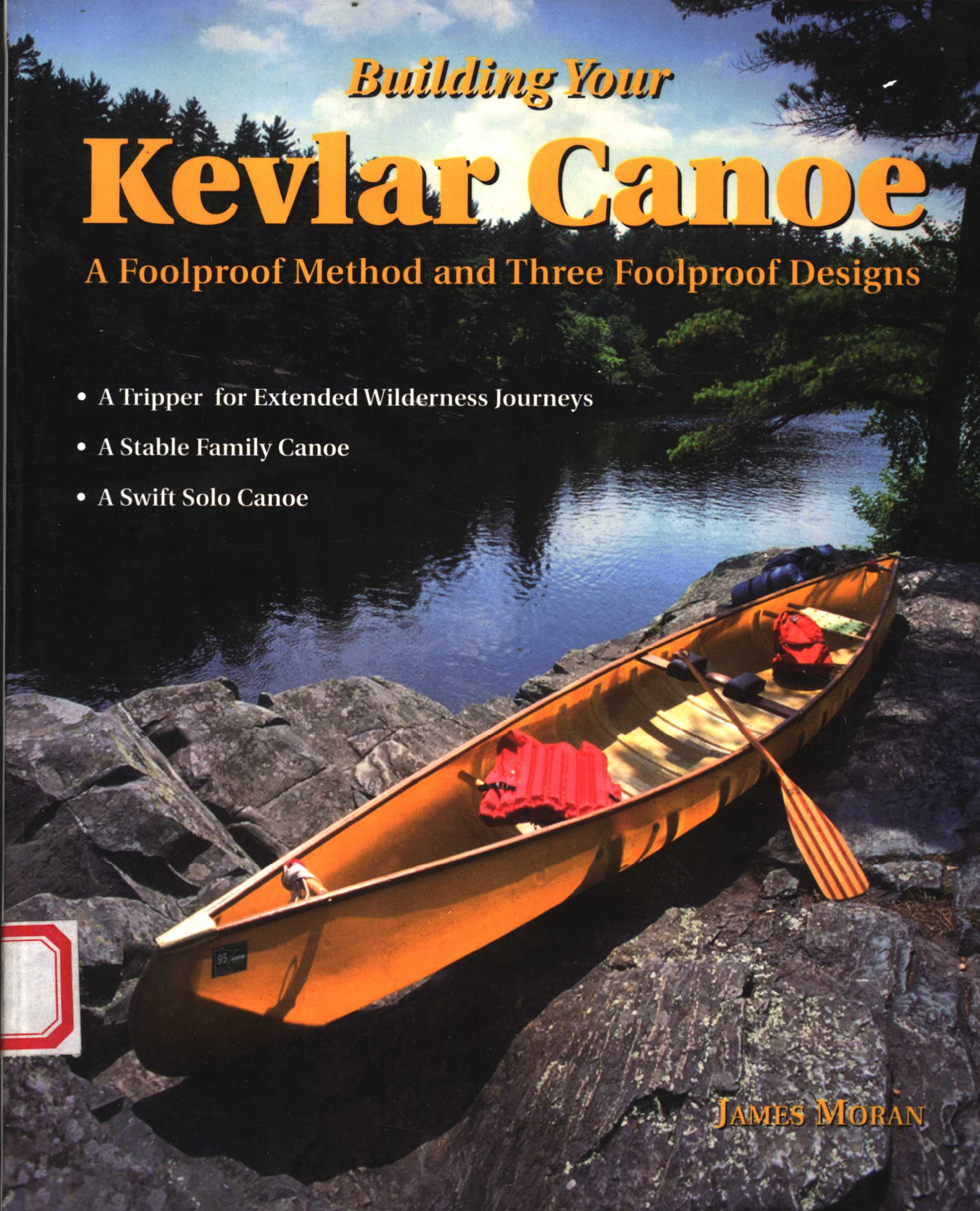
Building Your Kevlar Canoe

A Foolproof Method and Three Foolproof Designs

- A Tripper for Extended Wilderness Journeys
- A Stable Family Canoe
- A Swift Solo Canoe



JAMES MORAN

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James Moran

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To Kay Hawley,
a teacher in the true sense of the word,
I am very grateful.

