. apart. Many cupolas I saw were not set on rafters, and I suspect part of their leaking problems was due to this arrangement. I also decided to flash my cupola like a chimney. I found this construction rarely done on old-fashioned cupolas. But I don't like heights, and I didn't want to return to the rooftop to look for leaks.

To cut down on the amount of work I'd have to do on the roof, I used galvanized screws and preassembled the upper box of the cupola in my shop. 1 marked everything so that I would know exactly how it all went back together when I got it up to the roof. This process may sound time-consuming, but I had time. 1 finished

The trick to properly spaced slots is an indexing stick. The author attached the indexing stick to the miter fence on his table saw and set the small index pin, which is visible at the left of the stick, into the last slot cut, thereby perfectly aligning the piece for the next dado cut.



Cutting the louvers

I had never built large-scale louvers before, but I knew how to use an indexing stick for the repetitive tasks I encountered in boat building. An indexing stick is a long hardwood stick (2 in. by 20 in. usually does it) on which two slots are cut at 45° angles.

These slots are cut with a dado blade set at the thickness of the slats that make up the louver. In my case, this thickness was 5/16 in. The distance between the slots on the indexing stick is the same as the distance between the cupola slats (drawing below). In my case, this distance was 1 in. I chose this distance because the slats were 2¾ in. wide. The slats' spacing would ensure that rain driven horizontally would be repelled.

On the indexing stick, one of the dadoed slots stays aligned with the dado blades. The other dadoed slot is fitted with an index pin, a piece of wood that fits tight in the dadoed slot (photo left). I glue the index pin to the stick because each successive slot is set on this pin to measure the correct distance to the next slot to be cut.

Cutting the opposing slots is not a simple matter of reversing the indexing stick and dadoes. I found that even if the opposing pattern slots on the indexing stick are as little as 1/64 in. off, 19 slot cuts later the last slot is off by 19/64 in. I found it easier to use the first set of slots on the louver frame to locate the opposing set (photo below). I then cut the opposing dadoes guided by the lines from the first set of slots.

Finishing the louvers was a matter of boxing the slats in and fastening it all together. I used brass brads to fasten each slat in place. Inside the louver, I installed screen to keep out insects, bats and birds.

Cutting a curved opening into the cupola wall let me avoid making the louver slats taper into my elliptical opening. The cupola wall and trim create shadows that make it appear the louvers follow the ellipse.—*K. T.*

Transfer slots. The author used the first set of slots to transfer cut marks to the other set.

Drawings: Christopher Clapp

Blocking the elements. This cupola's roof was covered with a bituminous rubberized roof undercoating and then cedar shingles.

my boat barn in November and decided to leave the cupola off until spring. So I had all winter to work out problems (drawing right).

My kingdom for a crane—Professional cupola installers told me they use cranes to attach their creations, although this option seemed impractical. The local crane service charges $100 an hour—a cost I couldn't justify. Instead, after disassembling the upper box on the ground, I hauled each cupola wall up a roof ladder to its place (inset photo, p. 88).

This work is dangerous, and it's important to note that I did not use scaffolding that would pass muster with the Occupational Safety and Health Administration. That would have required wider planks and railings. But because I was working alone on my own properly, I felt comfortable adhering to my own safety standards. I just counseled myself to slow down, take it one step at a time and do nothing unless I was absolutely sure of my footing, temporary bracing and handholds.

Despite the fact that I had carefully built the upper box on the ground and prepared the support framing on the roof, once on the roof I found something was bound to fit a little less than perfectly. I had to sand and cut a few parts to get them just right.

I took extra steps to ensure watertight integrity. The cupola's roof was covered with bituminous rubberized roof undercoating (photo above). Over this I fitted ¾-in. cedar nailers, which are necessary for the shingles to dry properly after rain. After each course of cedar shingles, I step-flashed the valleys with more bituminous rubberized roof coating. At the peaks, I nailed and silicone-caulked cedar roof-cap boards together, putting them in place with some more roof-coating material underneath them and out of sight. The result so far is a watertight cupola. □

Ken Textor is a boat builder and furnituremaker in Arrowsic, Maine. He is also the author of two books on sailing. Photos by Steve Culpepper.