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Preface

Kevlar is an extraordinary material for canoes—far superior to fiberglass because it is stronger and much lighter. A 17-foot Kevlar canoe can weigh as little as 35 pounds, while a canoe of this size in fiberglass will weigh as much as 90 pounds.

This book will show you how to build a high-tech Kevlar canoe with a decidedly low-tech method—in a couple of weekends at a fraction of the cost of a factory model. Featured here as sample Kevlar canoes are complete designs for a stable family canoe, a swift solo canoe, and a tripper that can carry considerable cargo for extended wilderness trips. In Chapter 3, Principles of Canoe Design, you'll find ways to modify these designs to suit your purpose.

We'll look at an inexpensive technique for producing a male canoe mold at home, and how to work with Kevlar, S-glass, and epoxy to lay up your canoe. Once the canoe is off the mold, we'll pay particular attention to seat placement and design—an essential feature of a good canoe.

Also here are a discussion of materials, a list of sources, and metric conversion tables. With the help of these complete step-by-step instructions you can build a well-appointed Kevlar canoe. You'll need neither sophisticated tools nor much experience with construction.

And because you and your canoe will be eager to go exploring, you'll find practical advice for canoe-camping trips.

KEVLAR® is a DuPont registered trademark.

Acknowledgments

A special thanks to Bob Beetcher and Dave Lind, for many years my good friends and canoe partners. Without their ideas and criticisms, the techniques used in this text would not have come about.

And thanks to Art Schmeling, who built his first 18½-foot Kevlar canoe using this text, which was greatly improved by his comments and ideas.

A special thanks, also, to my brother, Robert Moran, who helped tremendously with the final editing.

And last but not least to Janet, my wife, who shot a good number of the photos. She is always there to lend a helping hand and supply a good idea.

Some Good Advice

If you are new to canoeing, I highly recommend that before you begin, you first read and heed Chapter 3, which discusses how different boats react under different conditions. Then paddle canoes of as many designs as possible to get a feel for what they will do and how they behave. If your local canoe livery rents only big bathtubs (most do), maybe you have a friend with a good boat, or a local sports shop that offers tryouts for prospective customers. In any case, get some experience first. Ideas for designing, building, and handling canoes come through experience, and knowing what you want will guide you to a more satisfactory choice. Paths without destinations often lead to disappointment. Think of building your own canoe only for one of the following reasons:

- 1. You want a high-tech canoe at a lower price.
- 2. You would like the pleasure of building your own canoe.
- 3. You enjoy and take pride in making something with your own hands.
- 4. You need a custom design or you want to try a design of your own.

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PART ONE

About Canoes

1

Introduction

When I was a boy, a friend and I borrowed a cement-mixing tub from a local building contractor, part of a grand plan to search the local pond for the elusive bullfrog. Never did I imagine, as we slipped the tub into the dark waters, that I had begun a lifelong quest to build a better canoe. That tub was the finest introduction to nature any boy could have. A new world opened up as we sailed looking for lost frogs and adventure.

To this day I never cease to marvel how close a person can get to nature in a small boat. Not just any small boat will do for me, though. It must be light, quiet, maneuverable in tight places, shallow-draft, and manageable in current. It must be fast as well as slow, able to move upstream and down with equal ease. Most important, it must be inexpensive, both in initial cost and in long-term maintenance. A cement tub just doesn't meet the design criteria. What comes closest is a canoe.

Learning from the Indians

My interest in lightweight boating continued as I grew older. Being something of a purist, I studied how the native peoples of temperate North America made birchbark canoes. All the materials were natural, so those bark canoes were inexpensive. Building

them required only a very few tools. After studying the Indians' methods, I went looking for the materials they had used.

After spending many hours walking through the Minnesota woods, I began to realize that materials once readily available to the master canoe builders of the Ojibwa tribes are now difficult to find. In fact, while Minnesota was once heavily forested, today the paper birch is rare and the white pine is nearly extinct.

But earlier conditions in the forests of my home state were just right for birchbark canoes. The Ojibwas' first task was to find large birch trees, from which they stripped the bark into long, solid sheets. These bark sheets were stacked between alternating layers of wet moss to keep them moist. A complete pile would be tied with twine into a tight bundle and given a daily watering to prevent drying.

Next, the native builders visited a cedar swamp to cut one or two green cedar trees, section them into 4-foot lengths, and take them home, where the craftsmen would split the green logs into thin strips for the canoe ribs. While in the swamp, the Indians would search the ground around the base of the cedars for small threadlike roots, which they pulled and rolled into loops about 2 feet in diameter. These cedar roots were used for lacing together the bark sheets. Pulling long strings of cedar from the earth was like pulling yarn from a sweater. To keep the roots moist and pliable, the Indians wrapped them in wet moss and watered them daily. (Once dried, the roots became brittle and useless. Spruce roots were also used.)

For pitch to seal the seams, the builders located one or two large white pines on higher ground. Pitch was extracted from the pines much as maple sap is extracted for syrup, by tapping trees and collecting the "syrup" in buckets.

Once the Indians had built a bark canoe, they faced a much bigger problem: The canoe needed constant maintenance. As the birchbark dried out, it split and broke apart; on hot, sticky summer days it absorbed moisture and tended to swell and

buckle. To mitigate climatic effects, the native peoples built their canoes using only green (wet) materials, and once built, a canoe would be filled with stones and submerged in a lake when not in use to keep its moisture content constant. This kept down maintenance, but it also made the canoes very wet and heavy. In winter, the boats were stored under the ice to preserve them for spring travel.

To avoid portaging the heavy canoes, the Indians developed a system that is still used today in some areas: They left a canoe at each end of every well-used portage. When they arrived at a portage they simply removed the cargo and submerged the canoe in about 3 feet of water, using stones found along the shore for ballast. At the other end of the portage, another canoe would be waiting just below the surface, where the last party moving through had left it. After retrieving the craft and loading the cargo, they soon were on their way.

Later the voyageurs used the same method on very long portages. Today in some parts of the Boundary Waters Canoe Area, outfitters use the same technique for their customers. I have found canoes along the Gunflint trail marked "Property of ABC Outfitter, for private use only." In today's world, though, the likelihood of theft has made this efficient custom scarce.

New Solutions to Old Problems

Design, weight, size, maintenance, and cost problems have always plagued canoe builders. As new materials were introduced, each was heralded as the final answer. But always, it seems, another new material soon comes along to supersede yesterday's "final" solution.

The space race led to a call for a fireproof, lightweight, very strong spacesuit material; one answer was Kevlar, a remarkably tough, flame-resistant organic fiber developed by DuPont. Kevlar

is quickly replacing many basic materials and is the foundation for a wide range of products—including bulletproof vests, work clothes, sporting goods, and much more. Even future aircraft may be wearing Kevlar for their outer skin.

We'll take a closer look at Kevlar in Chapter 5.

2

Canoe History

Early

The first approximation of a canoe was probably a log. Although we have no way of knowing, I'd imagine man's first canoe ride happened when he jumped on a floating log, with only his hands and feet to use as paddles. Over time, the log was split from end to end, forming a flat surface on which a person could stand. No longer did the canoeist need to get wet—working from a standing position he could use a long stick or pole to push the craft forward. The ends of the log most likely were pointed from chopping down the tree using stone tools.

The next development was carving or burning out the inside of the log for sitting and staying dry. Men were beginning to understand that shape had its effect, altering the stability of the craft and its forward momentum, and canoes were beginning to take the form of the boats we know today. Archaeological digs around the world have found evidence of dugout canoes wherever large trees once grew, and examples can still be seen today in Polynesia and in the Amazon region of Brazil. No one area can lay claim to having invented the canoe; log craft came into use independently in the primitive cultures of every populated continent. The canoe was

the natural answer to man's need for an efficient means of water transportation.

Persistent problems of design, weight, size, maintenance, and cost moved the native North American peoples away from the log approach. These indigenous craftsmen can take credit for the first all-wood canoe that was not simply a dugout. They began building their canoes using lightweight frames, which they wrapped with any natural materials at hand. Hides were plentiful and did the job, but they were heavy. Anything that would cover a large area, was waterproof, and needed few seams was acceptable.

Different water and weather conditions and locally available materials produced different types of canoe-style craft. In the far northern regions of North America the skin kayak was under development. In the temperate regions of the continent, the birchbark canoe appeared.

Always trying to lighten the hull and reduce the time required to build it, Indians turned to the bark of the paper birch, which grows from Alaska to Labrador and south to Pennsylvania, Michigan, Minnesota, Montana, and northwestern Washington. The bark from one mature tree in the southern part of its range could produce a seamless shell to cover an entire craft. Birchbark used in this way reflected the superb harmony in which the native peoples coexisted with their environment. By the early 1600s, canoes were in use all across North America.

The European explorers, arriving in North America with almost nothing, used any resources available to them to exploit the newfound land. The bark canoe gave them access to the rich backlands, where good hunting, furs, and gold were theirs for the taking. The canoe also provided an easy means to move cargo from point to point. Some of the earliest exploration was done by canoe. Pirogues, or dugout canoes, were Lewis and Clark's main mode of transportation, and as the explorers moved across the continent, they followed canoe trails that had been used for centuries by the native tribes.

Contemporary

Around the turn of the 20th century most canoes were of wood-and-canvas construction, in principle much like the birchbark canoe. The ribs, the outer planking, and the cleat nailing were nothing more than simple improvements in the same construction techniques. Nailing was an improvement over the cedar or spruce root lacings, but the design itself had not progressed. The only real difference was that canvas had replaced the birchbark covering. The canvas canoe also introduced the keel, which was needed to protect the craft's bottom. Because manufacturers did not know how to omit it, and sought to make a virtue of necessity, the keel was touted as providing better tracking when lake paddling. This did make some sense, and to this day an argument continues about the benefits of a keel.

Unlike canvas canoes, which need bottom protection, today's canoes have tough outer skins, so the need for protection is no longer a requirement. A keel adds to the drag, which offsets any benefit in tracking. On a river, a keel can flip a canoe: When the canoe is pushed broadside to the current, the water rushing under the craft will hit the keel, pushing the canoe over on the upstream side. A canoe without a keel is more mannerly in this circumstance.

In any case, the older wood-and-canvas models tipped the scales at anywhere from 100 to 150 pounds. They were a giant step forward, requiring little maintenance other than periodic varnishing to protect the canvas, and it was no longer necessary to store the boat underwater to keep it supple. Only after many years of use did the canvas finally crack and require replacement. When paddling, however, the canoeist had to be careful not to hit rocks, which could tear the canvas.

After the Second World War, with the introduction of aluminum, canoes really began to change. The rigid skin now comprised almost the entire canoe, and ribs were used for reinforcement

only in areas needing extra strength. Weight began to take on greater importance—a good aluminum 16-foot Grumman canoe weighs about 70 pounds. In addition, maintenance became dramatically easier: aluminum canoes can stay outside year-round, they never need painting or polishing, and sunlight reflects off their surfaces rather than breaking down the hull material, as with canvas. Hitting a rock only adds to the boat's character. It's rare to lose a good aluminum canoe; even when it hits a boulder or gets snagged in a rapid, it's soon back in action. A little work and a few ropes will free almost any pinned canoe. Still, the aluminum canoe is heavy and dents easily, and the dents are difficult to repair. Over time, rivets can loosen, leak, and become difficult to repair. One of the biggest problems is noise. In rocky going an aluminum canoe can sound like a garbage can loose on the street in a strong wind, warning all wildlife within a mile of its presence.

The early 1960s brought fiberglass, which makes an aesthetically pleasing craft. The colors are bright, a refreshing change from gray aluminum. New shapes appeared, with design taking on a fresh importance. The early boats weighed as much as any aluminum canoes, and maintenance was still a problem. Although fiberglass did not dent, a sharp blow could crack it. Time and weather took their toll, causing hairline cracks and fading colors.

The 1970s brought sophisticated designs, with new techniques producing better molds that could create a canoe in just about any shape. Canoes were no longer built, but "laid up." On the water, boats became faster and less sensitive to the wind. They were much easier to maneuver and tracked far better when crossing lakes (even without keels). Even the diehard aluminum lover began to have second thoughts when one of these boats passed—they moved so effortlessly on the water. On a long lake the aluminum boat would struggle to keep up, only to see the faster fiberglass boat disappear at the portage far ahead.

Today we are seeing a growing number of Kevlar canoes. The designs are sophisticated, the boats are fast, they are light, and they